

# INNOVATIVE ALTERNATIVES TO TRADITIONAL CLASSROOM HEALTH AND SAFETY TRAINING

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## ABSTRACT

After thoroughly covering the health and safety training subjects required under Title 30, Part 48, of the Code of Federal Regulations (CFR), mine operators often find themselves with little or no time left in the class schedule for other important topics. This paper discusses a technique developed in partnership with RAG Twentymile Coal Co., Oak Creek, CO, for incorporating employee participation at all levels in fire prevention and safe equipment operation training outside of traditional classrooms. The process involves development of training modules consisting of short, 5- to 7-minute videotapes coupled with toolbox talks that ground the content of the videos within the context of a miner's workplace.

## INTRODUCTION

Title 30, Part 48, of the Code of Federal Regulations (CFR) requires underground mine operators to cover no less than 10 health and safety topics as part of new hire and annual refresher training. While the mandated topics are obviously important, many instructors would like to cover one subject in more depth and review additional subjects during class. Fire prevention and preparedness is one topic that some trainers think they do not have sufficient time to discuss in adequate detail in the context of an 8-hour refresher class.

RAG Twentymile Coal Co. in western Colorado recognized the need to review fire prevention and preparedness, as well as other important health and safety topics, outside of its classroom training schedule. To meet this need, Twentymile Coal settled on using video training modules. In developing this training, the company had the following goals:

1. To find a method to conduct this additional training outside traditional annual refresher sessions,

2. To develop customized materials featuring the mine and its unique attributes,
3. To utilize input from mine employees and feature mine personnel as much as possible in the videos, and
4. To design the training so that it could be used for experienced as well as inexperienced miners.

Under a cooperative research and development agreement (CRADA), researchers from the Pittsburgh Research Laboratory of the National Institute for Occupational Safety and Health (NIOSH) collaborated with Twentymile personnel to develop a series of customized training modules on mine fire prevention and preparedness. This paper discusses the process used by Twentymile Coal, provides an example of one of the training modules, and presents data supporting the utility of this type of training.

## PROCESS

The purposes of the joint CRADA were to—

1. Assist Twentymile in improving employees' awareness of mine fire prevention and preparedness by covering topics not normally discussed in annual refresher training,

2. Make employees part of the fire prevention and preparedness system,
3. Raise employees' awareness of the fire brigade's role, and
4. Develop and assess the effectiveness of content-specific video training modules tailored to particular needs.

*Goal 1.* One way to improve an emergency preparedness system is to enhance prevention. This simple idea is often overlooked while elaborate response plans are being developed. Safety personnel at Twentymile Coal Co. recognized that they had given

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a lot of attention to their capability to respond to major emergencies, specifically underground mine fires, but had tended to neglect prevention and the basics of first response. The overall goal of the program, therefore, became to prevent fire-related emergency situations from happening or, at the very least, to control the events before a major response effort was needed. In addition, Twentymile Coal management saw the program as an opportunity to improve miners' level of awareness about management's commitment to fire preparedness.

*Goal 2.* The program was built on the underlying message that everyone at a worksite is responsible for emergency prevention and response. Thus, it was important to involve mine personnel at all levels in the process of developing and presenting training materials on fire prevention and preparedness. Recent research has focused on the involvement of employees in development, structuring, and presentation of training materials. In a study of the use of participatory training techniques, Miles (1992) concluded

that involvement of workers in the training process increased both job skills of the participants and their overall job knowledge.

*Goal 3.* At the mine, which employs about 300 workers, there are two specially trained teams of volunteers. One is the fire brigade and the other is the mine rescue team. While team members are included in the training, employees who are not part of the special teams are the main focus of the program.

*Goal 4.* The training modules detail basic fire prevention and first-response tasks and introduce some activities that would only be performed under the direction of someone with special training. The expectation is that, after training, each worker will know his or her responsibility during an emergency and will also understand the overall mine emergency system. For this portion of their preparedness, mine personnel and researchers from the Pittsburgh Research Laboratory worked together to develop a program focusing on the basics. Implementation of the program at the mine began in July of 1998 and was completed in early 2000.

## TRAINING MATERIALS

The program was started during a week-long session in January 1998 and included personnel having knowledge about content topic, effective training techniques, and video production techniques. Four initial video training modules were developed: "Introduction to Fire Prevention and Preparedness," "Conducting a Fire Risk Assessment," "Fire Prevention," and "Fighting Fire with Water."

NIOSH researchers collaborated with Twentymile personnel in creating the outlines and scripts for each video. The fire brigade members involved in this work assisted with script writing and were filmed presenting unscripted segments about their areas of expertise. They also assisted with development of the safety talk guides that accompany each video. A contractor was hired to shoot and edit the video footage to create the final videos.

Following development of the first four training video modules, four additional modules were created covering other topics concerned with fire prevention and preparedness: "The Foam Generator," "Fire Suppression Systems," "Responding to a Fire: Fire Fighting and Evacuation," and "Using and Maintaining Fire Extinguishers." As with the previous video modules, mine personnel and NIOSH researchers provided content and training expertise. Mine fire brigade members provided assistance with script evaluation and filming of various video clips. For the final videos, all footage was captured by an in-house videographer from NIOSH.

The safety talk guides are a key component of the fire prevention and response basics program. While the videos briefly introduce topics and touch on concepts that everyone at the mine

should know, the safety talks take the same topics and relate them to specific work locations.

For example, one video discusses the equipment needed to fight fire with water. It includes information such as types of hoses and nozzles used to fight fires and where they are stored underground. The associated safety talk focuses on the equipment used to fight fire with water and where available in a given work area. After this talk, the employees should know what equipment is available near their work area and where that equipment is located. The videos introduce a subject and bring it to the attention of the employees. The safety talks relate the topic to specific work locations and provide a forum for questions and concerns. In all, five safety talk guides were authored for the first four video modules, including two guides for the module "Fire Prevention."

The pairing of videos and safety talks allows material to be introduced to large groups and then targeted to small groups so that neither training segment takes much time. At the mine, the videos were presented as part of routine monthly production meetings. Every month or two a video would be shown during the preshift meeting. The safety talk guides were given to supervisors who already had the responsibility to provide such training on a regular basis. The length of the talks would vary by presenter and audience participation, but were designed to take 5 to 20 minutes. With this method, training was incorporated into the daily routine, rather than being put into special training classes that required employees to be away from their jobs for hours or even days.

## AN EXAMPLE OF A TRAINING MODULE: EMERGENCY COMMUNICATIONS

As mentioned earlier, two safety talks were created for the training module "Fire Prevention." One dealt with general issues of fire prevention and preparedness, including housekeeping and

the mine monitoring system, while the other, "Mine Emergency Communication Using the Communication Triangle," focused on the content of warning messages. Research has shown that when

an emergency occurs, people often do not get the information they need to enable them to take appropriate action (Mallett et al., 1993, 1998). This safety training module presents a procedure in which mental cues can be used by senders and receivers of warning messages (Mallett et al., 1999).

The safety talk was originally developed and field tested with Canterbury Coal Co. in western Pennsylvania. During the talk, miners learned about the six categories of critical information that should be provided during emergency communications. These are Who, Where, What, Miners, Event, and Response. Below is an explanation of these six communication categories.

- **WHO.** When reporting an emergency or receiving a warning, the first thing a miner must do is to identify him- or herself. This is important because people react differently depending on who gives them information. If a warning is received from an unknown person, the typical response is to try to gather more information before acting. Thus, significant time can be lost.
- **WHERE.** Telling or finding out where the problem is located is important. This may seem like common sense, but doesn't always happen. Forty-eight miners were interviewed and asked about their experiences following three mine fires that forced the evacuation of more than 60 miners through smoke. Only two of the 48 had known where the fire was as they were escaping, even though this information was known by either the dispatcher or the person who discovered the fire. As a result, miners had to make decisions about escape routes without knowing where the source of the fire lay. This lack of knowledge also increased the stress on

the miners because they didn't know how far they would have to walk to find fresh air.

- **WHAT.** Miners must tell or ask *exactly* what is happening. Again, this may seem like common sense, but such information is not always provided in an emergency. For example, during one serious mine fire, a warning was given for everyone on the section to evacuate. Miners who had been near the phone when the call came in went to gather others of their crew. One of these miners, a shuttle car operator, ducked under the check curtain and yelled to the miner operator, "Come on down to the mantrip! We're going out!" Since the belt was down and it was close to quitting time, the miner operator and his helper thought they were just leaving the section a little early. They went through their normal end-of-shift routine, including backing the continuous miner out of the cut, setting jacks, tightening check curtains, and disconnecting the power before reporting to the mantrip. Valuable time was lost.

After providing or obtaining these three initial pieces of critical information, miners can then provide or obtain details about the response in progress.

- **MINERS.** Is anyone hurt? Has everyone been accounted for? When and where was a missing person last seen?
- **EVENT.** Will this problem require a first-aid kit or an ambulance? Should mine rescue teams be called or will just a couple of fire extinguishers do?
- **RESPONSE.** What's been done so far? How many people are on the scene? What equipment is on the scene?

## EVALUATION

All training materials must be evaluated as to their effectiveness in teaching specific content. In conjunction with showing the first video, a questionnaire (see appendix) was given to all employees to assess their level of knowledge of and awareness about fire prevention and response, including the content of emergency warning messages. An identical follow-up questionnaire was administered in April 1999 after completion of the fourth training package.

### COMMUNICATION TRIANGLE

On both the pre- and post-training questionnaires, trainees were asked to list three pieces of information that should be communicated in a fire warning message. Data were coded to place trainees' responses into the six categories discussed above. On the pre-test, 63% of the miners mentioned at least one of the six information categories. On the post-test, this number rose to 77.5%. As figure 1 illustrates, analysis of the data showed that more than three times as many miners (43%) were able to name three pieces of information following the training session than before the session (13%).

Table 1 summarizes the percentage of miners identifying each of the six emergency communication elements on both the pre- and post-test questionnaires. In all categories, miners exhibited marked improvement. The data suggest this module was extremely useful as a teaching tool for improving emergency communication skills.

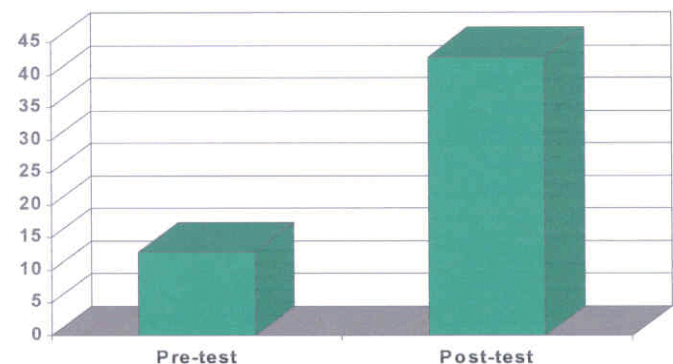


Figure 1.—Percentage of miners identifying at least three components of what information should be passed along in case of a fire or other emergency.

In addition, 14% of the miners on the pretest said they wanted information on what escape route to take in the event of a fire. This was seen as unrealistic by company safety staff. This number dropped to 8.6% on the post-test.

**Table 1.—Percentage of miners identifying each of the emergency communication elements**

Element	Pre-test	Post-test
Who .....	1.3	25.8
Where .....	61.0	75.8
What .....	2.5	23.0
Miners .....	7.6	10.7
Event .....	29.7	32.0
Response .....	14.8	23.0

### DEMOGRAPHICS

There was little change in the demographics of miners between the administration of pre- and post-training questionnaires. Fewer miners completed the post-training questionnaire, but this decrease can be explained by noting that (1) no summer employees were working when the post-training questionnaire was given and (2) a number of miners were on vacation at the time because their children were home for spring vacation. Tables 2 and 3 present the basic demographic information. For purposes of data analysis, miners were grouped into two categories: age (less than 30 and 30 and older) and experience at Twentymile (2 or less years and over 2 years).

**Table 2.—Miner demographic data, years**

	Number	Average age	Average years of mining experience	Average years of experience at Twentymile
Before training . . .	236	37.1	12.3	5.3
After training . . .	178	36.7	12.2	5.6

**Table 3.—Age and experience ranges for Twentymile miners, percent**

	Before training	After training
Age (1-29) .....	30.4	31
Age (30 and over) .....	69.6	69
Experience (0-2 yrs) .....	30.1	20.4
Experience (over 2 yrs) .....	69.9	79.6

### OTHER FIRE PREVENTION AND PREPAREDNESS ISSUES

On both questionnaires, miners were asked a series of questions to assess their awareness of fire prevention and preparedness at Twentymile. These included questions about the mine's general level of preparedness, the likelihood of a fire at the mine, knowledge of various fire prevention and preparedness activities, knowledge of fire-fighting supplies and their location, and possible fire prevention strategies.

*Level of Fire Preparedness.* Workers could select from "Legal requirements met," "More is done than required by law," and "Not all state/federal requirements met." Data presented in table 4 shows the percentage of change in responses between the pre- and post-tests, broken down by age and experience at Twentymile. Following the training, a greater percentage of younger, less-experienced miners felt more is done than required by law compared with this same group before training. A slight increase in awareness was also seen for older, experienced miners. For all miners, 59.1% on the pre-test felt more was done compared to 63.4% on the post-test.

**Table 4.—Percentage of change between pre- and post-tests according to age and year of experience at Twentymile**

Level of preparedness	Age		Experience	
	Under 30	30 and up	0-2 years	Over 2 years
Law met .....	-11.8	-2.2	-18.1	-1.4
More is done .....	12.2	1.9	12.2	4.3
Law not met .....	1.0	0.3	5.7	1.7

*Likelihood of Fire Occurring.* Miners were asked how they felt about the likelihood of a fire on Twentymile property, underground at Twentymile, and in their work area. As table 5 illustrates, fewer miners in the post-test believed fire was likely compared with the pre-test. This shift might indicate that, since learning about Twentymile's efforts in fire prevention and preparedness, miners believe that a fire is less likely to occur. Interestingly, nearly one-half of miners in both the pre- and post-test indicated that fire was not likely in their work area. This may reflect the sentiment that "It won't happen to me."

**Table 5.—Percentage of change between pre- and post-tests regarding the likelihood of a fire**

Location	Overall	Age		Years of experience at Twentymile	
		Under 30	30 and over	0-2 years	Over 2 years
On Twentymile property .....	-9.2	-10.4	-8.3	-7.3	-11.2
Underground at Twentymile .....	-5.8	-5.8	-7.5	-11.2	-7.1
In your work area .....	-1.7	-10.5	-0.2	-2.3	-5.0

Similar trends were seen when the data were analyzed by workers' age and level of experience at Twentymile.

*Awareness of Various Twentymile Fire Prevention Activities and Programs.* On both the pre- and post-test questionnaires, miners were asked about their awareness of the fire brigade, the mine rescue team, the mock drill at Empire Mine, smoke training, fire prevention training, and fire response training. The analysis suggested that awareness of fire prevention and preparedness at Twentymile increased, especially among less-experienced miners. Prior to training, nearly 77% of the workers said they knew about the fire brigade. After training, 85% reported knowledge of the fire brigade. Similarly, fewer miners on the post-test questionnaire gave "don't know about" responses in the remaining activity categories when compared to the pre-test responses.

## FIREBOSS INTERVIEWS

Besides administering the post-training questionnaire to miners, NIOSH researchers interviewed firebosses to obtain their views on the program and to determine if they had seen differences in fire preparedness and prevention since the start of the program. Overall, the firebosses felt that the training was good and that it generated discussion and increased awareness among workers. Firebosses indicated overall housekeeping at the mine was better since the start of the program. They felt sections and outby crosscuts were cleaner. The firebosses also said that rock dusting throughout the mine was much better.

While the number of frozen or bad belt rollers had not changed, the firebosses felt response time for changing out rollers was better. They reported seeing no difference in belt alignment problems, but this item had not been specifically targeted in the training. Finally, firebosses said they had seen fewer bad fire extinguishers since the program started.

## SUPERVISOR INTERVIEWS

In addition to interviewing Twentymile's firebosses, researchers also spoke with many of the supervisors who administered the safety talks to crews. Overall, supervisors felt the training modules and safety talks were good and covered topics not typically reviewed as part of regular training. Many liked the fact the videos showed Twentymile Mine and included its own personnel.

Most foremen felt the safety talk guides were easy to use and were about the right length for holding trainees' attention. One exception was the talk on the communication triangle, which most supervisors believed was too long. (This talk was originally developed for another purpose.) In general, foremen reported their crews talked about fire hazards after the safety talks. Some foremen said they had seen improvements in fire hazard awareness among crews. Several also stated that their crews were more aware of the correct placement and installation of water drops for fire fighting. Finally, most foremen said crews were doing a better job of housekeeping and were more aware of belt lines, hot rollers, and accumulations of material.

## LESSONS LEARNED AND CONSIDERATIONS

From this collaborative effort in developing site-specific training modules, researchers and Twentymile Coal safety personnel obtained valuable information and identified several issues to be considered.

Fire brigade members were willing and able to convey what they had learned in their special training. They knew what key points should be covered and were able to talk through the topics while being videotaped. Using them to help develop scripts and be "actors" greatly improved the return on investments in their fire-fighting training.

For the program to be successful, Twentymile Coal believed that it was paramount for management to buy into the process and convey this commitment. Production managers, including the mine manager, general mine foreman, and the longwall coordinator, were asked to give introductory remarks on the videos. Each manager was given a prepared script for a single video. They all agreed to present remarks, but were not comfortable

with the task. It was felt they should have received the scripts sooner or should have been asked to introduce the videos in their own words.

Producing training videos in a production environment requires maximum flexibility. Frequently, the person needed for a given segment is not available or a location can not be used as planned. Schedules change constantly, and alternate plans should always be prepared.

Scripts should be written in advance of shooting footage whenever possible. The scripts will then guide what is to be shot. This is particularly important if a contract videographer is to be employed.

Safety professionals, production managers, trained response personnel, and other employees all have ideas about emergency prevention and response. The issues important to each group can vary greatly. It is by gathering the concerns and solutions from all these groups that the most complete package can be created.

## CONCLUSION

From the data, it is evident the video/safety talk modules have improved Twentymile employees' awareness of fire hazards, fire prevention, and fire preparedness. The prevention and response program was designed to target a given worksite and a specific hazard. The basic concepts and methods can be adapted to other companies and/or hazards. Twentymile Coal Co. has begun to expand the use of video training modules for other important safety topics, including proper pre-shift inspections on diesel scoops and roof bolters.

The unique aspect of these types of training modules are that they are site specific. The content experts and video locations come from the chosen site. The local experts choose the targeted hazard and develop the content of the training. Outside consultants may be required to obtain the video footage. The end result, however, is a unique training package that meets targeted needs, but that cannot be obtained off the shelf.

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## APPENDIX

### Fire Protection Questionnaire – Twentymile Coal Company

1. How likely is a fire to start in the following locations? (Circle the best answers.)

On Twentymile property	Very likely	Likely	Not likely	Not at all likely
Underground at Twentymile	Very likely	Likely	Not likely	Not at all likely
In your work area	Very likely	Likely	Not likely	Not at all likely

2. Which of the following best describes Twentymile's level of fire protection activities? (Circle the best answer.)

- A. Not all state and federal requirements are followed.
- B. Legal requirements are met.
- C. More is done than is required by law.

3. What do you know about the following Twentymile activities/programs? (Circle the best answers.)

Fire brigade	Participated in	Know about	Don't know about
Mine rescue team	Participated in	Heard about	Don't know about
Mock emergency drill at Empire	Participated in	Heard about	Don't know about
Training in artificial smoke	Participated in	Heard about	Don't know about
Training related to fire prevention	Participated in	Heard about	Don't know about
Training related to fire response	Participated in	Heard about	Don't know about

4. Please list three things that should be included in a fire warning message.

5. Please list three fire-fighting supplies found in your work area.

6. Please list three ways you can help prevent fires at Twentymile.

Please answer the following questions for a study being done by Pittsburgh Research Laboratory.

7. Job title: \_\_\_\_\_

8. Age \_\_\_\_\_ 9. Years mining experience \_\_\_\_\_ 10. Years at Twentymile \_\_\_\_\_

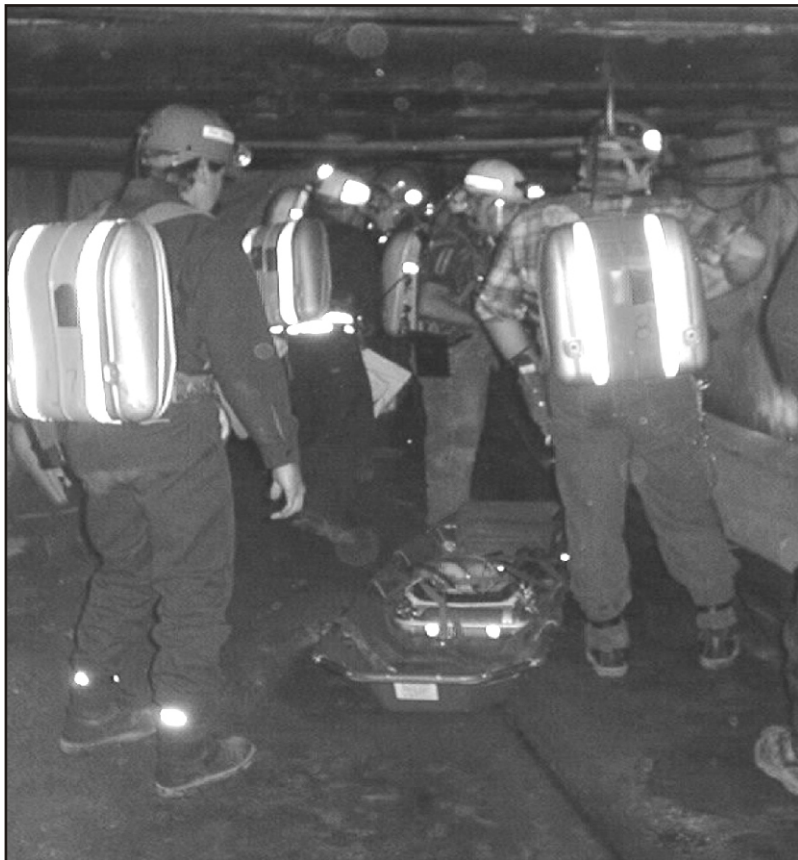
11. Circle your direct employer:      Twentymile      Contractor



# IC 9463

INFORMATION CIRCULAR/2002

# Strategies For Improving Miners' Training





**Information Circular 9463**

# **Strategies For Improving Miners' Training**

**Robert H. Peters, Editor**

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