MSHA Design Document

Mine Supervisor Training

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GEORGE MASON UNIVERSITY

GRADUATE SCHOOL OF EDUCATION

Table of Contents

Table of Figures

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Background

Coal accounts for approximately 50% of the electricity produced in the United States today as shown in Figure 1 (Energy Information Administration, 2004). While the coal usage attributed for electric power generation decreased slightly from 2003 to 2004, the actual coal tonnage consumed in electric power generation actually increased by 10 million short tons in 2004 to a total of 1,015.1 million short tons (Figure 2) (Energy Information Administration 2004). In addition there were net exports totaling 20.7 million short tons of coal. These statistics are a small window into the importance of the coal mining industry within the United States and international economies.

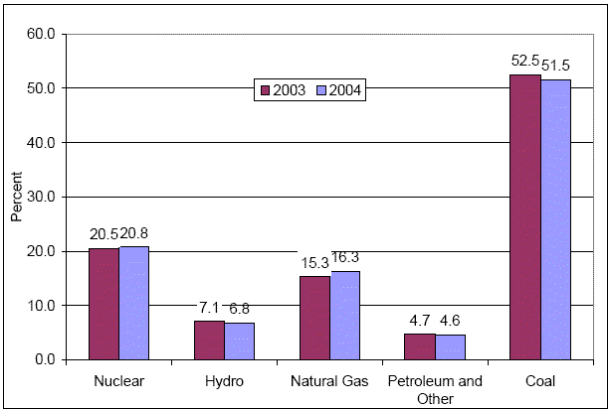


Figure 1: Electric Power Generation by Energy Source for 2003 and 2004

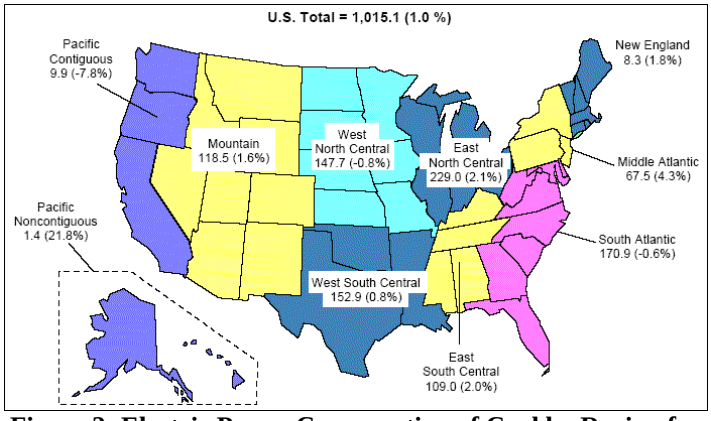


Figure 2: Electric Power Consumption of Coal by Region for 2004

Historically the mining industry is among the most hazardous working environments. Due to the fatalities and serious injuries year after year and the importance of fossil fuels to the country, the Federal Mine Safety and Health Act of 1977 (Mine Act) was passed, creating the Mine Safety and Health Administration (MSHA). The mission of the Mine Safety and Health Administration is "to administer the provisions of the Federal Mine Safety and Health Act of 1977 (Mine Act) and to enforce compliance with mandatory safety and health standards as a means to eliminate fatal accidents; to reduce the frequency and severity of nonfatal accidents; to minimize health hazards; and to promote improved safety and health conditions in the Nation's mines."

In a study conducted by Fotta and Bockosh (2000) using injury and illness data reported to MSHA, it was revealed that from 1988 to 1998, the percentage of injured or ill older workers (45 or older) has been steadily increasing. The most notable increase occurred at coal mining operations where the proportion of injured/ill older workers increased from 24 to 44 percent. Accident statistics in coal mining (1968-1978) also indicated that being young and inexperienced leads to higher injury rates (Kowalski et al., 2001). These statistics suggest that there is a significant safety issue with both the older and younger worker in the nation's mines. Currently older miners represent the majority of the mining workforce.

In his statement to the US House of Representatives Subcommittee on Energy & Mineral Resources (Committee) on July 8, 2004, Bruce Watzman, Vice President Safety, Health and Human Resources for the National Mining Association stated "[The mining industry] will need

to replace a major portion, approximately 50%, of the underground coal mining workforce in the next 5 to 7 years." At the time of this statement 58.3% of the coal mining workforce was above the age of 45, and only 3.4% of that workforce was under the age of 25 (Bureau of Labor Statistics 2004). As the older generation of miners retires and leaves the mines, mining operations will be faced with a significant gap in domain knowledge as well as a serious human resources gap, if the number of people entering the coal mining workforce does not increase significantly in the upcoming years. According to the Energy Information Administration (2004), the overall coal mine employment numbers will climb by nearly 10,000 new positions over the next 20 years, from 72,749 in 2004 to 82,103 in 2025 (Figure 3). This does not include the replacement of positions vacated through retirement or tragedy.

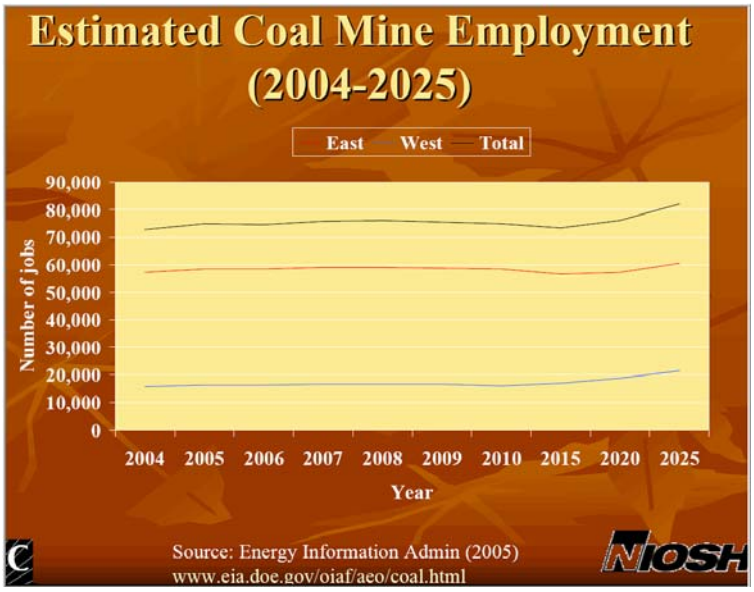


Figure 3: Anticipated Coal Mine Employment Rates

A recent review of the state of the mining industry conducted by Balfour Holdings, Inc. on behalf of the National Mining Association stated that "just as the demand for mining workers appears poised for expansion, the capability to provide new mining professionals has significantly deteriorated through the downsizing and disappearance of university degrees and other programs offering this very specialized education." Additionally, in his speech to the Committee, Mr. Watzman suggested additional factors contributing to the pending shortages in the mining workforce, which include:

- A diminishing pool of human resources due to the relocation of people away from mining communities.
- Ever-changing production methods are raising the demands placed on employees.
- The increasing high technology environment requiring workers with advanced skills.

Mr. Watzman concluded his speech by saying, "How these skills will be gained in advance of employment is a continuous challenge." This is precisely the challenge that MSHA is addressing in its pursuit of a formalized Section Foreman/Mine Supervisor Training Program.

Problem Statement

As more experienced coal mine supervisors retire, shifting the demographics in the industry, the need for more formal, industry-wide supervisory training becomes urgent and critical. Mine supervisors are the key individuals in maintaining a mine's safety and health program. Additionally, the growing need for energy and the inherent hazards in the industry make mine supervisors essential for ensuring future coal supplies. Currently mine supervisory training lacks comprehensiveness and does not adequately address the complexity of supervisory tasks.

Project Overview

The George Mason University (GMU) Immersion Project Team has been tasked by MSHA to create a dynamic data driven training program for mine foremen/supervisors. Given the growing shortfall of experienced miners eligible to take on the role of foreman/supervisor and the safety and health concerns surrounding the coal mining industry, it is critical that current and new foremen/supervisors are thoroughly prepared for the role that they play in the mines. More specifically, supervisors in the nation's mines are subjected to many if not more of the hazards that non-supervisory miners face and therefore they must be aware of how to perform their jobs properly, and they must learn to recognize and control the hazards in their work places. Currently however, mine supervisory training does not address the range and complexity of supervisory tasks. In addition, current supervisory training approaches are not compatible with new training theories, methodologies, and technologies. Supervisors need more effective tools and knowledge processes if they are to be effective team leaders. Effective leadership requires effective communication, problem solving, decision-making, and conflict resolution skills, and the ability to motivate people.

The goal of this project is to examine and validate the mine foreman/supervisor Job Task Analysis (JTA) developed by MSHA in cooperation with the U.S. Navy, and to transition this JTA to an effective and efficient training strategy for mine supervisors. This training strategy will be based on state-of-the-art instructional design principles, processes, and learning technologies, in order to help mine supervisors achieve the required knowledge and skills to carry out their jobs effectively and efficiently.

While the scope of this project is to primarily address the training need for current and new coal mine supervisors, MSHA anticipates that this data-driven training strategy will be utilized to address the training needs of all mine supervisors. MSHA also anticipates that States, mining associations, mining schools, private contractors, and individual mine operators will also benefit from this training strategy. It is envisioned that the eventual full-scale implementation of this training strategy will result in improved mine productivity; reduction of maintenance costs; and an improved safety record of the nation's mines.

Project Goals

In order to develop this training strategy, the specific project goals include:

(1) Conducting a comprehensive performance and needs analysis of the current state of mine supervisor training
(2) Conducting a cognitive task analysis of mine supervisory tasks to determine the cognitive domain type and level of these tasks
(3) Developing an appropriate training strategy and delivery approach
(4) Conducting formative evaluation and usability testing on model training prototypes

The above project goals will be implemented in two phases. Phase 1 will address goals 1 and 2 and phase 2 will address goals 3 and 4.

Needs Assessment

To implement phase 1 of this project, the GMU project team conducted a needs assessment to define the scope of the training requirements of coal mine foremen/supervisors. This needs assessment was conducted using the following processes and methods:

- A review of extant data sources (see References section for list of sources)
- Interviews with Subject Matter Experts (SME)
- A survey of Mine Foremen/Supervisors and Mine Foremen/Supervisor candidates
- The analysis of the Job Task Analysis (JTA) Mind Maps for the job of Mine Foreman for both Excel Mining and CONSOL Energy.

Extant Data Sources

The project team conducted a review of nearly 50 sources of existing information including industry publications, websites, and DVD/videos. These sources provided information on the current and past conditions of the coal mining industry, federal and state regulations governing the industry, the training and certification of miners and mine foremen/supervisors, and the aging mining workforce. In addition, the project team engaged many human resources during this phase of this project.

Stakeholders

Jim Baugher, the Management Program Analyst and Educational Policy Analyst for MSHA, is the primary stakeholder and a subject matter expert for this project. The project team met with Mr. Baugher on September 15, 2005 for an initial interview. He has asked that the project team address the need to formalize training for coal mine supervisors and anticipates that this training strategy will be utilized to address the training needs of all mine supervisors. The key issues essential to the task are the constant changes that occur in the workplace environment, most training occurs on the job, and human resources are not available or adequate to meet the needs of current MSHA-directed hiring requirements for supervisors. A summary of the initial interview with Mr. Baugher is included in Appendix A.

Subject Matter Experts

The project team conducted interviews with Subject Matter Experts (SMEs) to gain a better understanding of the state of mine foreman/supervisor training. Mr. Baugher provided the following individuals as subject matter experts:

- Mr. Gene Williams, Mine Manager for Excel Mining
- Mr. Gerald Nicholson, Corporate Trainer for CONSOL Energy
- Mr. Frank Linkous, Director of Mines for VA Department of Mines, Minerals and Energy
- Mr. Jerry Vance, Educational Field Services for MSHA

During the interview each SME was asked the following questions:

1. What are the challenges and difficulties related to training in the coal mining industry?
2. What's working well in current mine supervisor training programs?
3. If you had a wish list for mine supervisor training, what would it include?
4. Please list the necessary qualities of a mine supervisor. If you had to rank these qualities, where would you start?
5. Can you suggest additional people or resources that we should contact or access regarding the training of mine supervisors?

A summary of the interview results is discussed in the findings section. The complete interview responses are located in Appendix B.

Learners

In order to get an accurate picture of the learner (target) audience the project team developed a mine foreman/supervisor survey. This initial survey sought to gather data regarding, demographics, job experience, technology experience, training experience, and foreman skills and tasks (see Appendix C). In addition, the survey provided an open response question that asked the learner to cite additional training that would be helpful in supporting their day to day activities. To date twenty-seven learners were surveyed.

The findings of these data collection methods were analyzed and synthesized to construct this needs assessment. Below we discuss these findings to include, the current state of mine foreman/supervisor training, the learner audience, the knowledge and skills that are required and lacking by the learner audience, and based on these findings a training solution system will be proposed to address these discrepancies.

Findings: Current State of Mine Foreman/Supervisor Training

Aging Workforce and Knowledge Transfer

SME interviews, extant data sources and survey responses highlighted the issue of the aging workforce in the mining industry. The last hiring surge spanned approximately 20 years

through the 1970's before ending in 1982, when the coal mining industry experienced a downturn in production and interest in mining as a career. Currently, it is estimated that more than 50% of the current coal mining workforce is at or nearing retirement age resulting in a shortage of coal mining personnel in general, but more specifically, it has created a lack of qualified mine foremen/supervisors. Because foremen/supervisors are essential to the safety and productivity of the mining industry, prior to becoming a foreman/supervisor, candidates for the position must have the requisite years of experience and the knowledge and ability to pass a certification examination.

Accompanying the issue of the aging workforce is the transfer of coal mining knowledge from the aging workforce to younger miners of the newer generations. One of our data sources (NIOSH Information Circular 9474, 2004) states, "Of present major concern in the mining industry is how to provide appropriate training for an aging workforce and concurrently develop training for the expected influx of new and less experienced miners as older workers retire."

The extant data that the project team has reviewed supports evidence of the resurging demand for coal as an energy source. With projected production of 1.14 billion tons, coal mining companies are challenged to increase recruiting efforts to bulk up the work force and to develop training programs to prepare these new miners to replace the soon-to-retire miners. CONSOL Energy, for example, has re-instituted an updated version of its "red hat" program that pairs new miners with more seasoned miners to teach them the tools of trade and how to stay safe underground (Nightline, 2005) This program aids in facilitating knowledge transfer, as well as rehiring retired foremen/supervisors to work part time and as instructors for training programs. The company has also developed its own supervisory training program which consists of three training modules including two levels of supervisory skills development and a workshop specifically for managing a mine.

In addition, developments in technology have allowed the mining industry to do more work with fewer workers. Technology will also be an integral part of knowledge transfer training delivery. The newest miners belong to Generation Next and are cyber literate. "Nexters expect technology to be used in training if possible and also expect the trainer to be comfortable and competent in its use" (NIOSH, 2004).

Certification, Training and Education

Mine foreman/supervisor certification and refresher training tools and programs have a crucial role in the training and education of foremen/supervisors and miners seeking supervisory positions. This training focuses primarily on educating this population on the performance of duties related to and mandated by federal and state regulations that govern the safety and health of the mining industry. In addition to certification, management/leadership skills training as well as training programs that utilize the JTAs have begun to take on a greater emphasis. As our SME interviews and extant data revealed, individual mining companies are approaching the challenge differently.

Due to their economic constraints, a number of smaller mining companies use outside educational resources to provide training opportunities to foremen/supervisors and miners

seeking supervisory positions. These economic constraints prevent small companies from developing their own extensive training programs, as well as inhibit their ability to send personnel to training sessions during normal workday hours. Evening courses at area colleges and universities as well as continuing adult education classes at local high school facilities, aid in education and certification. Some of these programs include, but are not limited to, certificate and degree programs in mining engineering, which concentrates on the various steps involved in mineral extraction, geological sciences and geography. Some programs also integrate management courses and the development of leadership skills.

Larger mining companies have developed their own comprehensive training programs for foreman/supervisors and miners seeking supervisory positions. Some of these companies, such as CONSOL Energy and Excel Mining, use the JTAs in their instructional programs. A mine manager from Excel Mining reported that using the JTAs provided a more detailed training environment. During training, the JTAs present a visual reference tool to ensure that vital procedures are not missed when foreman/supervisors perform critical tasks. In addition, different operators, such as continuous miner and shuttle car operators and drivers are brought in to explain their jobs. These operators also use the JTAs as a reference tool to more carefully detail the tasks included in their jobs while they explain it to foremen/supervisors in training.

There is also an emphasis being made by larger companies to incorporate management skills into their curriculum. A corporate trainer from CONSOL Energy reported that management development and communication courses are essential in providing soft skills training to foremen/supervisors and miners seeking supervisory positions. These skills are necessary to gain credibility and trust of those being supervised. The importance of management skills was also stressed by the Director of Mines for the VA Department of Mines, Minerals and Energy.

Survey Findings

As mentioned earlier, a survey was conducted of Mine Foremen/Supervisors, referred to as “learners” for the purpose of this analysis. The 27 learners surveyed to date all attended training provided by CONSOL Energy. This survey gathered data regarding basic demographic information, assessed the learners’ comfort with the use of targeted technology/software packages, and sought the learners training delivery preferences.

General Demographics

All respondents surveyed were adult males. The age of respondents was distributed across three age ranges: one third of respondents were 20 – 30 years of age, one third of respondents were 31 – 50 years of age, and one third were 51 years of age or older. The educational level of the learners span from High School Diploma through Advanced Degree, one learner did not respond (Figure 4).

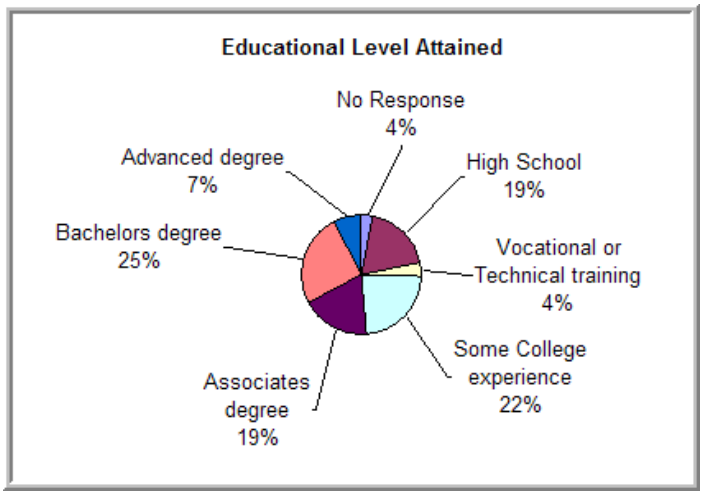


Figure 4: Educational breakdown of survey respondents

The learner's job experience is also varied. Of the learners that responded with 1-3 years of mining experience prior to moving to the position of section foreman, their years as a foreman are distributed evenly across the < 1, 1 - 3, and 3 - 5 years as a section foreman categories. Conversely, miners that were miners for > 5 years have also primarily been section foreman for > 5 years. This is representative of the slow down that the industry experienced during the 1980's and 1990's. During this time there was a hiring freeze in the industry and miners had fewer opportunities for advancement. Today miners are advancing more quickly as is represented by the learners with 1 - 3 years experience as a miner prior to promotion (Figures 5 & 6).

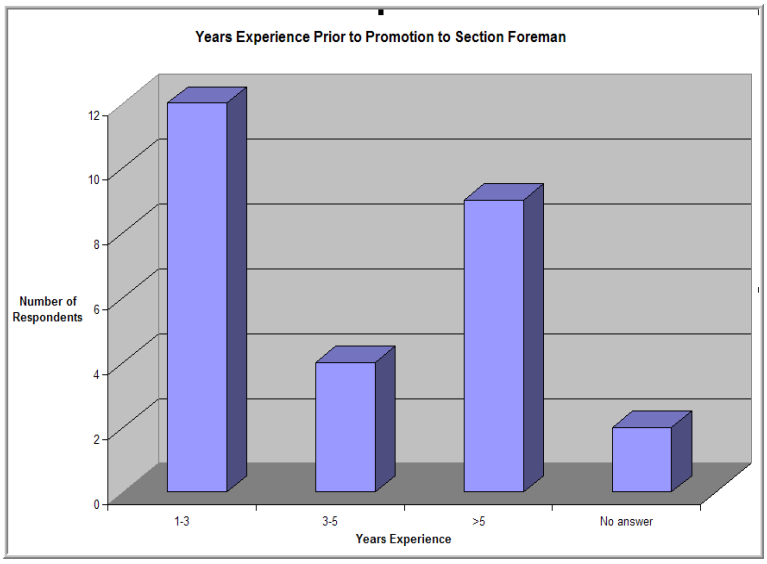


Figure 5: Years as a Miner prior to Promotion

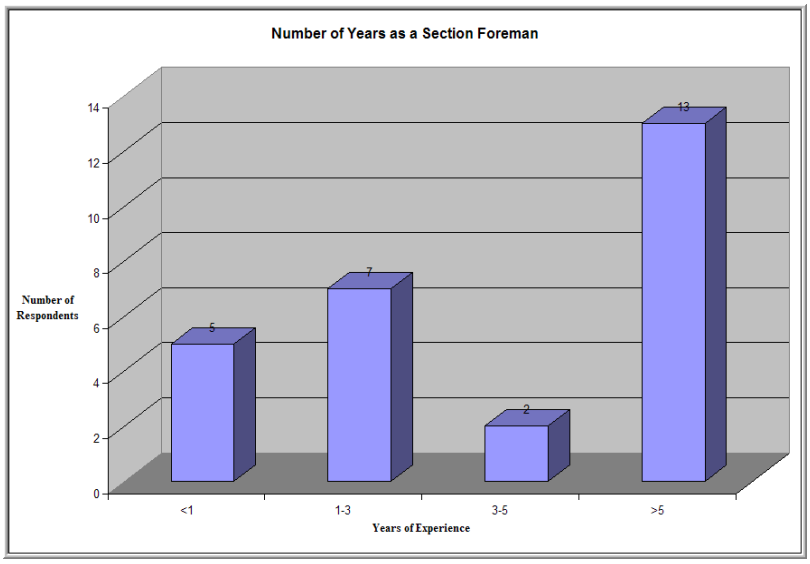


Figure 6: Years as a Section Foreman

Technology Comfort Level

In order to determine the appropriate technological training options, the survey asked learners about their access to the Internet and to rate their comfort level with four (4) types of computer based tasks: Navigating the Internet, Word Processing, Email, and the use of

Interactive CD-ROM. One hundred percent (100%) of respondents reported that they had access to the Internet either at work or at home or both. Figure 7 shows that a majority of the learners are comfortable with the technology tools included in the survey. In addition, the results of the survey also support the NIOSH findings that the older workforce nearing retirement is not as comfortable with computer-based technology (Kowolski, et al., 2004) learners age 51 and older listed themselves as somewhat comfortable or uncomfortable.

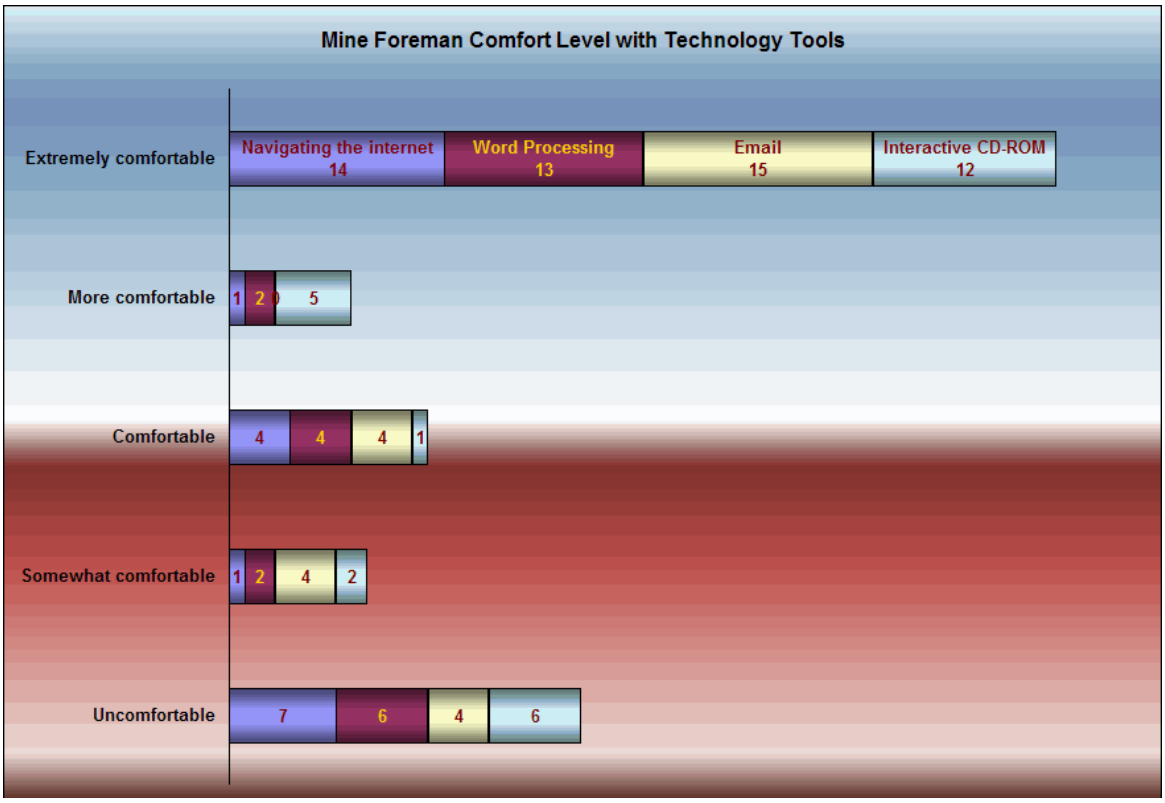


Figure 7: Mine Foreman Comfort Level with Technology Tools

Training preferences

While our learners, overall, expressed a comfort level with technology, their training preferences focused on more traditional forms of learning. As displayed in Figure 8, Instructor Led Classroom Training and On the Job Training tied for first place among nearly eighty percent (80%) of all respondents. Only ten percent (10%) of respondents indicated a preference for Online Training and CD-ROM Training respectively. These results are in line with the training preference findings of NIOSH that state that learners within the mining industry do not tend to follow the training preferences of their generational peers in other industries.

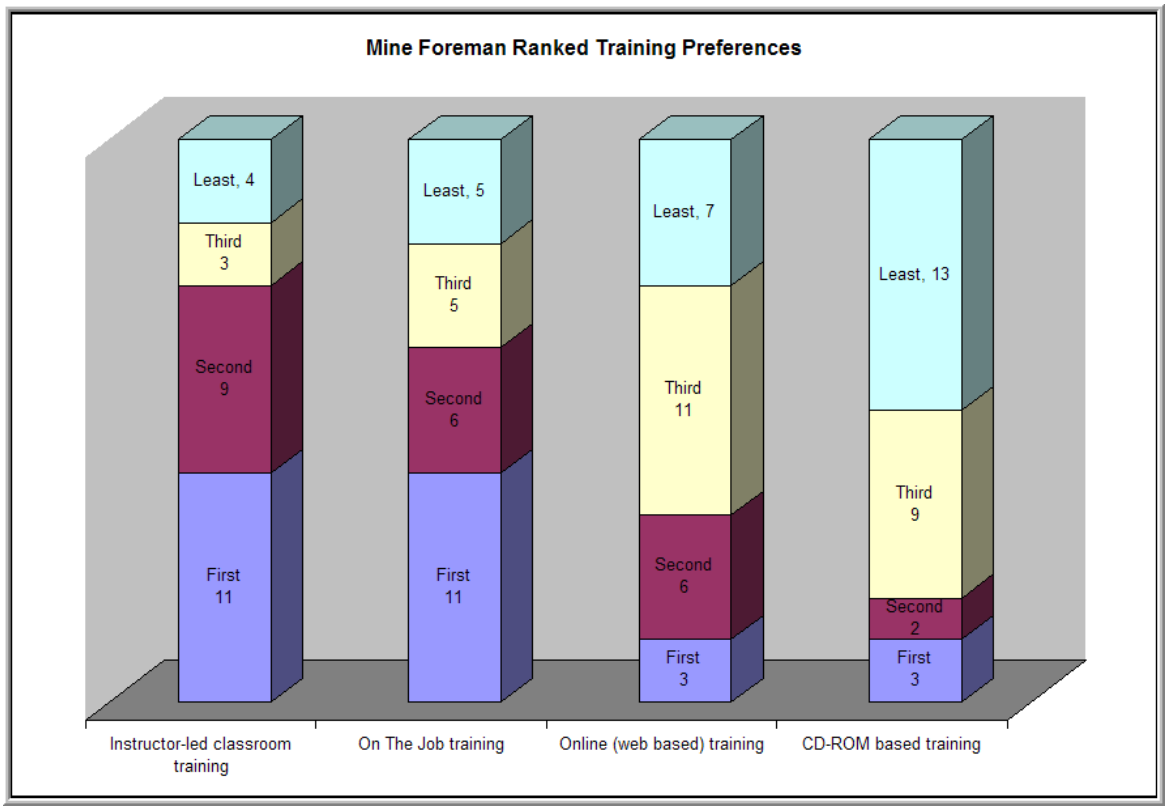


Figure 8: Mine Foreman Training Delivery Preferences

Survey Conclusions

In the project team's SME interviews it was stated that mine supervisor candidates often did not have a strong formal education and in some cases illiteracy is a challenge when conducting training. This is one stark difference between the findings of the SME interviews and the survey results, as the results of the survey showed all participants had a High School Diploma or greater.

The project team is working on gaining access to a broader group of learners to administer the survey. This population of survey respondents came from a large underground coal mining company with vast resources. As a result, the educational achievements represented by these respondents may not be indicative of the educational levels throughout the industry.

In addition, given the learners access to computers and their comfort level with technology, the project team has adjusted the survey to assess whether learners currently prefer instructor-led classroom training and on the job training to electronically based training because they do not have experience with technology driven forms of training.

Learner Analysis

Based on the extensive literature review, SME interviews, and survey results presented above, the project team compiled a learner analysis. This learner analysis includes the general and

specific characteristics of the learner audience, as well as a proposed set of learner roles that the training solution system will target.

General Characteristics

The mining industry as a whole and coal mining in particular is facing a shortage of experienced miners to fill the role of foreman/supervisor. Our primary target audience is comprised of novice mine supervisors with less than 3 years supervisory experience and experienced miners with the requisite regulatory years of underground mining experience. Regulatory requirements vary by state. Overall, the learners are adult male and female underground coal miners and underground coal mine supervisors with a range of underground coal mining experience.

These individuals belong to the following generational groups—Baby Boomer (born between 1943 and 1960), Generation X (1960-1980), and Generation Next (1980-2000). These generational groups have diverse learning preferences. Baby boomers prefer classroom training that includes working interactively with other trainees. Generation X learns well independently. They want to be involved with what they are learning, utilize visually stimulating training materials that contain few words, and seek feedback on their use of skills (NIOSH, 2004). Generation Nexters have a preference for working in groups and expect technology to be used in training. Nexters require structured and formalized training to be most effective (www.trainingmag.com, 1999).

Specific Characteristics

Through our extant data review, SME interviews, and survey instrument several specific learner characteristics became evident. These include educational and training requirements, communication and attitudinal characteristics, and a set of learner roles.

Educational or Training Requirements

The educational background of the learner audience ranges significantly from some high school education through advanced collegiate degrees. Miners seeking promotion are required to complete a Mine Supervisor Certification program prior to being promoted. Miners pursuing promotion are generally motivated to seek out the additional qualifications required by state and federal law to advance to the position of mine supervisor. Additionally, miners working toward the requisite experience levels may take advantage of a supervisor training program as a means to advance their knowledge and improve their chances for advancement at the first opportunity.

Communication and Attitudinal Characteristics

Through interviews it was emphasized to the project team that mine supervisors must possess a modicum of soft skills prior to taking on the role of supervisor. It is essential that a supervisor can assess not only the technical capabilities of their workforce but also their attitudinal state. In addition, supervisors need to be accessible to miners when problems arise. The following set of communication and attitudinal characteristics were emphasized by our Subject Matter Experts:

1. Approachable, rapport with mine operators, already cognizant of miner needs, but not fully comfortable with the potential role of managing former co-workers
2. Good communication/listening skills, fluent in technical terminology
3. Untested phone or written communication thus far; fluent in technical terminology and colloquial jargon
4. Excellent written and verbal communication skills but lacking in colloquial jargon

Roles

The available data suggests that ideal candidates for mine supervisor training are either miners with more than three years experience or new mine supervisors whose practical experience is not fully commensurate with the demands of the job. Multiple data sources show that for a miner to be considered experienced, he or she must have worked in an underground mining environment for 12 months to 5 years dependent upon the state the miner is working in. In addition to job longevity, certification may be required for a miner to be designated as experienced: the Colorado Mining Association states that a miner with 1 year of mining experience may be declared an experienced miner after completing an MSHA-approved training program for underground miners. Educational background varies greatly for experienced and intermediately-experienced miners.

The survey results suggest that new mine supervisors are more likely to have attained a higher degree of than their older colleagues or experienced miners. The survey results also suggest that new mine supervisors are relatively young and belong to the Generation X and Generation Next groups. The user roles listed below are divided into primary and secondary audiences.

Primary Audience

The primary audience is those individuals that receive the most direct benefit from training. This includes:

1. Experienced Miner
2. Intermediate Miner
3. New Mine Supervisor

<u>The Experienced Miner Seeking Promotion</u>

1. Who would use the training?
   - The experienced miner who is knowledgeable about and well-rounded in technical tasks associated with mine operations. These learners are primarily from the Generation X cohort.

2. How would they use the training?
   - To formalize training needed to become a supervisor
   - To gain a better understanding of the expectations of the mine supervisor position
   - To ensure that they are exposed to all aspects of current mining operations

- As a tool to build upon industry-mandated training
- To improve communication skills
- To update and learn technology skills

3. How do they expect the training to be delivered?
    - Hands-on training (on-the-job training, apprenticeships)
    - Authentic learning environments
    - Collaboration
    - Training materials that include visual stimulation, such as headlines, quotes, graphics, and lists
    - Incorporation of technology

Intermediate Miner Seeking Promotion

1. Who would use the training?
    - Miners with 3+ years experience and are eligible for promotion to mine supervisor. These learners are primarily from the GenerationNext cohort.

2. How would they use the training?
    - To learn tasks and procedures performed by supervisors
    - As a study resource to be used for promotion
    - As a formalized and comprehensive way to learn supervisory tasks

3. How do they expect the training to be delivered?
    - Group-oriented
    - Varied technology
    - Hands-on practice in classroom
    - Practice at worksite
    - Simulation

New Mine Supervisor

1. Who would use the training?
    - New mine supervisors who have had limited technical training/work experience and lack adequate mentoring due to the shortage of veteran supervisors (Kowalski et al, 2004). This group contains individuals from both Generation X and Generation Next.

2. How would the new mine supervisors use the training?
    - To reinforce previously learned material and enhance technical knowledge
    - To define what their new position requires of them
    - To determine the best way to accomplish required tasks
    - To prioritize areas of responsibility
    - As a reference tool

3. How do they expect training to be delivered?
   Generation X expects training that is:
   - self-paced
   - visually stimulating
   - not text-heavy

   Generation Next expects training that includes:
   - written explanatory information
   - interactive learning activities
   - the use of technology

Secondary Audience

The secondary audience contains those individuals preparing for future advancement, those that may be seeking refresher type training resources, and individuals presenting training courses. This includes:

1. New Miners
2. Veteran Mine Supervisors
3. Trainers and Facilitators

New Miners

1. Who would use the training?
   New miners who lack the required years of experience to become a mine supervisor

2. How would the training be used?
   - As an information resource for career development planning to develop requisite skills in preparation for consideration as mine supervisor candidate
   - To develop a better understanding of duties and responsibilities of a mine supervisor

3. How do they expect the training to be delivered?
   - Formalized mentoring framework
   - Classroom situation that encourages interaction between students
   - Group learning
   - Technology expected to be used in training
   - Lively, varied, with multiple focal points similar to Generation Xers

Veteran Mine Supervisors

1. Who would use the training?
   Veteran mine supervisors seeking refresher training or brushing up on specific skills

2. How would the training be used and/or needed?
   - To continuing education for new technology and procedures

- As a refresher
- In the development of 'train-the-trainer' materials
- As a mentor guide

3. How do they expect the training to be delivered?
   - Well-organized
   - Valid content and up-to-date
   - Easy to use
   - Easily accessed
   - Traditional delivery methods, group and situational learning environments

Trainers/Facilitators

1. Who would use the training?
   Trainers or Facilitators constructing or delivering training materials to Miners or Mine Supervisors

2. How would the training be used and/or needed?
   - Train-the-trainer materials
   - Job aids/handouts for training
   - Instructional methods and strategy
   - Just-in-time training

3. How do they expect the training to be delivered?
   - Well-organized
   - Valid content and up-to-date
   - Easily accessed
   - Varied and appropriate media and delivery methods

Findings: Optimal State of Mine Supervisory Training

It was revealed during the SME interviews that the desired abilities in a foreman/supervisor fall into two distinct categories, task performance and leadership/knowledge performance. Task performance includes operational checks that a foreman/supervisor should perform during the course of a workday. Foremen/supervisors are subjected to many, if not more, of the hazards that non-supervisory miners face and therefore they must be aware of how to perform their jobs properly and they must learn to recognize and control the hazards in their work environment. These skills are task-related and are outlined in the JTAs. They are listed below in order of importance as stated by a MSHA subject matter expert:

Task Performance:

1. Make sure the mine areas and crews are safe.
2. Examine conditions of the mine (roof strata, seams, roof control and ventilation plans).
3. Make sure crews have all necessary tools, safe equipment and supplies.

4. Make sure that the crews had proper training to do their jobs (train the operator or make sure they get training).
5. Make sure that crew members are performing their jobs in a safe manner.

In addition, a number of qualities/skills are desired in foremen/supervisors other than the ability to do the required operational checks. Leadership/knowledge performance includes skills that a foreman/supervisor should demonstrate. Leadership skills entail the ability to develop, grow and motivate the people being supervised. Good communications skills are needed to pass on information to mine staff in layman's terms and listen to mine personnel and understand their needs. The ability to problem solve is critical when encountering unknown and situationally-dependent problems. A complete and thorough understanding of the federal regulations governing underground coal mining is necessary to maintain safety and health. Efficient and effective planning skills are vital in the preparation of the foreman/supervisor workday. These qualities/skills are listed below in order of importance as stated by a MSHA SME:

Leadership/Knowledge Performance:

1. How to listen and communicate effectively.
2. How to be good problem solvers.
3. An understanding of the required state and federal mining regulations as well as company policy.
4. How to plan efficiently and effectively.
5. How to motivate different types of people to work.

The combined skills included in task and leadership/knowledge performance provide supervisors with more comprehensive tools and knowledge processes to be more effective leaders. Effective leadership requires effective communication, problem solving, decision-making, and conflict resolution skills, and the ability to motivate people.

Job/Task Analysis

Overview

A task analysis is a description of the breakdown of a job duty into its component tasks, which are then further divided into the steps and sub-steps required to complete the job. In addition, the task analysis documents the knowledge and information needed by the performer to carry out the tasks effectively.

The purpose of a task analysis is to answer the questions, “What does the person performing the job in question actually do?” and “What does the person need to know in order to perform the tasks that define that job?” The answers to these questions help determine the instructional goals and objectives of the project, and consequently, identify effective instructional strategies needed to train someone to perform the job.

To perform a task analysis, the MSHA project team analyzed the diagrams, called the job task analysis spiders (JTAs) created by CONSOL Energy and Excel Mining that identify and describe the duties performed by coal mine supervisors at the respective companies. Based

upon our analysis, a generic set of JTAs was developed. A cognitive task analysis (explained later in this document) was performed on these generic duties to categorize them according to their associated intellectual skill domains. As a result, learning hierarchies were formulated.

The New Generic JTA

The JTAs created by CONSOL Energy and Excel Mining differed in their breakdown of the duties performed by mine supervisors. For example, CONSOL determined that there were thirteen primary or high level supervisory duties whereas Excel Mining identified fifteen primary or high level supervisory duties. The MSHA subject matter expert determined that some duties described by the two mines were company-specific and would not necessarily translate to operations within smaller mines with fewer resources.

Using both sets of JTA spiders as a foundation, the project team, with assistance from an MSHA SME, developed a set of generic JTAs that represent the high-level duties performed by mine supervisors in general (See Appendix D). The overall supervisory job was categorized into twelve top duties, and each top duty is completed by sequential steps/tasks. Further, the tasks were assigned a rating, which was used to prioritize the most significant in regard to safety factors. The ratings include:

- 1 = Important
- 2 = Very Important
- 3 = Critical

A task labeled as "1" would have marginal safety effect if not properly completed. A level "2" task may cause significant, but non-fatal effects if not properly completed. A "3" or critical task may cause fatalities or have a catastrophic effect if not completed properly.

For the purposes of developing an effective training strategy, the *important* (2) and *critical* (3) tasks will receive primary consideration for development. The table below represents a summary of job-related tasks.

Duty/High-Level Task	Description	Tasks	Importance Rating
1. Self Assessment and Personal Fitness	Preparing for a safe and healthful work shift for himself/herself and crew through self-assessment and personal fitness determinations prior to start of shift	1.1. Conduct self-assessment	2
		1.2. Be prepared to deal with employee problems/concerns	2
2. Start of Shift Activities	Conducting start-of-shift activities	2.1. Arrive on time to review reports and records	
		2.2. Review records and reports at mine office	3

Duty/High-Level Task	Description	Tasks	Importance Rating
		2.3. Talk to previous shift foreman	2
		2.4. Take pre-shift phone call	3
3. Prior to Entering the Mine	Conducting the required activities prior to entering the mine	3.1. Check for and/or obtain necessary safety equipment	3
		3.2. Obtain necessary tools and equipment	2*
		3.3. Check crew	3
		3.4. Perform check-in at the mine	3
4. Entering the Mine	Properly boarding and traveling into the mine by slope car and/or elevator	4.1. Conduct smoke search	3
		4.2. Board slope car	
		4.3. Board elevator	
		4.4. Board mantrip	
5. Travel to the Section	Properly traveling to the section by rail and rubber-tired mantrip	5.1. Board mantrips	3*
		5.2. Observe conditions while traveling	3*
		5.3. Park mantrip	3*
6. Arrive on the Section	Conducting the appropriate activities upon arrival on the section.	6.1. Meet with previous shift foreman for switch-off discussion	2
		6.2. Monitor equipment operators pre-op examination	
		6.3. Verify hot seating procedures	1
		6.4. Proceed to the section feeder	
7. Section Observation	Conducting a safe and thorough section observation	7.1. Monitor start-up	2
		7.2. Check for hazardous conditions and methane	3
		7.3. Monitor employee activities	3
		7.4. Monitor equipment	2
		7.5. Assure supplies and tools are available to complete assigned tasks	2
		7.6. Assure center lines are installed prior to a place being mined	2
		7.7. Coordinate anticipated downtime	1
8. Conduct On-shift Examination	Conducting a proper and thorough on-shift examination	8.1. Examine faces	3
		8.2. Examine other areas of section	3

Duty/High-Level Task	Description	Tasks	Importance Rating
		8.3. Observe location and physical conditions of cables	2
		8.4. Check for first aid equipment	2
9. Conduct Pre-shift Examination	Conducting a proper and thorough pre-shift examination	9.1. Examine section tail piece and perform checks	2*
		9.2. Examine haulway	2*
		9.3. Conduct dust parameter examination	2
		9.4. Examine battery charging station	2*
		9.5. Examine faces and immediate returns	2
		9.6. Monitor roof control requirements	2
		9.7. Examine power center	2
		9.8. Call results out to the oncoming shift	3
10. End of Shift	Conducting a proper and thorough end-of-shift examination	10.1. Talk to oncoming section foreman	3
		10.2. Ensure that all employees have checked out of the mine	2
		10.3. Order immediately needed supplies	2
		10.4. Communicate with shift foreman and chief electrician	2
		10.5. Charge methane detectors according to shift	2
		10.6. Review and sign pre-shift books	3
		10.7. Complete production and delay report	2
11. Emergency and Unusual Situations	Effectively handling emergency or unusual situations	11.1. Account for all personnel	3
		11.2. Ensure communications	3
		11.3. Make sure that all SCSRs are gathered and available	3
		11.4. Assess situation	3
		11.5. Address fire/explosion	3
		11.6. Address inundations	3
		11.7. Address serious injury	

Duty/High-Level Task	Description	Tasks	Importance Rating
		11.8. Address unintentional roof falls	
		11.9. Conduct or schedule training	
12. Training Responsibilities	Conducting and monitoring required training	12.1. Conduct escape and evacuation training	3
		12.2. Conduct or monitor task training	3
		12.3. Conduct or monitor hazard training	3
		12.4. Conduct "Introduction to the Work Environment" tour	3

* Indicates tasks containing subtasks with rating shown.

Cognitive Task Analysis

The goal of a cognitive task analysis is to identify the cognitive skills that are needed for task performance. More specifically, it is used to identify and take into account the cognitive requirements inherent in performing tasks. This includes the knowledge, mental processes, and decisions that are required to execute tasks.

In examining the JTA, the primary objective of the cognitive task analysis was to provide an overview of mine supervisor decision-making tasks, the sources of complexity contained within those tasks, and the knowledge and skills required to properly complete tasks.

Using the generic JTA, the project team conducted a cognitive task analysis of the 12 top duties performed by coal mine supervisors. This cognitive analysis method was used to determine the cognitive skill level and the progressive mental activity required for execution of tasks. The project team utilized Gagne's learning taxonomy of the Intellectual Skills domain in the examination of the intellectual skills used in the execution of supervisory tasks. Gagne's Intellectual Skills domain includes four levels; discrimination, concrete concept, rule using and problem solving.

The first intellectual skill is discrimination. Discrimination is the ability to discern the difference between objects along one or more physical dimension and to make different responses accordingly. Concrete concept is the next level in the taxonomy. Concrete concept is the ability to identify and see the similarity in a class of objects. Rule-using is the next level and is defined as applying a rule to a given situation or condition by responding to a class of inputs with a class of actions. The highest level of the intellectual skills taxonomy is problem solving. Problem solving is defined as combining discrimination, concrete concept and rule-using skills to solve problems in a situation never encountered by the person solving the problem (Gagné & Briggs, 1974).

The project team found that a small number of mid and lower-level tasks in the JTA required discrimination or concrete concept skills. However, the majority of tasks performed by

supervisors required rule-using skills, while emergency situations and the overall supervisory job encompassed problem-solving skills. Figure 9 is a hierarchical representation of the learning taxonomy of intellectual skills used in the analysis process.

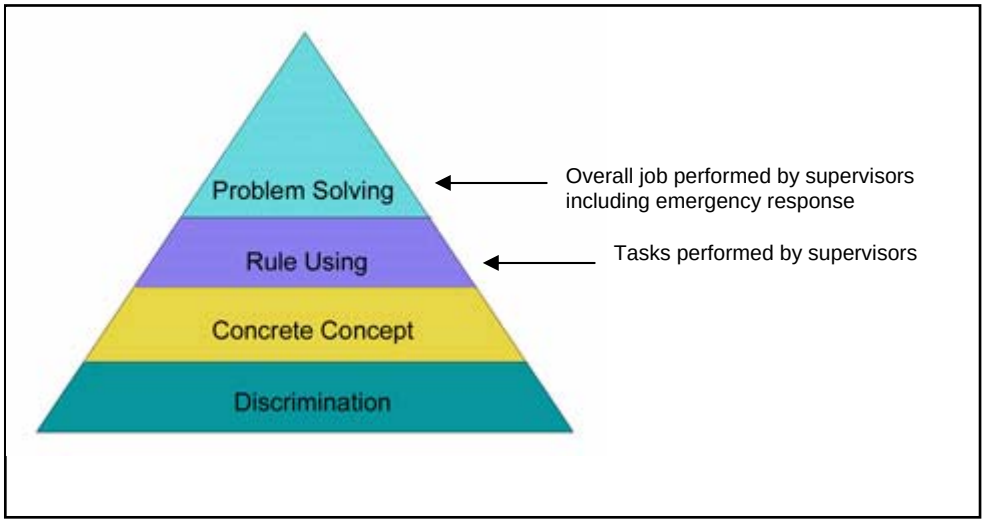


Figure 9: Gagne´s Intellectual Skills Learning Taxonomy

With the cognitive task analysis method, the project team was able to separate the 12 high-level duties of the generic JTA into two rule-using categories, procedural and principle. Procedural rule-using tasks (1-10) are those that follow a set of predefined steps to ensure that all components of that task are completed properly. This requires recalling a large body of interconnected facts. Principle rule-using tasks (12) are actions that can be converted into "if-then" situations; this includes training responsibilities. As stated above, it was determined that the overall job of a supervisor requires problem-solving skills.

During an additional analysis of task number 11, emergency and unusual situations, it was determined that this task requires problem-solving skills. The basis of this conclusion involved the re-assessment of emergency situations. Although there are rule-using processes that must be adhered to during an emergency, as specified by this task, the composition of an emergency situation is ill-structured and may contain unknown and situationally-dependent problems that have multiple correct solutions. Hence problem solving is the appropriate skill for this task.

For each of the duties listed above, the mine supervisor must be able to explain the job duties, why they are conducted, any associated risk, and how to implement appropriate controls. The first ten duties describe steps in the normal workday of a supervisor. The final two duties describe necessary elements of a supervisor's knowledge base and responsibilities that are not necessarily everyday occurrences.

Requires problem-solving skills	**OVERALL JOB PERFORMED BY SUPERVISORS**
Requires procedural rule-using skills	**Duty 1: Self-Assessment and Personal Fitness**
	Duty 2: Start-of-Shift Activities
	Duty 3: Prior to Entering the Mine
	Duty 4: Entering the Mine
	Duty 5: Traveling to the Section
	Duty 6: Arrive on the Section
	Duty 7: Section Observation
	Duty 8: Conduct On-Shift Examination
	Duty 9: Conduct Pre-Shift Examination (for the next shift)
	Duty 10: End-of-Shift Examination
Requires problem-solving skills	**Duty 11: Emergency or Unusual Situations**
Requires principle rule-using skills	**Duty 12: Training Responsibilities**

Job Task Analysis Conclusions

The original JTAs were created by two commercial coal mining companies to reflect what a section foreman would do in a workday. The project team converted the individual mines' interpretations of coal mine supervisor's duties to pertinent generic duties and aligned these duties and tasks to valid instructional design learning taxonomies.

Discrepancies

A need may be defined as the discrepancy between what exists and the desired state (Altschuld & Witkin 2000, p. 45). The results of the needs assessment show that the following three areas contain discrepancies between the actual conditions and the optimal expectations of the state of the coal mining industry as it relates to mine supervisory training: Workforce/Human Resources, Training, and Job Responsibilities.

Workforce/Human Resources

There is human resource shortage occurring in the underground coal mining industry today. The last 'boom period' of employment prospects in the industry occurred in the late 1970s. Consequently, well over half of the workforce (58.3%) is above the age of 45. These same veteran workers are today entering retirement in staggering numbers. Because of the downturn in the fortunes of the industry circa 1982, almost an entire generation of mining has

been lost: under 3.5% of today's underground coal mining workforce is under the age of 25 (Bureau of Labor Statistics 2004). While the industry is doing its part to remedy the sudden lack of bodies – coal mine employment numbers will rise by 10,000 in the next two decades – there is not yet a viable solution for capturing/replacing the years of experiential knowledge that is leaving with the veteran workers. Because of their key role in the safety and production aspects of mine operations, it is crucial that the knowledge leaving with retiring section foremen not be lost.

Training

Despite the obvious need for continued knowledge transfer described above, comprehensive underground coal mine foreman training does not exist. Professionals are well aware of this disconnect, the Director of Mines for the Virginia Department of Mines, Minerals and Energy, has commented that in the past, cognitive apprenticeships accounted for much of the technical and procedural learning that mine personnel gained on the job. A Training Specialist with the Educational Field Services division of MSHA, noted the disappearance of formal educational avenues for mining that existed for persons interested in becoming mine foremen/supervisors. This is in large part due to the down turn in the industry during the early 1980's and the corresponding migration away from the pursuit of mining related jobs. A cursory survey of extant data performed by the project team revealed that while there are a number of mine-related training programs offered at both public and private institutions nationwide, most of them focus on specific aspects of general mine workers' domains (e.g., Longwall technology) rather than supervisory duties and procedures. In addition, course catalogs that deal with supervisory issues more often than not focus on state and federal regulations. While it is important for section foremen to understand applicable laws – much of their job consists of making sure that operations in their section adhere to the regulations – it is equally important for them to have a clear understanding of what their duties are and how best to perform them.

Job Responsibilities

Current mine specific JTAs were not representative of the mine supervisory tasks across the industry, hence the need for a generic JTA. The outcome of the task analysis resulted in a generic JTA that provides a comprehensive representation of the complexity of the section foreman/supervisor job. This new generic and streamlined JTA has revealed 12 top level supervisory duties that describe the job responsibilities of mine supervisors overall. In addition, the cognitive task analysis revealed the intellectual skill level of each of these duties enabling the development of learning objectives and design approaches for training.

Learning Objectives

A learning objective is a brief, clear statement of what the learner should be able to do as a result of training. By stating measurable outcomes, learning objectives focus on what needs to be taught. The terminal objective represents the overall specific learning goal and the enabling objectives represent the specific knowledge or skill areas that must be learned to meet the terminal objective. Using the generic JTA, the project team determined constructed the following learning objectives:

Terminal Objective

The learner will apply the necessary problem-solving skills to demonstrate the proper sequence of job tasks performed by a mine supervisor/section foreman as outlined in the JTA

Enabling Objectives

Objective 1: Prior to start of the shift, the learner will demonstrate preparedness for a safe and healthful work shift for himself/herself and crew through self-assessment and personal fitness determinations as outlined in the JTA

Objective 2: Upon arrival at the work site, the learner will demonstrate the proper procedures for conducting the start-of-shift activities as outlined in the JTA

Objective 3: Before entering the mine, the learner will demonstrate the proper procedures for conducting the required activities prior to entering the mine as outlined in the JTA

Objective 4: While entering the mine, the learner will demonstrate the proper procedures when boarding and traveling by slope car and/or elevator as outlined in the JTA

Objective 5: Upon entering the mine, the learner will demonstrate the procedure for properly traveling to the section by rail and/or mantrip as outlined in the JTA

Objective 6: Upon arrival at the section, the learner will demonstrate the proper procedure for conducting the appropriate arrival on the section activities as outlined in the JTA

Objective 7: Upon arrival at the section, the learner will demonstrate the proper procedure for conducting a safe and through section observation as outlined in the JTA

Objective 8: At the section, the learner will demonstrate the proper procedure for conducting thorough on-shift examination as outlined in the JTA

Objective 9: At the section, the learner will demonstrate the proper procedure for conducting a thorough pre-shift examination (for the next shift) as outlined in the JTA

Objective 10: At the end of the shift, the learner will demonstrate the proper procedure for conducting a thorough end-of-shift examination as outlined in the JTA

Objective 11: Under emergency and/or unusual situations, the learner will demonstrate necessary principles and make appropriate decisions to effectively and safely handle unforeseen circumstances as outlined in the JTA

Objective 12: When conducting training, the learner will demonstrate the knowledge necessary to effectively conduct and monitor required training responsibilities as outlined in the JTA

Prerequisite Analysis

The overall supervisory job, which is the terminal objective of the supervisory training, has been identified at the problem solving level as a result of the cognitive task analysis. Problem solving is the highest level of the learning hierarchy. The twelve duties in the generic JTA were identified as rule using level, procedural or principle. Figure 10 presents the highest level of the learning hierarchy. It shows that a supervisor must know how to accurately perform the twelve duties before being qualified to carry out the supervisory job.

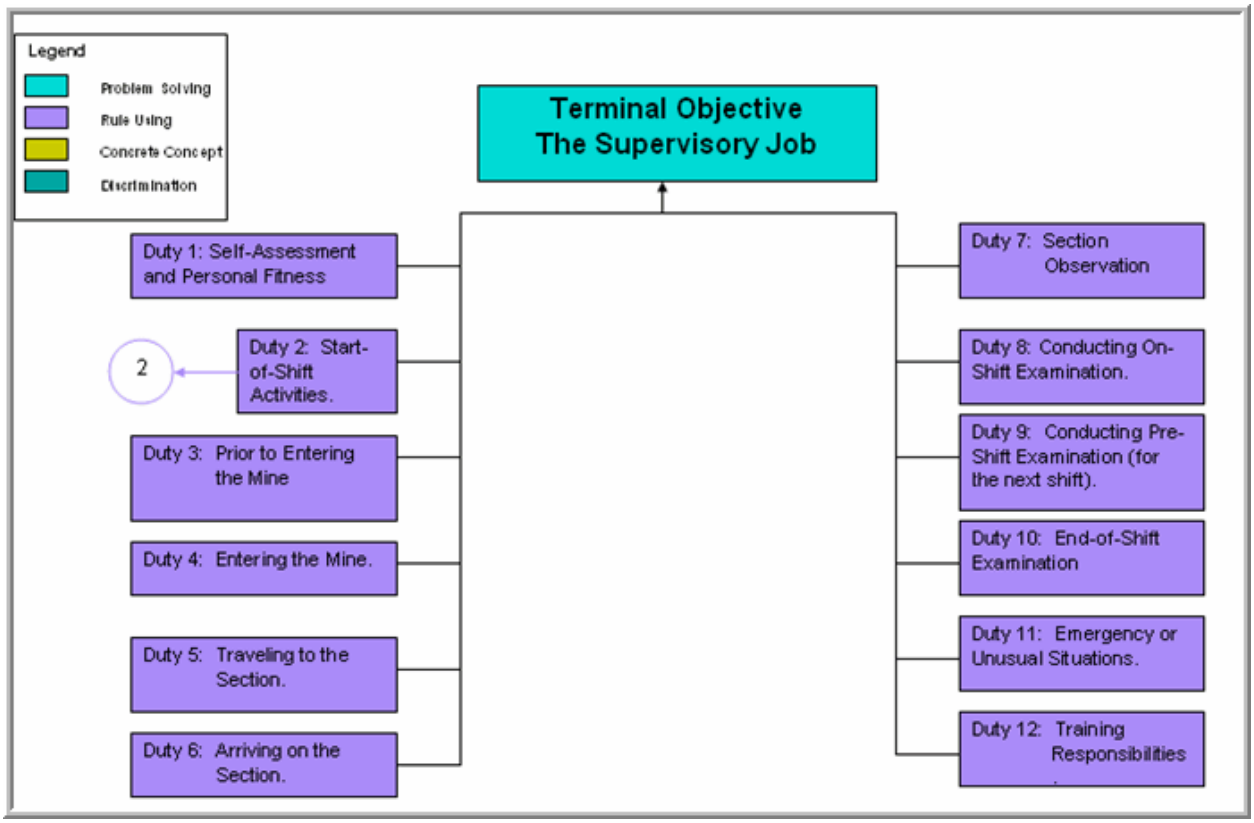


Figure 10: Prerequisite Analysis

The twelve duties form the next level of the learning hierarchy. These duties show the prerequisite knowledge that a supervisor must have. For example, Duty 2 identifies the knowledge needed in order to conduct start-of-shift activities. Figure 11 shows the learning hierarchy of the prerequisite skills.

The learning hierarchy helps the project team to identify and order the learning objectives and their prerequisites. Based on the learning hierarchy, the project team will apply the appropriate instructional strategies and methods to teach the tasks according to their intellectual skill domains.

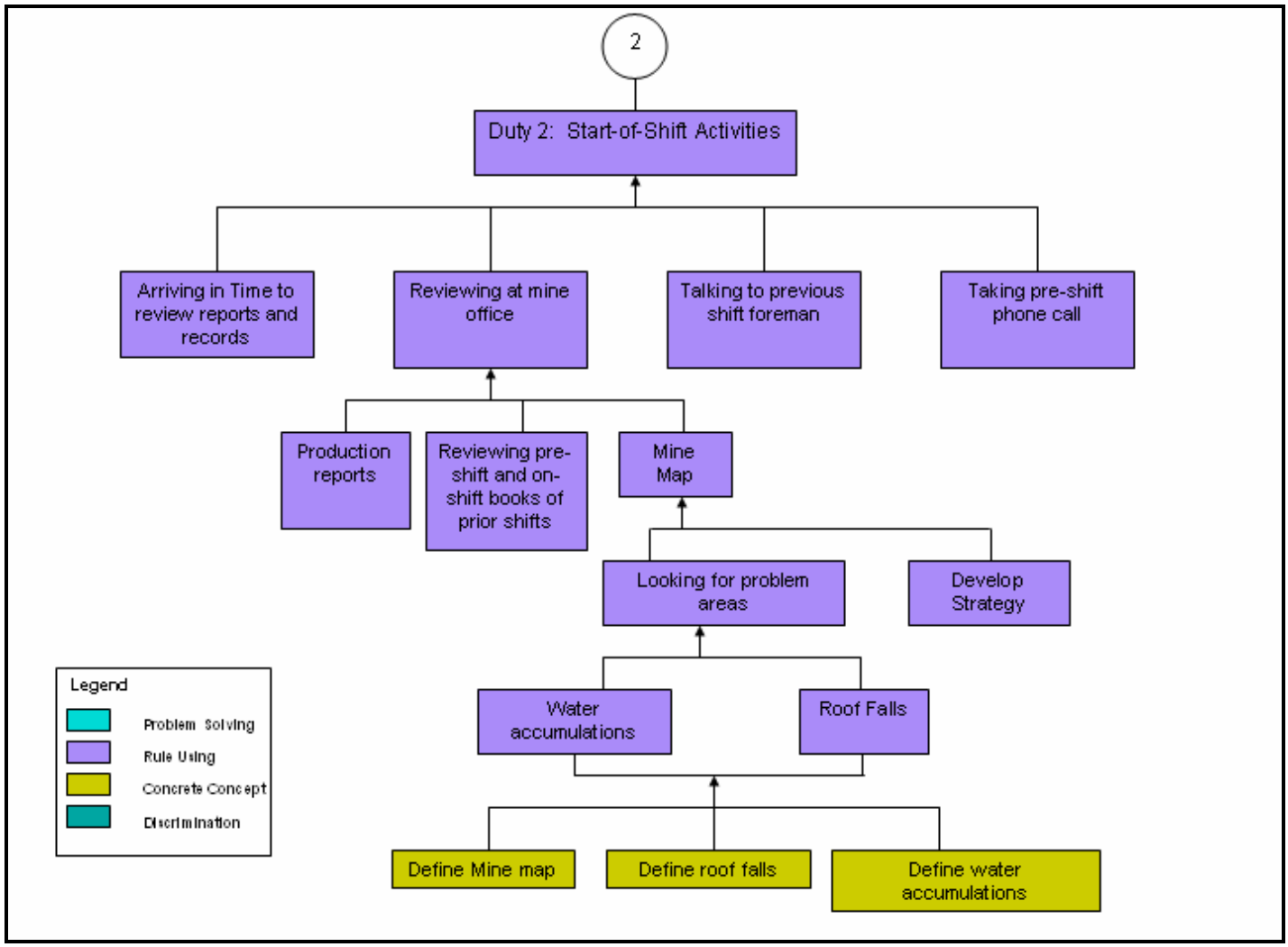


Figure 11: Learning Hierarchy - Duty 2

Proposed Solution System

Based on our findings we recommend a solution system grounded in state-of-art instructional theory and pedagogical models. The solution system is comprised of design approaches that address specific learning needs and intellectual skill levels. The purpose of the design approaches is to determine how the objectives will be taught, the instructional strategies that will be used, and the structure and sequence of the instruction. The design approaches detail the instructional components and provide an explanation of the justification and rationale behind the design. System flowcharts, wire frame structures, and storyboards provide a visual representation of the resulting design.

In terms of both instructional delivery and strategy, our design approaches take advantage of not only our audience's technology comfort level, but are based on additional findings from the needs assessment, including:

- The generational cohorts from Generation X and Generation Next prefer visually stimulating training that incorporates graphics, and they expect technology to be used in training
- 100% of the primary audience who responded to the survey has access to the Internet either at work or at home
- 70% of the survey respondents expressed a medium to high comfort level with technology, including email, Internet, interactive CD-ROM, and word processing.

Based on the findings from the extensive analysis phase, a visually simulating interactive, adaptive, customizable and flexible online learning environment is recommended as the solution system. This can be achieved with a web-based distributed learning support system (DLSS) design approach.

Distributed learning occurs when learning is distributed across space, time, and various media. "When telecommunications media is utilized, distributed learning refers to off-site learning environments where learners complete courses and programs at home or work by communicating with faculty and other students through e-mail, electronic forums, videoconferences, and other forms of computer-mediated communication and Internet and Web-based technologies" (Dabbagh & Bannan-Ritland, 2005, p12). Instruction may be accessed in a specific order or 'just-in-time' as a refresher according to the needs of the target audience members. In some cases, as with smaller mines, this approach mitigates the need requiring miners to take training during on-shift hours, which possibly impacts production for mines with a limited workforce.

Through our task analysis, the overall supervisory task and Duty 11 (emergency and unusual situations) is identified at the problem-solving level according to Gagné's intellectual skill domain, whereas the rest of the supervisory duties are identified at the rule-using level. The problem-solving characteristics of the overall supervisory task and Duty 11 should be aligned with scenario-based or case-based learning approaches suited for problem-solving instruction. The procedural characteristics of the majority of the supervisory tasks should be aligned with a systematic instruction design approach, specifically the "expanded events of instruction".

Figure 12 provides a high-level depiction of the design approach that is comprised of three organizational strategies, each of which addresses a different level of detail. At the macro level is the overall delivery strategy. It contains an over-arching structure that will organize supervisory training and related information so that it is accessible to the identified primary and secondary user groups. This macro level design approach takes the form of a web-based Distributed Learning Support System (DLSS).

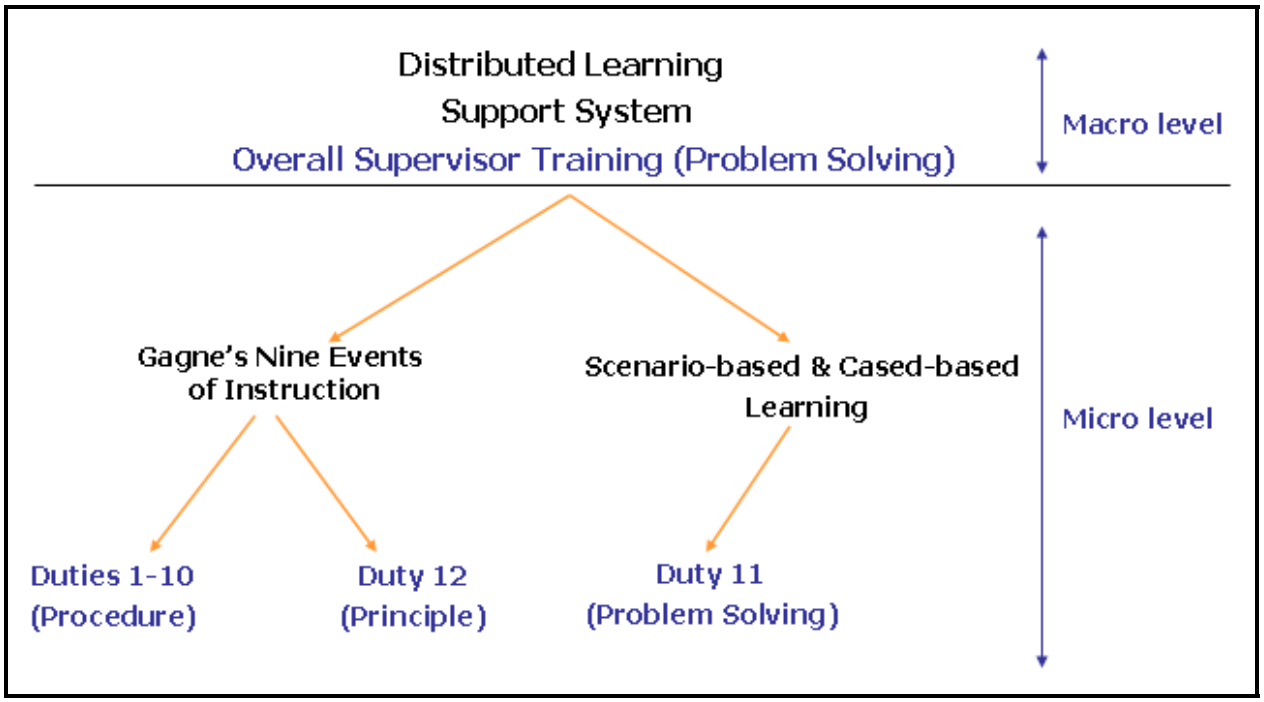


Figure 12: Multi-level Design Approach

Design Approach

This section discusses the selected design approaches in more detail, and includes:

- Distributed Learning Support System (macro level strategy)
- Problem-Solving/Case-based Learning(CBL) (micro level strategy)
- Expanded Events of Instruction (micro level strategy)

Distributed Learning Support System: Based on the data and findings in needs analysis; the supervisor training support system is designed to be delivered primarily over the Web. Other methods of delivery include CD-Rom, handheld or other electronic devices.

More specifically, the generic JTA will be converted into curriculum structures of units, and lessons. The modular learning objects and the training lessons are based on the design principles of distributed learning. Generally, the supervisor training support system will be designed to meet the standards of a Learning Management System (LMS), the specifications of W3C, and usability requirements of distributed learning.

To take full advantage of a distributed learning environment, reusable learning objects (RLO) will be developed to comply with Sharable Content Object Reference Model (SCORM) standards. This allows the web-based training to be compatible with a learning management system (LMS), which launches learning content, keeps track of learner progress, figures out in what sequence learning objects are to be delivered, and stores and reports student mastery through a learning experience. Specifically, the following characteristics apply:

- Learner performance as the center of the design: The system provides just-in-time and just-enough information to assist the learners to successfully complete the authentic and simulated tasks.
- Learning objects in the JTA: The reusable and modular learning objects are the smallest components of the training program. In the JTA, some of the sequential tasks and steps are repeated during the entire supervisory task. These units will be converted into digital reusable learning objects. This design approach will simplify and accelerate the process of design and development, and make future updates easier.
- Intuitive and consistent user interfaces: The user interface of this training program is easy to follow and use. The consistency in visual layouts, delivery message and reaction to the user's behaviors are the most critical considerations in the design of this supervisor training support system.
- Adaptability to the learners' needs and pre-requisites: The learning needs are determined by the experience of supervisors and are different for each learner. This system will adapt to the varying learning needs to provide corresponding customized training content and activities. The level of adaptability is determined through pre-assessment activities. Based on the pre-assessment results, learners may "opt out" of units and/or proceed to other segments of the training.

Problem solving/CBL approach: The whole supervisory task and Duty 11 are at the highest level of Gagne's intellectual skills taxonomy - problem solving. Therefore scenario-based and case-based instructional approaches will be applied to situate learning in authentic activities, allowing the learners to explore real-world problems and solutions.

Expanded events of instruction approach: This approach will be used for the majority of the generic JTA tasks which are at the rule-using level according to Gagne's intellectual skills taxonomy. A systematic approach to instruction, specifically the expanded events of instruction will be used to design training to teach those supervisory tasks. This approach is grounded in Gagné's nine events of instruction providing structure for rule-using lessons. The expanded events of instruction approach will be utilized to transfer the generic JTA into the lesson plans and activities.

Training System Structure

At the micro level, instruction is delivered at the module and lesson levels. As stated earlier, eleven of the twelve training modules require rule-using intellectual skills, which are further separated into procedural and principle rule-using contexts. The remaining training module (Duty 11) requires problem-solving intellectual skills.

The structure of the supervisor training Distributed Learning Support System and the lesson plans are constructed based on the generic JTA and the three design approaches. The structure includes four levels (see Figure 13).

- the *training system* which is the system,
- the *modules* which are the 12 JTA duties,

- the *units* which are the sequential tasks at the top level of each duty, and
- the *lessons* which represent the smallest components in the JTA.

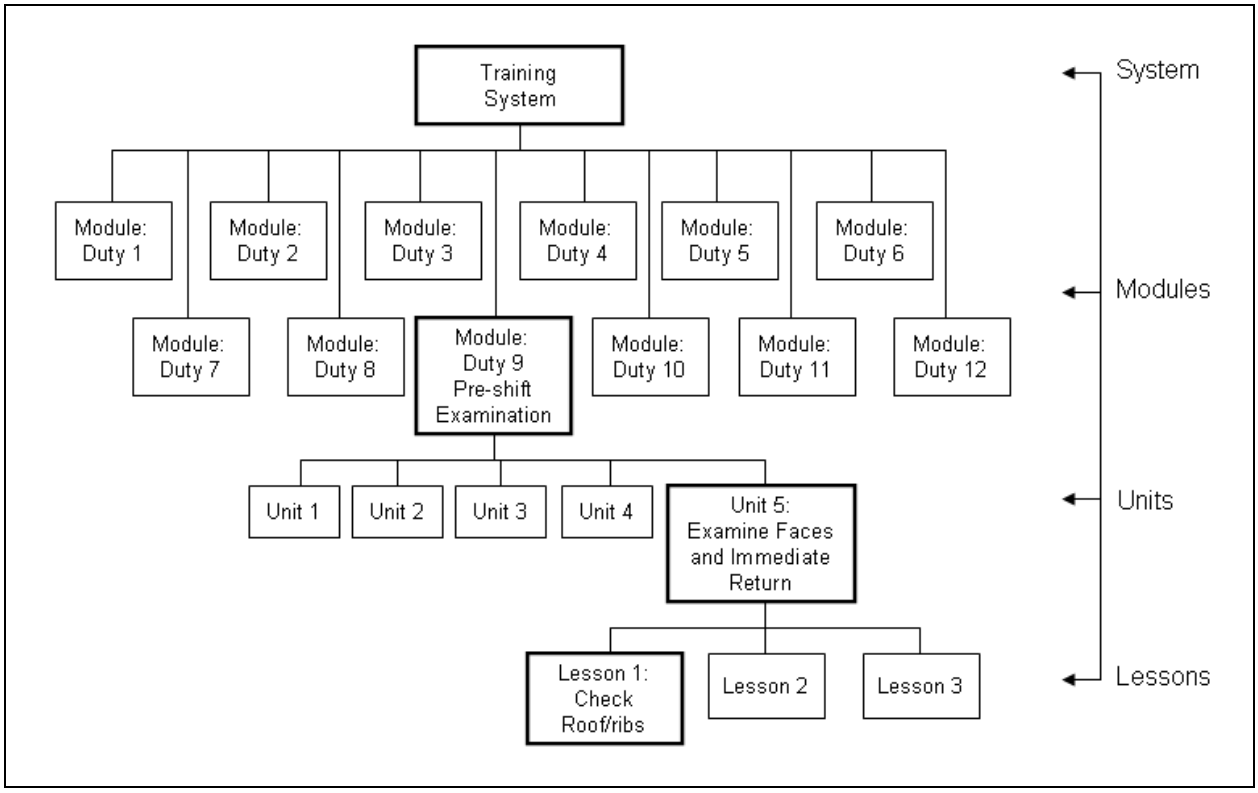


Figure 13: Training System Structure

Lesson Plans

The instructional methods, strategies and the learning activities of the lesson plans are determined according to the intellectual skill domain of the tasks and the design approaches applied in this system. The learning objective for each lesson is identified and constructed according to the target audiences, optimal performances, condition and the degrees of measurement. Pre-assessments, learning activities and self-assessments are designed at application and problem-solving levels depending on the intellectual skill domain of the task. The outcomes of the learner's performance are measured and stored into a database.

Design Approach Examples

Lesson 1: Check roof/ribs* under *Unit 5: Examine Faces and Immediate Returns* of *Module Duty 9: Conduct Pre-Shift Examination

This task is at the rule-using level; the strategy is the expanded events of instruction.

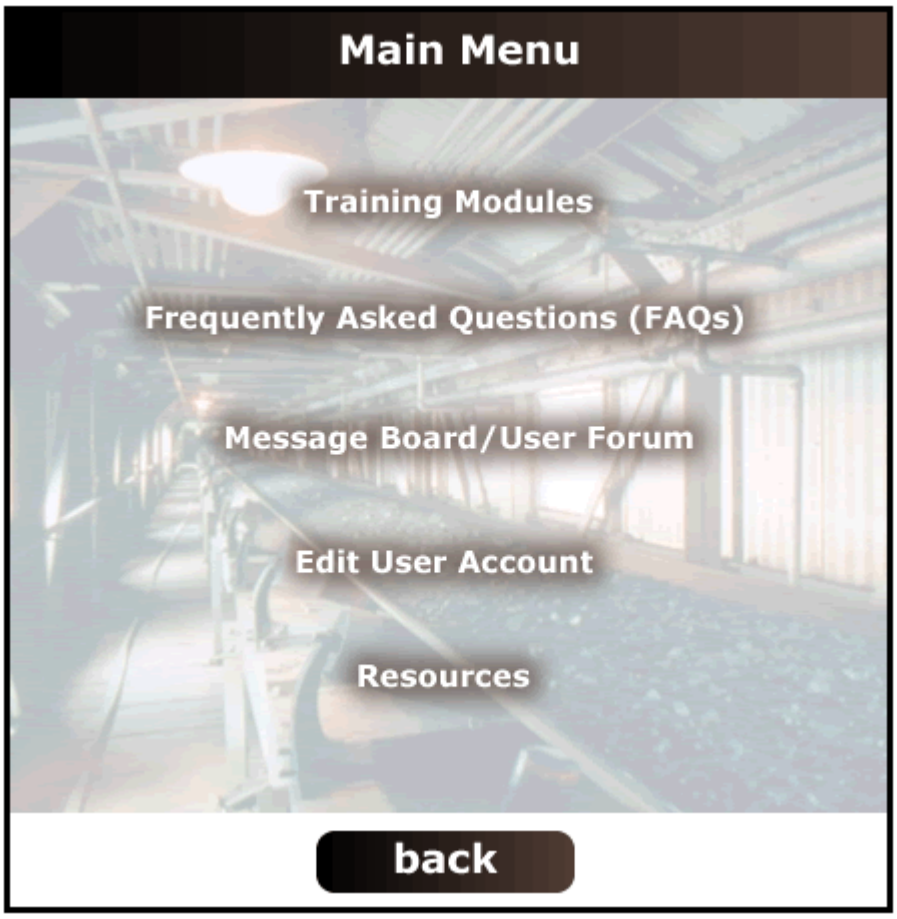
Expanded Event Approach

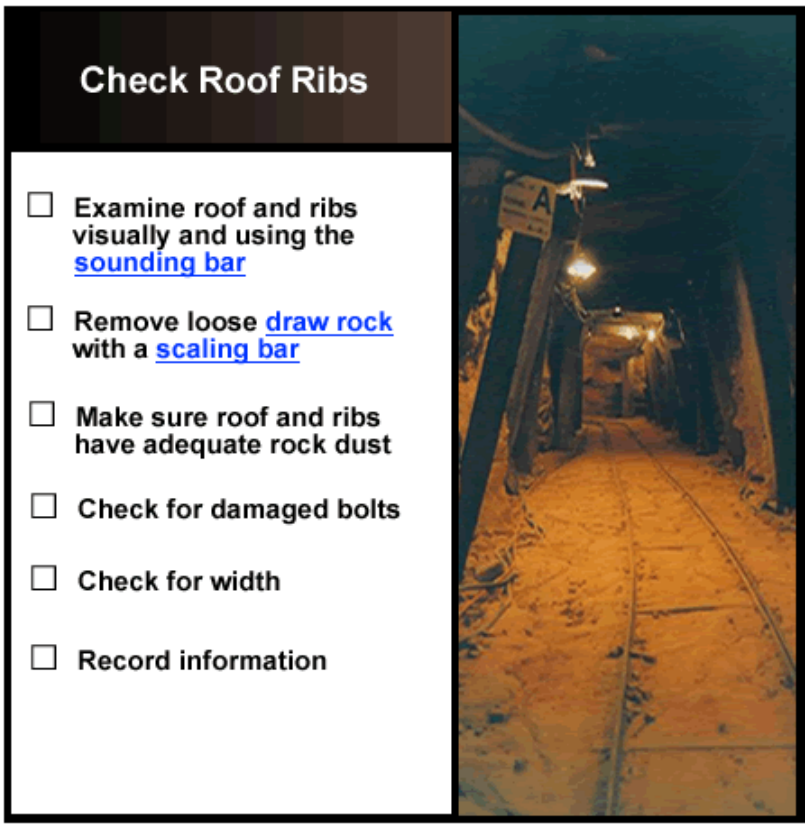
- Motivation strategy
- Pre-assessment: to assess what the learner already knows and what needs to be learned. Based on the assessment, the system directs the learner to corresponding learning activities.
- Presentation of the procedural task
- Simulated and authentic activities
- Enhance knowledge and skills transfer
- Feedback and review
- Self-assessment

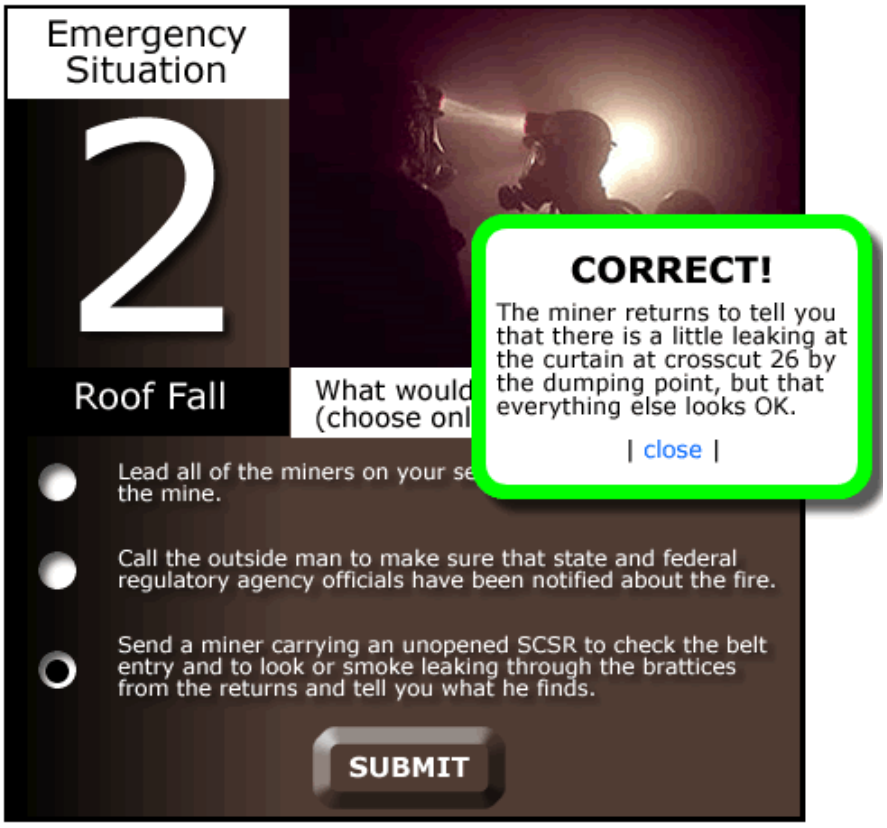
Lesson 1: Prepare to evacuate* under *Unit 1: Fire/Explosions* of *Module Duty 11: Emergencies and Unusual Situations

The task is at the problem-solving level; the strategy is case-based learning. A portion of the scenario covers potential roof collapse (see Figure 14).

The following is a sample of storyboard screens. For the complete solution system storyboard screens please see the Storyboard link on the project website http://immersion.gmu.edu/MSHA/Fall2005.




Check Roof Ribs
Examine roof and ribs visually and using the sounding bar
Remove loose draw rock with a scaling bar
Make sure roof and ribs have adequate rock dust
Check for damaged bolts
Check for width
Record information


Emergency Situation
2
Roof Fall
What would
(choose onl
Lead all of the miners on your se
the mine.
Call the outside man to make sure that state and federal regulatory agency officials have been notified about the fire.
Send a miner carrying an unopened SCSR to check the belt entry and to look or smoke leaking through the brattices from the returns and tell you what he finds.
SUBMIT
CORRECT!
The miner returns to tell you that there is a little leaking at the curtain at crosscut 26 by the dumping point, but that everything else looks OK.
| close |

Continuous Miner Fire Exercise

Background

As you complete your pre-shift checks of the face area of the no. 5 entry, you hear someone yelling “Fire!” You crawl out from the face of the No. 5 entry into the last open crosscut between No. 2 and No. 3 entries. Study the mine map to orient yourself. Take account of the following:

- You are the acting section foreman in the absence of the regular section foreman.
- You are at the face of the No. 5 entry on the 001 section making pre-shift checks for the oncoming second shift.
- Miners from the first shift are working on the other two active sections in this mine.
- Section 001 is 3,500 feet from the portal.
- This mine has an average seam height of 36 inches.
- The mine is dry, dusty and not well rock dusted.
- The section EMT is the scoop operator. At the moment you believe that he is at the supply hole unloading bolts and plates.
- You are well-trained in basic first aid procedures.

Part 1

You and Jim arrive on the scene of a mine fire and find a miner lying unconscious on the ground. Jim opens the first aid kit and begins to treat the miner. You notice the roof over the miner is working and some small pieces of shale are falling in front of the miner, near you and Jim.

What should you do? (Choose only one)

- Go get a couple of roof jacks and set them around Jim and the miner.
- Help Jim stabilize the miner so you can move him to a safer place as soon as possible.
- Continue to watch the roof carefully. If it gets worse, tell Jim to help you move the unconscious miner to a safer spot.
- Immediately tell Jim to help you use a clothing drag to move the miner to a safer place.
- Help Jim carefully roll the miner onto a stretcher, then secure the miner to the stretcher, covering him with a blanket. Immediately take the miner to the dinner hole for safety.

Part 2

After moving the injured miner to safety, you leave Jim to go to the scene of the firefighting, where the buggy operator and the continuous miner operator are fighting the fire from the fresh air side. Unfortunately, their efforts aren’t making much of a difference and the fire has now spread to the ribs and the mine floor. The roof is beginning to fall around the continuous miner and has not burned for 20 minutes. It is so hot that you can’t get closer than 20 feet from the machine. The miner monitoring the mine phone comes and tells you that the two missing miners went out the belt entry and are now outside.

What would you do at this point? Select as many answers as you think are correct.

- Lead all of the miners on your selection outside and evacuate the mine.
- Call the outside man to make sure that state and federal regulatory agency officials have been notified about the fire.
- Send a miner carrying an unopened SCSR to check the belt entry and to look or smoke leaking through the brattices from the returns and tell you what he finds.
- Send a miner to open the regulator and man door between the No. 3 belt entry and the No. 2 return air entry to short circuit air away from the fire.
- Call outside for more equipment to fight the fire from the fresh air side.
- Call the outside man and tell him to chew out the roof bolter operator and helper for going outside without telling somebody.

Figure 14: Problem-solving Case Scenario

Next Steps

In the upcoming months the project team will continue to further their knowledge and understanding of the underground coal mining industry by surveying additional mine supervisors and conducting a mine visit in early February 2006. The project team will also be transitioning the prototype training materials presented here into a functional solution system. Upon completion of this initial set of materials the project team will conduct a formative evaluation of this training in the field. The findings of this work will be presented in a cumulative presentation in May of 2006.

Appendix A- Project Kick-off Meeting Minutes

Meeting Minutes for MSHA Project Kick-off Meeting

Date: September 15, 2005

Time: 2:00 PM

Location: Commerce I, George Mason University

Attendees: James Baugher, MSHA
Dr. Nada Dabbagh, George Mason University
Dr. Kevin Clark, George Mason University
Dr. Joi Moore, University of Missouri
Jennifer Cochran, MSHA Immersion Project Team
Hong Li, MSHA Immersion Project Team
Shawn Sullivan, MSHA Immersion Project Team
Craig Wiggins, MSHA Immersion Project Team
Betty Wilkins, MSHA Immersion Project Team
Paula Johnson Williams, MSHA Immersion Project Team

Meeting Discussion Items

I. Introductions (10 Minutes)

- Paula Johnson Williams, Facilitator

II. Project Overview and Review of Statement of Work presented by the GMU Immersion Team (10 Minutes)

- Betty Wilkins provided an overview of the Statement of Work for the group.

III. Question and Answer Session (30 Minutes)

Jim provided an overview of Mining and the project:

- Overview
  - Definition of a Mine – Any place you dig a hole and sell what you get out.
  - There are two types of mines Coal and Metal/Non-metal (including sand/gravel/crushed stone)
  - Only shrimping, firefighting, and offshore drilling are currently ranked as more hazardous than mining.
  - Mining is one of the few industries where federal law dictates the workplace environment (All US industry is covered by federal safety law MSHA: mines OSHA: all other industries and institutions. MSHA has the most

comprehensive training requirements.); MSHA is the first agency to control workplace environment.

- Problems Stated
  - Ingenuity of miners sometimes leads to accidents.
  - The workplace is ever changing
    - Electrical hazards
    - Geological changes
    - Constant testing of the environmental surroundings for gas levels, etc.
  - There is a need to formalize supervisor training and retain domain knowledge
  - Short training times (Supervisors and mine workers are production oriented)
  - Most training is on the job training and task oriented
  - Human resources are not available to meet the needs of the current MSHA directed hiring requirements (5 years as a miner to be eligible as a supervisor)
- Learner Characteristics
  - There are generally 5 to 10 miners assigned to a given supervisor.
  - The number of supervisors per shift varies depending upon size of mine operations and workforce
  - Career Path
    - Miner
    - Mine Supervisor
    - Shift Supervisor
    - Mine Manager
  - Education level varies from High School Diploma through advanced degrees; Geologists, Engineers, etc.
  - All new Miners undergo a 40 hour mandatory training program and 8 hours of refresher training annually
  - Task training is required for all new task assignments
  - Miners are innovative and ingenious because they have to develop workarounds on the job
  - Mining Supervisors have three areas of responsibility
    - Safety
    - Production
    - Maintenance
  - Supervisors are responsible for conducting training or procuring training for tasks when they have no practical experience.
- Resources
  - National MSHA Training Academy in Beckley, WV
  - Jim will provide several points of contact, to include
    - The Virginia State Mine Inspector – expert on state laws versus federal which are more stringent in different areas of mining.
    - Mr. Vance – expert on mining; good resource for terminology
    - Contacts at 3-5 mining companies for interviewing purposes; representing 80% of industry

- Dictionary of Mining Terms
- NIOSH – Training suggestion in the IC9463 from the CDC
- Data gathering
  - Put all questions, surveys, etc through Jim first
  - What are our options for polling supervisors, what should we look for?
    - Differences in responses between experienced and newer supervisors
    - A possible panel to work with: old miner, new miner, safety personnel, and maintenance personnel (The panel approach was used in developing the JTAs. That work is done. We are helping the industry find an effective way to use the JTAs to train.)

- Additional Training needs to consider
  - When to use regulations, how to refer to them, not to teach them
  - Look beyond training to ways to manage performance
  - Explore PDA job aides and environmental factors that might preclude the use of these types of devices
  - Jim requested rapid prototyping in the spring semester in order to elicit feedback during this school year.

IV. Recap and Closing (10 Minutes)

- To Do Items
  - Jim to provide contact information and a laminated set of JTAs
  - Immersion Team to provide contact person and Project Web address
  - Work on the briefing report will begin the week of September 19, 2005

Appendix B – Subject Matter Expert Interview Results

Interviewee	***"What are the challenges and difficulties related to training in the coal mining industry?"***
Frank Linkous	History: In the past, training focused on the mechanical, procedural and technical side. Training was personal, such as, father to son but it wasn't the highest priority. Once government mandates were established, responsibility was established. Today, section foremen (supervisors) must be certified. Initially, certification started with safety training. The introduction of technology created a need for special skill training. Currently: Supervisors fail to recognize their leadership role. Very little quality training is done to ensure that the supervisor is an effective leader. Today, the training emphasis is on the technical when it should be on leadership. Supervisors already receive 8 hours of refresher training a year in areas such as safety and production.
Gene Williams	The most challenging aspect of training miners is developing the trust of the trainees. As a trainer, it is often hard to obtain direct, straight answers to questions. Miners are very proud, and do not readily admit when (or if) they don't understand something. Gaining the trust of the people is the first step in helping them to openly and honestly deal with issues up front. This is the key to the development of good communication skills. As people trust, their confidence and comfort level increase, and their communication skills improve. In the coal mine industry, miners are sometimes not very well educated. It takes compassion and patience to reach them. Once a trainer establishes trust, the trainees will be more open and honest about sharing any inadequacies that might exist. They will express their needs because they take pride in the finished product. The challenge of training is finding people in the industry that have both the mining skills and the ability to communicate. Usually the people who come to supervisory training are already skilled in mining – they are usually the best of the best. Helping the trainees to open better lines of communication requires a level of expertise that's difficult for a non-miner to understand. The trainer has to identify with the coal mining process and the miners' experience. For example, miners have to have confidence in the face foreman because lives are at stake. His background knowledge is important when giving instructions – he has to make sense. So, a good trainer is worth his weight in gold.
Jerry Vance	• Getting people to work. A large portion of the experienced workforce is retiring. The last hiring boom was in the 1970's, so a lot of miners have put in their 30 years and are exiting the workforce.

Interviewee	***"What are the challenges and difficulties related to training in the coal mining industry?"***
	• In 1982 the industry took a downturn and it became more difficult to get people interested in mining. • A lack of qualified applicants. In WV and KY one can be a section supervisor/assistant foreman with 3 years of mine experience. • Fewer training programs.
Gerald Nicholson	1. Getting people away from operations and into training classes. 2. Acquiring qualified trainers to teach the mining classes. Currently using safety personnel from mines to teach: – One supervisor course – Six (6) safety courses 3. The average age of mine supervisors is 52 years old and the company will lose them in 3-4 years when they retire. CONSOL currently handles knowledge transfer by: – Hiring back retired mine supervisors as instructors – Hiring back retired mine supervisors part time to work whatever shift they choose 4. Finding qualified people and getting them certified – Penn State and state of PA are re-evaluating the certification test for Pennsylvania – The state offers the certification exam twice a year (spring and fall) – Other states have their own test with different qualifications and schedules (eg.., WV, UT, OH) 5. The technical qualifications that a candidate should possess are: – 4 year degree (engineering-mining, electrical, etc) plus 1 year experience – No degree plus 3 years experience (WV) or 5 years experience (PA); differs from state to state Someone wanting to take the test does not have to currently work for or be sponsored by a mining company. All they have to do is fill out the application and specify their experience and they can take the certification test. NOTE: Generally, the requirements that CONSOL seeks are: 6. 4-year degree in engineering (e.g., mining, electrical) and 1 year experience or 7. No degree plus 3 years experience (WV) or 5 years experience (PA)

Interviewee	*"What are the challenges and difficulties related to training in the coal mining industry?"*
	Pennsylvania requires that the foreman candidate pass the following tests before taking the foreman test: 8. Ventilation test 9. Gases test

Interviewee	*"What's working well in current mine supervisor training programs?"*
Frank Linkous	Federal and state mine agencies have put a lot of effort into providing critical information to mines. In 1996, Virginia mandated continuing education for section foremen so they stay current with changes in the industry. Many mining companies understand the need to provide focused leadership training. Alpha is one of those companies. Leadership doesn't happen by just giving supervisors rules, regulations and standards. Leadership development is key.
Gene Williams	Use of the JTAs because they provide necessary details that every miner "ought to know." Using them ensures that no one missed any steps along their career. The JTAs help polish the skills of trainers. It is much easier to convey information when the details are right out in front, and trainees can easily spot when they have missed any vital information. In Excel's training program, the company brought in different operators (such as continuous miners, drivers, and shuttle car operators) and held breakout sessions for training. When using the JTAs, the operators took more time to explain every aspect of the job and paid closer attention to details. Some of the questions people ask are answered on the JTAs. Workshops on building communication skills, gaining trust, and that hold people's attention. Training time is expensive, and it's a waste to hold training that doesn't keep people's attention or hold their interest. Holding training sessions in small groups to allow for individualized attention
Jerry Vance	Larger mines, such as CONSOL or Eastern, can have miners enter 3-5 year training programs and then bring them into play (whereas smaller mines in KY, WV and VA put miners through evening classes as they can't afford to put miners through extended supervisor training.)
Gerald Nicholson	10. Management Courses Fundamental of Supervising 1 (FOS) – Management development course – 3 days at corporate; includes communication skills – Send back to mines for a month with an action plan to implement – Bring back for 2-day follow-up FOS 2 - One year later – 3 days focusing on how to plan and employee accountability

Interviewee	*"What's working well in current mine supervisor training programs?"*
Gerald Nicholson (cont)	– Send back to mines for a month with an action plan to implement – Bring back for 2-day follow-up Managing Your Mines (MYM) – 2 days; no follow-up 11. EEO training 12. OPT (?) Current recruitment efforts focus on colleges, high schools, and vocational centers. Once on board, they go through a 1 year program that includes 80 hours of class time. The recruits are observed over time and led into different positions based on observed aptitudes like electricians, mechanics, and maintenance. Some are steered toward management courses.

Interviewee	*"If you had a wish list for mine supervisor training, what would it include?"*
Frank Linkous	Section foremen are the point of control. They are certified. They must have 5 years of experience as a miner, 3 of which must be underground, and they must pass a rigorous all day exam. However, they need a level of training that goes beyond the technical and into leadership. More attributes are needed in supervisors than the ability to do the required checks. They need leadership and communication skills…the ability to develop, grow and motivate the people being supervised.
Gene Williams	Three trainers! If I had three trainers tomorrow, I would use them to train foremen and have one at each operation. Right now, there's not enough people to go around because there's not enough trained workers. I have machines idle – without operators, due to a lack of qualified trainers. I don't just mean people "certified" by the state – I mean people who are educated in the performance of the tasks and who can communicate effectively. *[NOTE: Mr. Williams is currently conducting supervisory training himself because he doesn't have anyone on hand who has the necessary blend of mining skills, communication skills, and training skills.]*
Jerry Vance	• More MSHA regulations featured in supervisor training. Currently a good deal of regulatory content in mine supervisor training is state-specific. • More qualified applicants. • More comprehensive certification, both in terms of content and frequency of 'refresher' sessions. Also, there should be a requirement that someone who has gained supervisor certification but has been out of the field for several years would have to recertify. • Detailed, first-hand experience on the surface before allowing supervisors to get underground.

Interviewee	*"If you had a wish list for mine supervisor training, what would it include?"*
Gerald Nicholson	The company could use help with: 13. Developing new materials 14. Developing new courses, for example, 8-hour refresher courses 15. Finding good qualified instructors 16. Developing instructors 17. Finding new ideas and new ways to teach especially required refresher courses like Fundamentals of First Aid 18. Updating materials MSHA has been too slow in responding to training development. Turnaround is usually about 2 years so any help comes on the back end. CONSOL Energy is the largest coal mining company in the U.S. and tends to work independently of MSHA where training is concerned. They have developed their own academy. CONSOL would also like to see no more laws passed that would affect the mining industry.

Interviewee	*"Please list the necessary qualities of a mine supervisor. If you had to rank these qualities in order of importance, where would you start?"*
Frank Linkous	• Principle-centered: Must recognize that people are important. Must uphold the core values of the organization. • Experience: Must have practical experience that can't be gotten out of a book. Workers won't follow the supervisor if experience (not knowledge) isn't evident. • Attitude: Must have the right desire and understanding to be a supervisor.
Gene Williams	good communicator, integrity, courage, compassion, background knowledge. Ranking order: 2. Compassion: the person has to have compassion in order to pursue the job to the next level. 3. Courage: if he doesn't have courage, it's worthless effort anyway. 4. Good communication skills are needed to pass on information, get things done. 5. Integrity to do the job right; 6. Background knowledge – that's a given; to become a foreman, a person has to have five years' experience underground.
Jerry Vance	1. 4-5 years mining experience, actually working sections. To have been brought into the environment before getting into the supervisory position. 2. Communication skills: to be conversant in differing technical terminology and jargon, but to be able to explain other information to mine staff in layman's terms when necessary. Often times a mine supervisor may be performing 'tech support': talking a mine operator through a problem by phone. Finally, must be able to really listen to mine operators and

Interviewee	*"Please list the necessary qualities of a mine supervisor. If you had to rank these qualities in order of importance, where would you start?"*
	understand their needs. 3. Attitude: a mine supervisor, especially a new one, must approach his or her operators with a willingness to learn, to allow the operators to describe their own job and understand what they need and how best to keep them safe. A supervisor whose attitude is "my way or the highway" will not get optimal output or support from their operators.
Gerald Nicholson	• Job knowledge • Good communication skills • Good listener • Respected and gives respect • Sets the example • Predictable • Takes care of employees; disciplined, well-oiled team including: – being trained – knowing what to do – has a game plan – functions well day in and day out

Interviewee	*"Can you suggest additional people or resources that we should contact regarding the needs of mine supervisor training?"*
Frank Linkous	Ideas: 7. Have focus groups with section foremen from large, middle and small mines. (The responsibilities of the supervisor may be different depending on the size of the mine.) 8. Talk to new and old section foremen to get each perspective. 9. Talk to miners to find out what they think are good qualities in a supervisor
Gene Williams	Mr. Williams will respond via e-mail with contact information for the following people and will include others that he might think of. • Paul Bishop, who is using operators in a classroom environment. Mr. Williams suggests that to develop an understanding of the challenges associated with mine supervisor training, we study the JTAs first, contact Mr. Bishop to schedule a time to OBSERVE a training session (his emphasis), and perhaps then visit a mine to appreciate the practical applications of the training. • Ray McKinney of MSHA • Mr. Williams also recommends that we visit the company website of Alliance Resource Partners, at http://www.arlp.com/. A "sister" mine of Excel Mining is Mettiki Coal, LLC in Oakland, MD.

Interviewee	*"Can you suggest additional people or resources that we should contact regarding the needs of mine supervisor training?"*
Jerry Vance	Mr. Vance suggest that we start by contacting mine managers and upper supervisory directors at CONSOL and Peabody mines, among others; offered to see about arranging contacts for us and to set up a possible mine visit in the near future. Design team will follow up with Mr. Vance during the week of October 25th.
Gerald Nicholson	– Jim Dean, Director of Certification and Outreach West Virginia University (WVU) 304-293-4211 • Has a training center set up by CONSOL that offers Foreman certification and new miners training. – Penn State University (no specific contact; call the university and ask for mining programs) • Helps write certification tests • Conducts mining engineering courses, electrical engineering courses, and trains mechanics.

Appendix C – Mine Foreman/Supervisor Survey

SECTION FOREMAN/MINE SUPERVISOR SURVEY

Please take a moment to complete this short survey from George Mason University in Fairfax, Virginia.

(1) Demographics

State where you work

Age
- ☐ 20 - 30
- ☐ 31 - 40
- ☐ 41 – 50
- ☐ 51 or over

Gender
- ☐ Male
- ☐ Female

Educational level
- ☐ Some high school
- ☐ High school diploma
- ☐ Vocational/technical training
- ☐ Some college experience
- ☐ Associate's degree
- ☐ Bachelor's degree
- ☐ Advanced degree

If you checked a degree or vocational training option, please state what your degree(s) or specialization was in.

_____

_____

(2) Job Experience

How long were you a miner before you became a section foreman/mine supervisor?
- ☐ 1 – 3 years
- ☐ 3 – 5 years
- ☐ 5 – 10 years
- ☐ > 10 years

How long have you been a section foreman/mine supervisor?
- ☐ < 1 year
- ☐ 1 – 3 years
- ☐ 3 – 5 years
- ☐ > 5 years (How long? ____ years)

(3) Technology Experience

Where do you have access to the Internet?
- ☐ At home
- ☐ At work
- ☐ Both
- ☐ Other
- ☐ No access

How comfortable are you with the each of the following technology tasks? Rate each item on a scale from 1 – 5. Circle your choice.
(1 = Not comfortable, 5 = Very comfortable)

1 – 2 – 3 – 4 – 5	Navigating the Internet
1 – 2 – 3 – 4 – 5	Downloading files to your desktop
1 – 2 – 3 – 4 – 5	Using search engines (e.g., Google)
1 – 2 – 3 – 4 – 5	Word Processing
1 – 2 – 3 – 4 – 5	E-mail
1 – 2 – 3 – 4 – 5	Interactive CD-Rom
1 – 2 – 3 – 4 – 5	Using a PDA (personal digital assistant)

(4) Training Experience

Rank the following training methods in the order of preference.
(1 = most preferred, 2= next most preferred, etc.):

____ Instructor-led classroom training

____ On-the-job training

____ Online (web-based) training

_____ CD-Rom based training

Do you like learning in a group or team environment?
- ☐ Yes
- ☐ No

OVER →

(5) Foreman Skills and Tasks

A. Do you agree that the following are the **5 most important skills** that a section foreman *should have*? Check Yes or No. ☐ **Yes** ☐ **No** (1) How to listen and communicate effectively. (2) How to be a good problem solver. (3) Knowledge of state and federal mining regulations (Part 75) as well as company policy. (4) How to plan efficiently and effectively. (5) How to motivate different types of people to work. B. If you would like to add/change something or if you checked *No*, please provide comments on the right.	**Comments:**
C. Do you agree that the following are the **5 most important tasks** that a section foreman *does*? Check Yes or No. ☐ **Yes** ☐ **No** (1) Make sure the mine areas and crews are safe. (2) Examine conditions of the mine (roof strata, seams, roof control and ventilation plans). (3) Make sure crews have all necessary tools, safe equipment and supplies. (4) Make sure that crews have had proper training to do their jobs. (5) Make sure that crews are performing their jobs in a safe manner. D. If you would like to add/change something or if you checked *No*, please provide comments on the right.	**Comments:**

(6) What additional training would be helpful in supporting your day-to-day duties as a section foreman/mine supervisor?

_____

_____

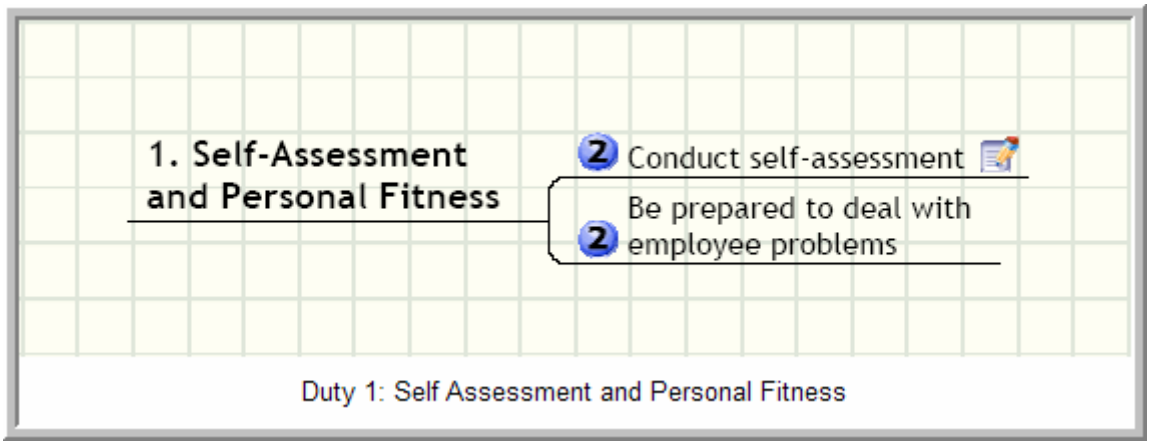
_____

_____

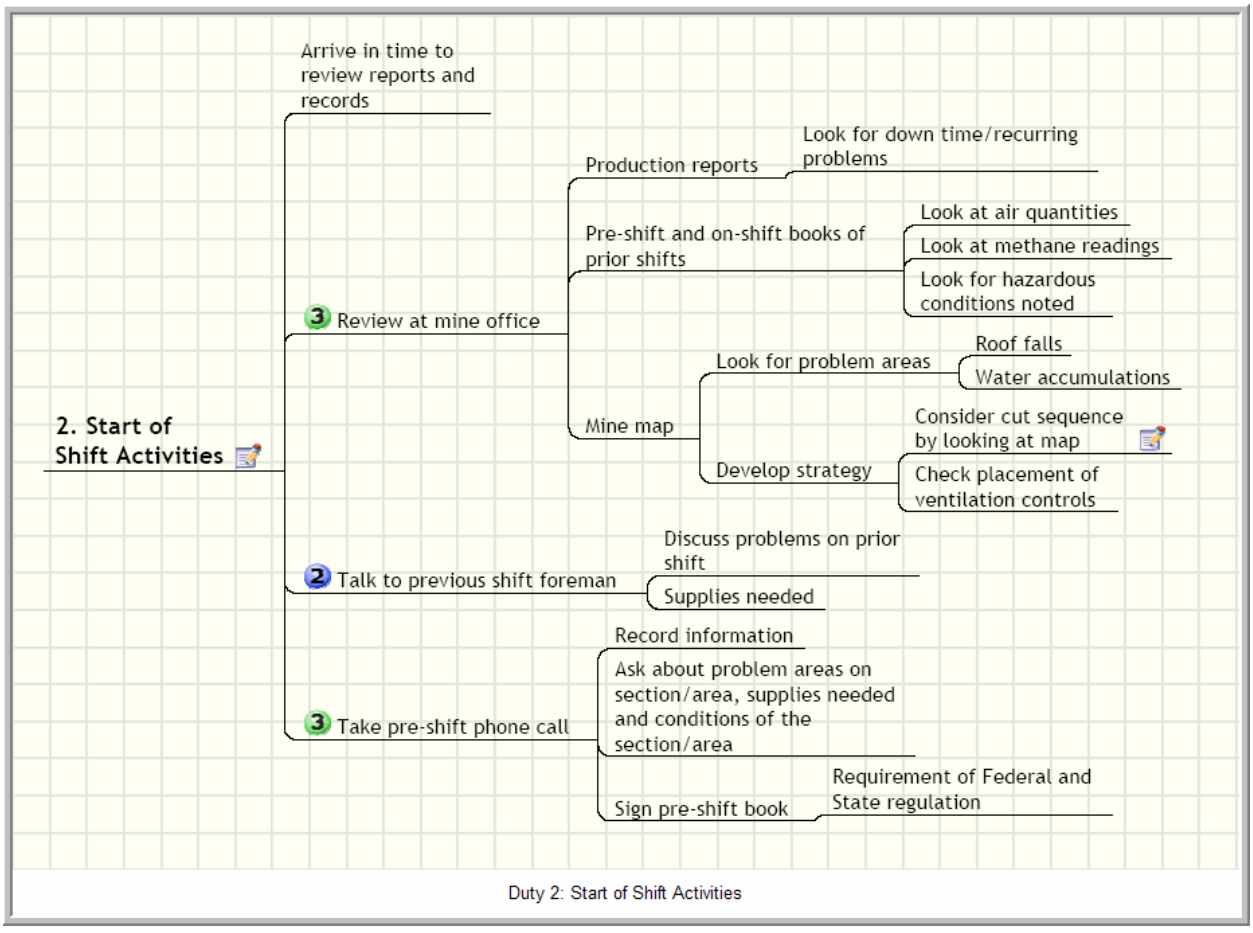
Thank you for your participation!

OVER →

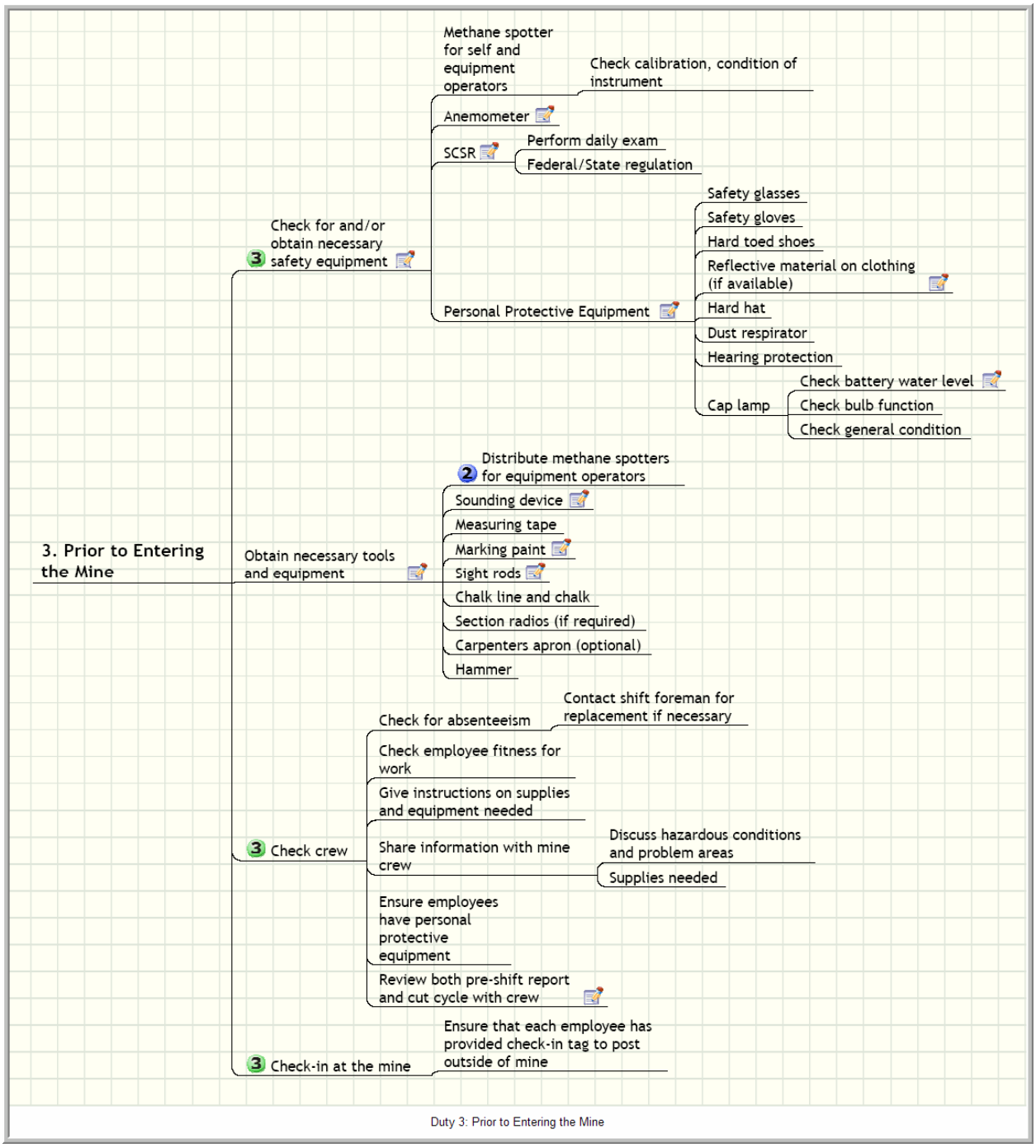
Appendix D – Job Task Analysis

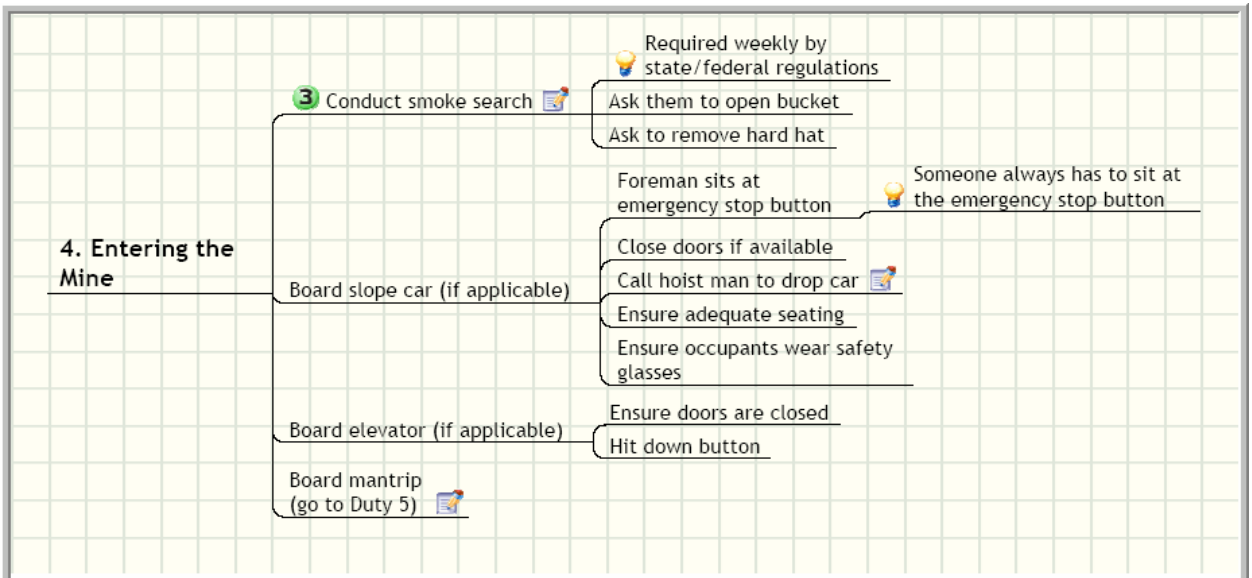


Duty 1: Self Assessment and Personal Fitness

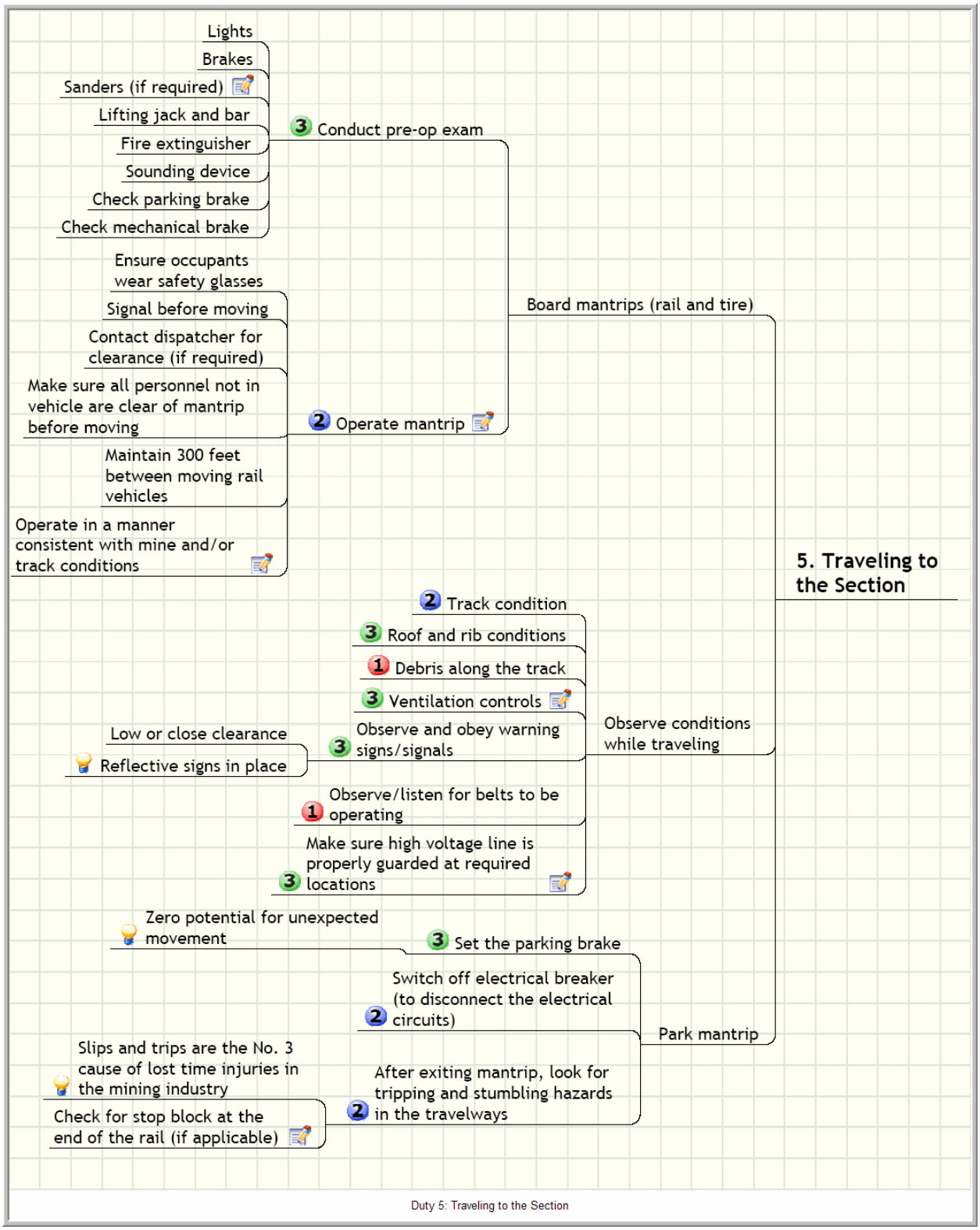


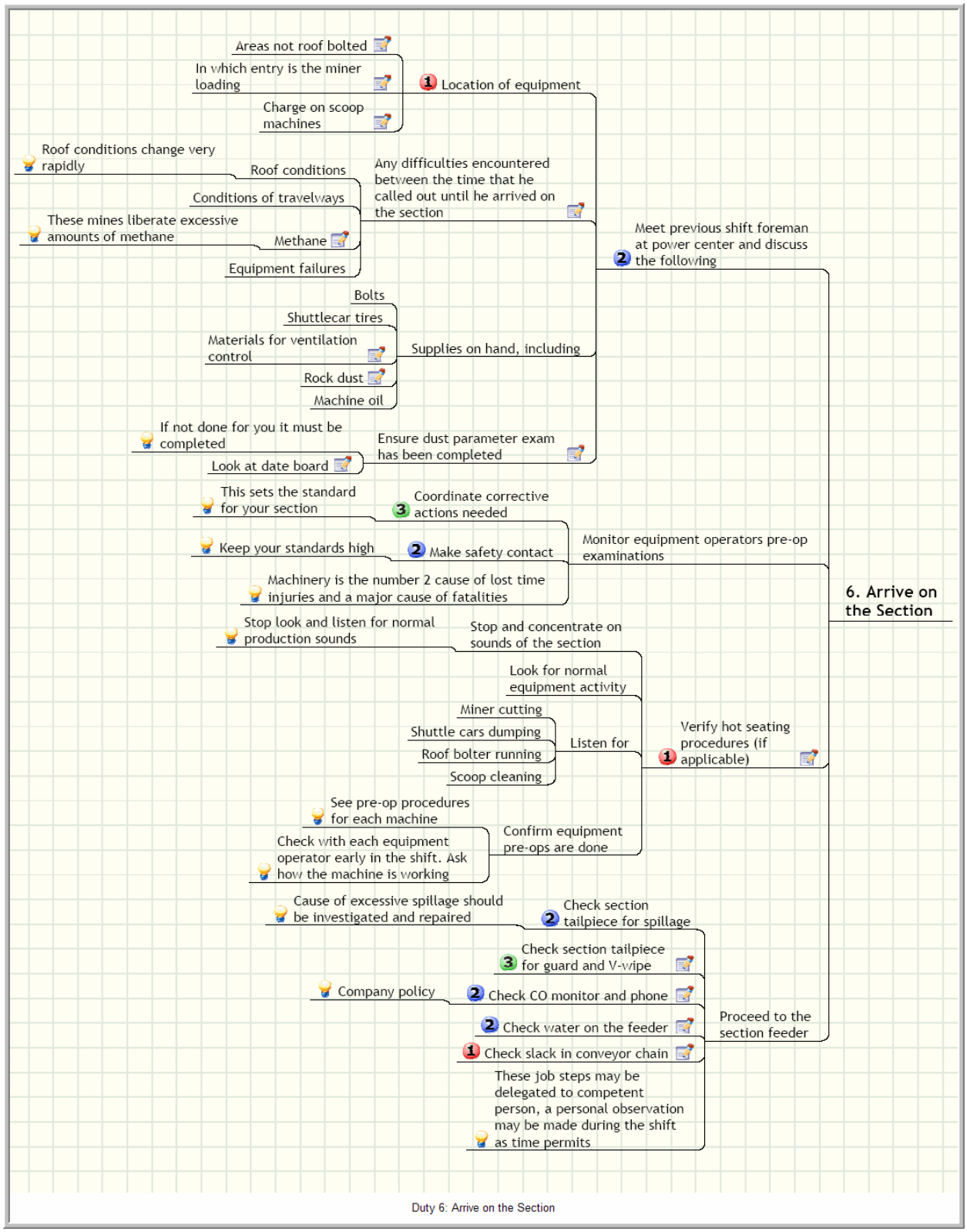
Duty 2: Start of Shift Activities

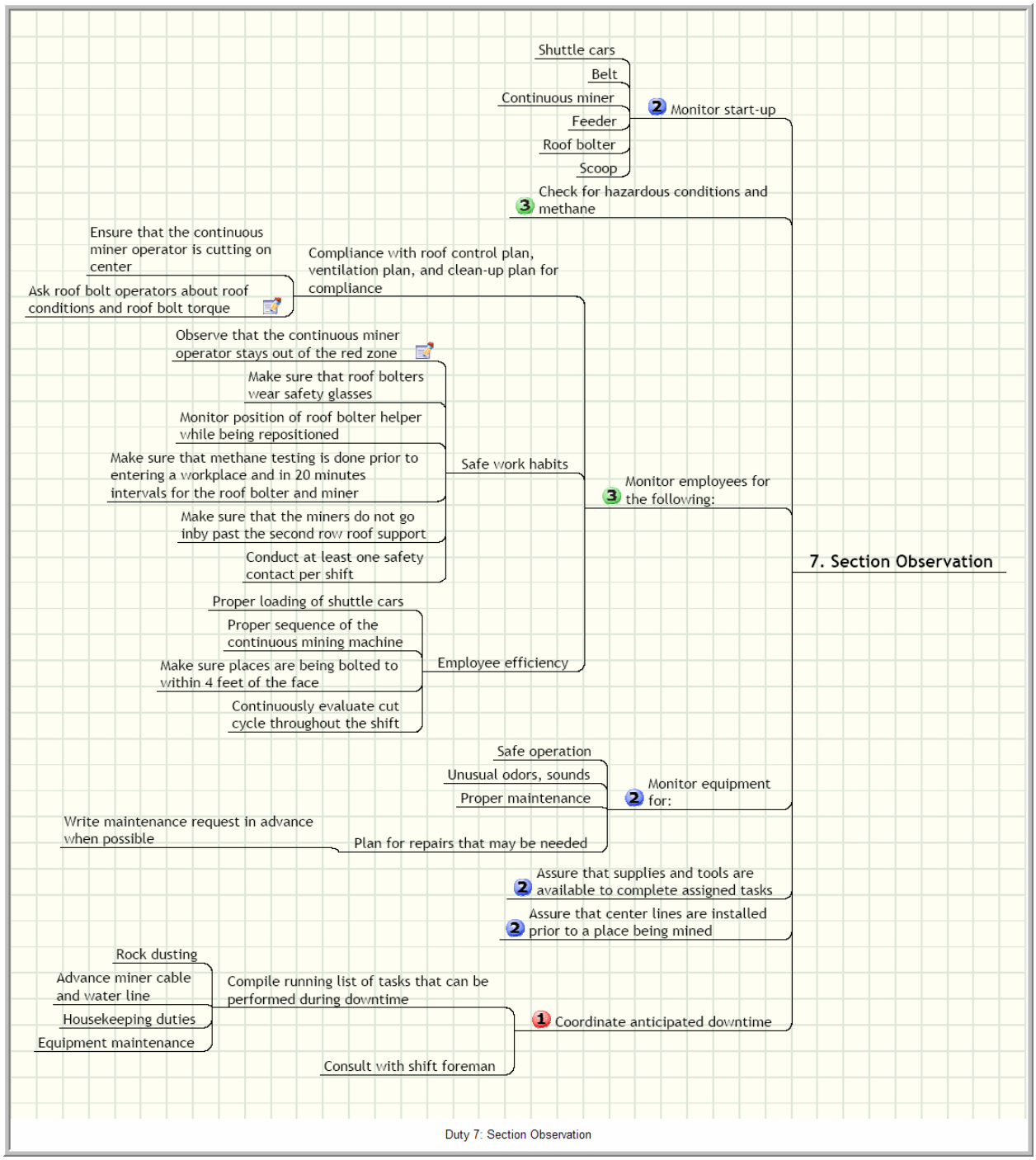

3. Prior to Entering the Mine
Obtain necessary tools and equipment
Methane spotter for self and equipment operators
Check calibration, condition of instrument
Anemometer
SCSR
Perform daily exam
Federal/State regulation
Personal Protective Equipment
Safety glasses
Safety gloves
Hard toed shoes
Reflective material on clothing (if available)
Hard hat
Dust respirator
Hearing protection
Cap lamp
Check battery water level
Check bulb function
Check general condition
Check for and/or obtain necessary safety equipment
Distribute methane spotters for equipment operators
Sounding device
Measuring tape
Marking paint
Sight rods
Chalk line and chalk
Section radios (if required)
Carpenters apron (optional)
Hammer
Check crew
Check for absenteeism
Contact shift foreman for replacement if necessary
Check employee fitness for work
Give instructions on supplies and equipment needed
Share information with mine crew
Discuss hazardous conditions and problem areas
Supplies needed
Ensure employees have personal protective equipment
Review both pre-shift report and cut cycle with crew
Check-in at the mine
Ensure that each employee has provided check-in tag to post outside of mine
Duty 3: Prior to Entering the Mine

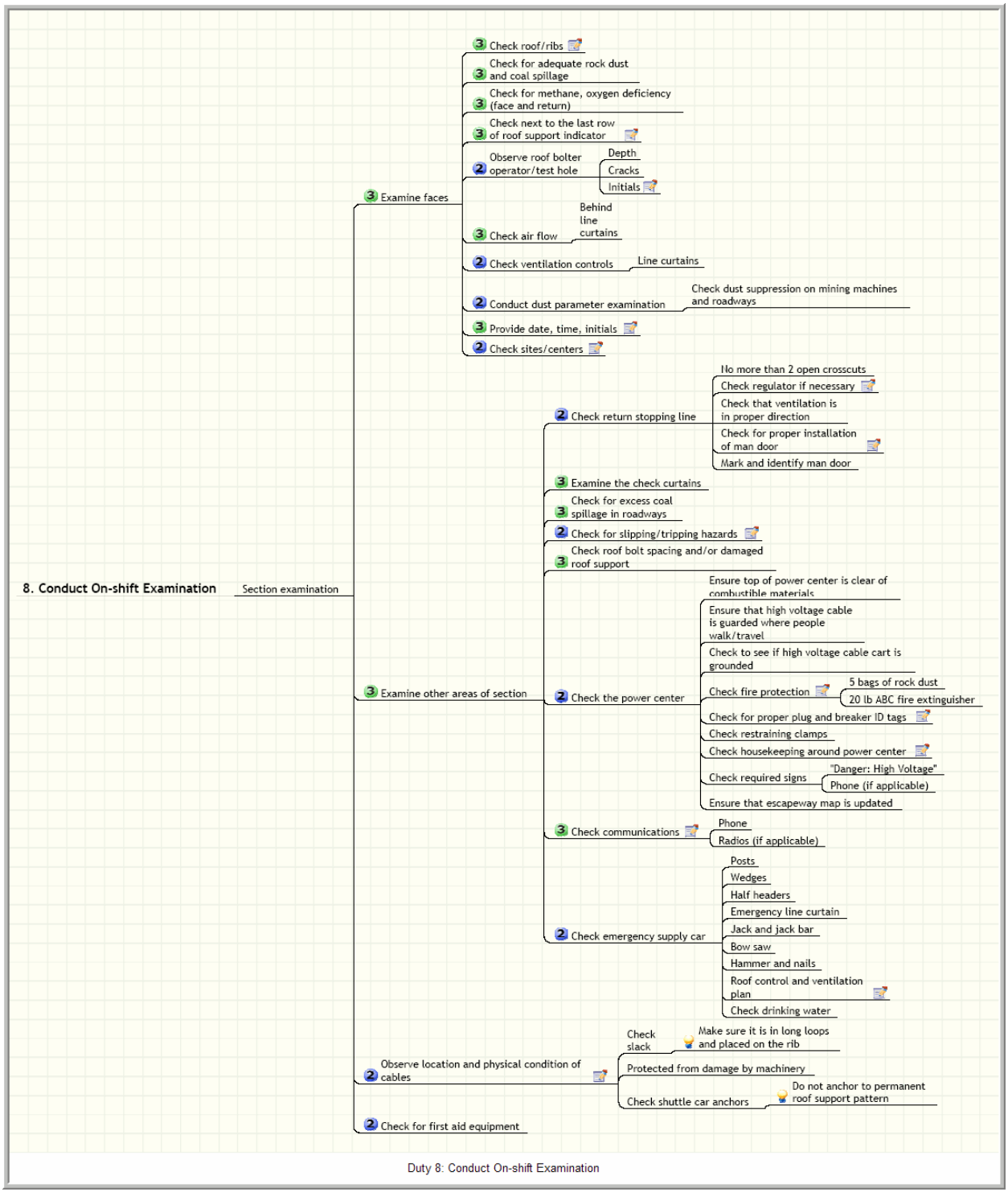


Duty 4: Entering the Mine

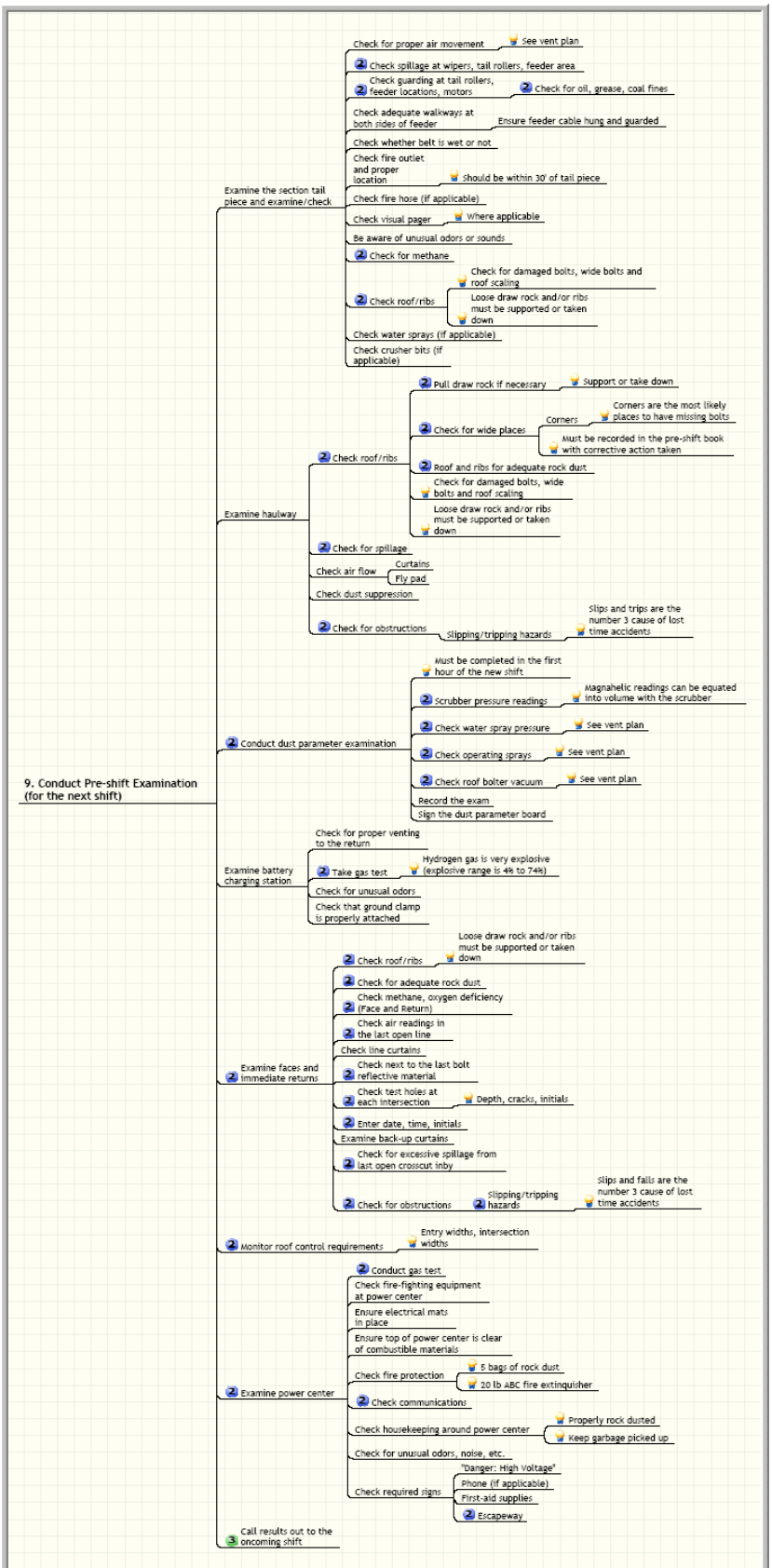

5. Traveling to the Section
Board mantrips (rail and tire)
3 Conduct pre-op exam
Lights
Brakes
Sanders (if required)
Lifting jack and bar
Fire extinguisher
Sounding device
Check parking brake
Check mechanical brake
2 Operate mantrip
Ensure occupants wear safety glasses
Signal before moving
Contact dispatcher for clearance (if required)
Make sure all personnel not in vehicle are clear of mantrip before moving
Maintain 300 feet between moving rail vehicles
Operate in a manner consistent with mine and/or track conditions
Observe conditions while traveling
2 Track condition
3 Roof and rib conditions
1 Debris along the track
3 Ventilation controls
3 Observe and obey warning signs/signals
Low or close clearance
Reflective signs in place
1 Observe/listen for belts to be operating
3 Make sure high voltage line is properly guarded at required locations
Park mantrip
3 Set the parking brake
Zero potential for unexpected movement
2 Switch off electrical breaker (to disconnect the electrical circuits)
2 After exiting mantrip, look for tripping and stumbling hazards in the travelways
Slips and trips are the No. 3 cause of lost time injuries in the mining industry
Check for stop block at the end of the rail (if applicable)
Duty 5: Traveling to the Section


6. Arrive on the Section
1 Location of equipment
Areas not roof bolted
In which entry is the miner loading
Charge on scoop machines
Any difficulties encountered between the time that he called out until he arrived on the section
Roof conditions change very rapidly
Roof conditions
Conditions of travelways
These mines liberate excessive amounts of methane
Methane
Equipment failures
2 Meet previous shift foreman at power center and discuss the following
Supplies on hand, including
Bolts
Shuttlecar tires
Materials for ventilation control
Rock dust
Machine oil
Ensure dust parameter exam has been completed
If not done for you it must be completed
Look at date board
3 Coordinate corrective actions needed
This sets the standard for your section
2 Make safety contact
Keep your standards high
Monitor equipment operators pre-op examinations
Machinery is the number 2 cause of lost time injuries and a major cause of fatalities
Stop and concentrate on sounds of the section
Stop look and listen for normal production sounds
Look for normal equipment activity
Listen for
Miner cutting
Shuttle cars dumping
Roof bolter running
Scoop cleaning
1 Verify hot seating procedures (if applicable)
Confirm equipment pre-ops are done
See pre-op procedures for each machine
Check with each equipment operator early in the shift. Ask how the machine is working
2 Check section tailpiece for spillage
Cause of excessive spillage should be investigated and repaired
3 Check section tailpiece for guard and V-wipe
2 Check CO monitor and phone
Company policy
2 Check water on the feeder
1 Check slack in conveyor chain
Proceed to the section feeder
These job steps may be delegated to competent person, a personal observation may be made during the shift as time permits
Duty 6: Arrive on the Section

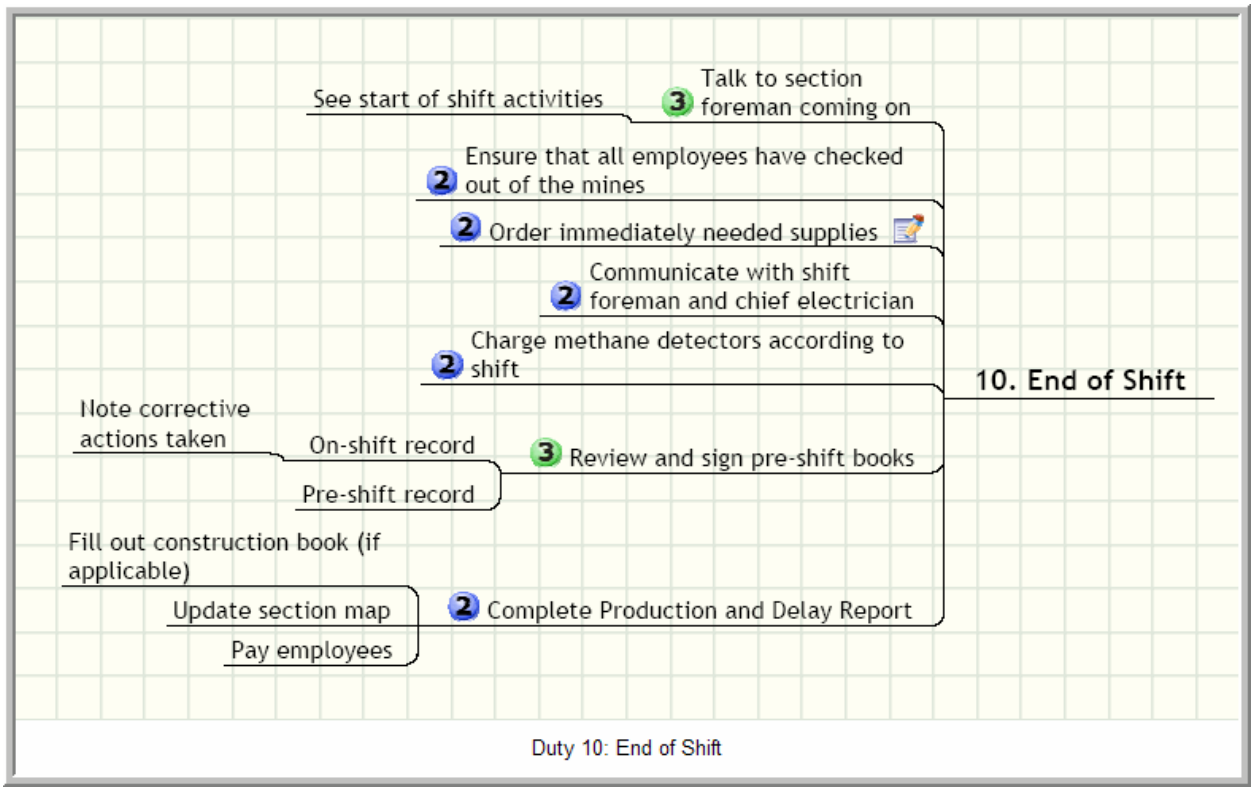

7. Section Observation
Monitor start-up
Shuttle cars
Belt
Continuous miner
Feeder
Roof bolter
Scoop
Check for hazardous conditions and methane
Monitor employees for the following:
Compliance with roof control plan, ventilation plan, and clean-up plan for compliance
Ensure that the continuous miner operator is cutting on center
Ask roof bolt operators about roof conditions and roof bolt torque
Safe work habits
Observe that the continuous miner operator stays out of the red zone
Make sure that roof bolters wear safety glasses
Monitor position of roof bolter helper while being repositioned
Make sure that methane testing is done prior to entering a workplace and in 20 minutes intervals for the roof bolter and miner
Make sure that the miners do not go inby past the second row roof support
Conduct at least one safety contact per shift
Employee efficiency
Proper loading of shuttle cars
Proper sequence of the continuous mining machine
Make sure places are being bolted to within 4 feet of the face
Continuously evaluate cut cycle throughout the shift
Monitor equipment for:
Safe operation
Unusual odors, sounds
Proper maintenance
Plan for repairs that may be needed
Write maintenance request in advance when possible
Assure that supplies and tools are available to complete assigned tasks
Assure that center lines are installed prior to a place being mined
Coordinate anticipated downtime
Compile running list of tasks that can be performed during downtime
Rock dusting
Advance miner cable and water line
Housekeeping duties
Equipment maintenance
Consult with shift foreman
Duty 7: Section Observation



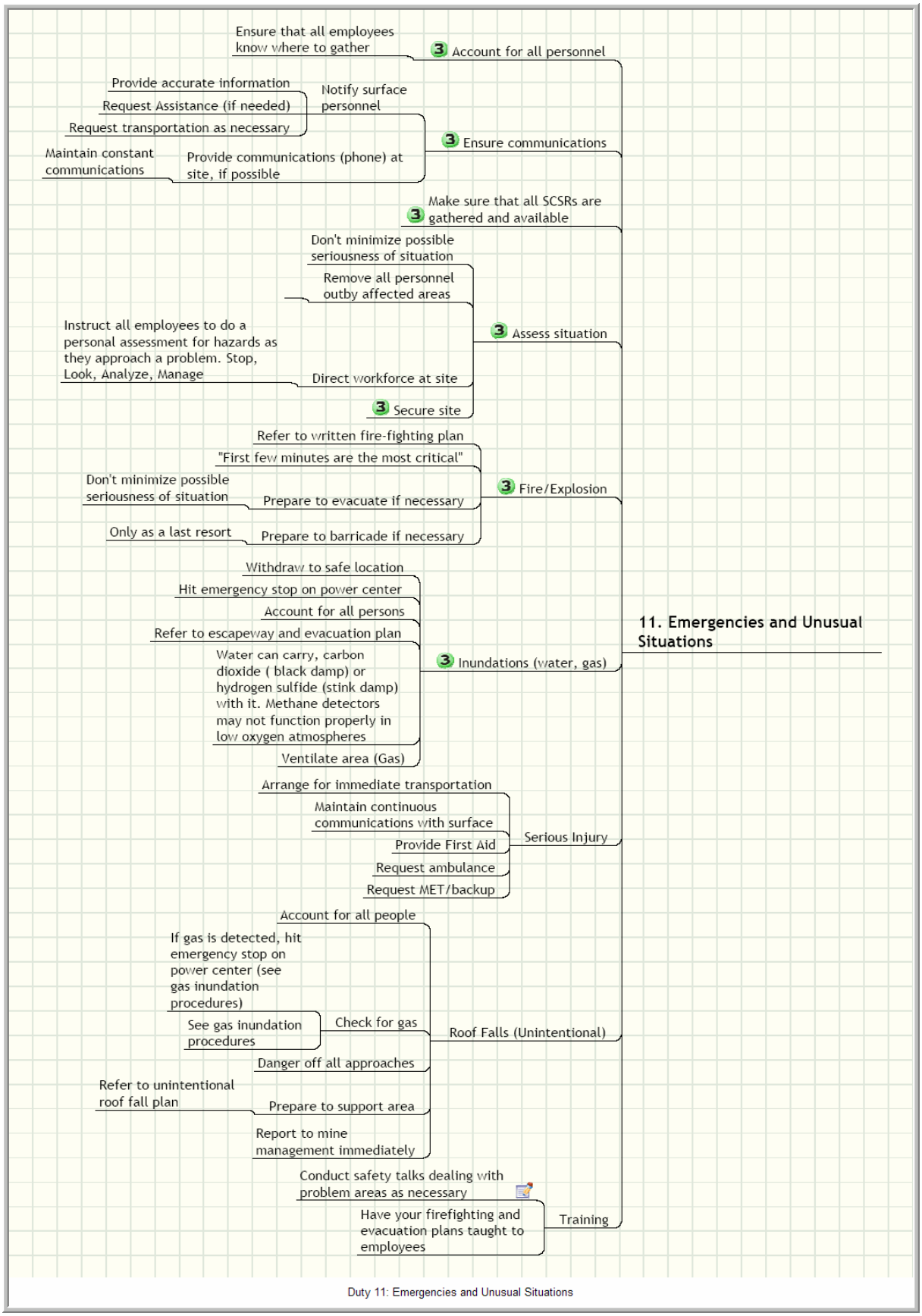
Duty 8: Conduct On-shift Examination

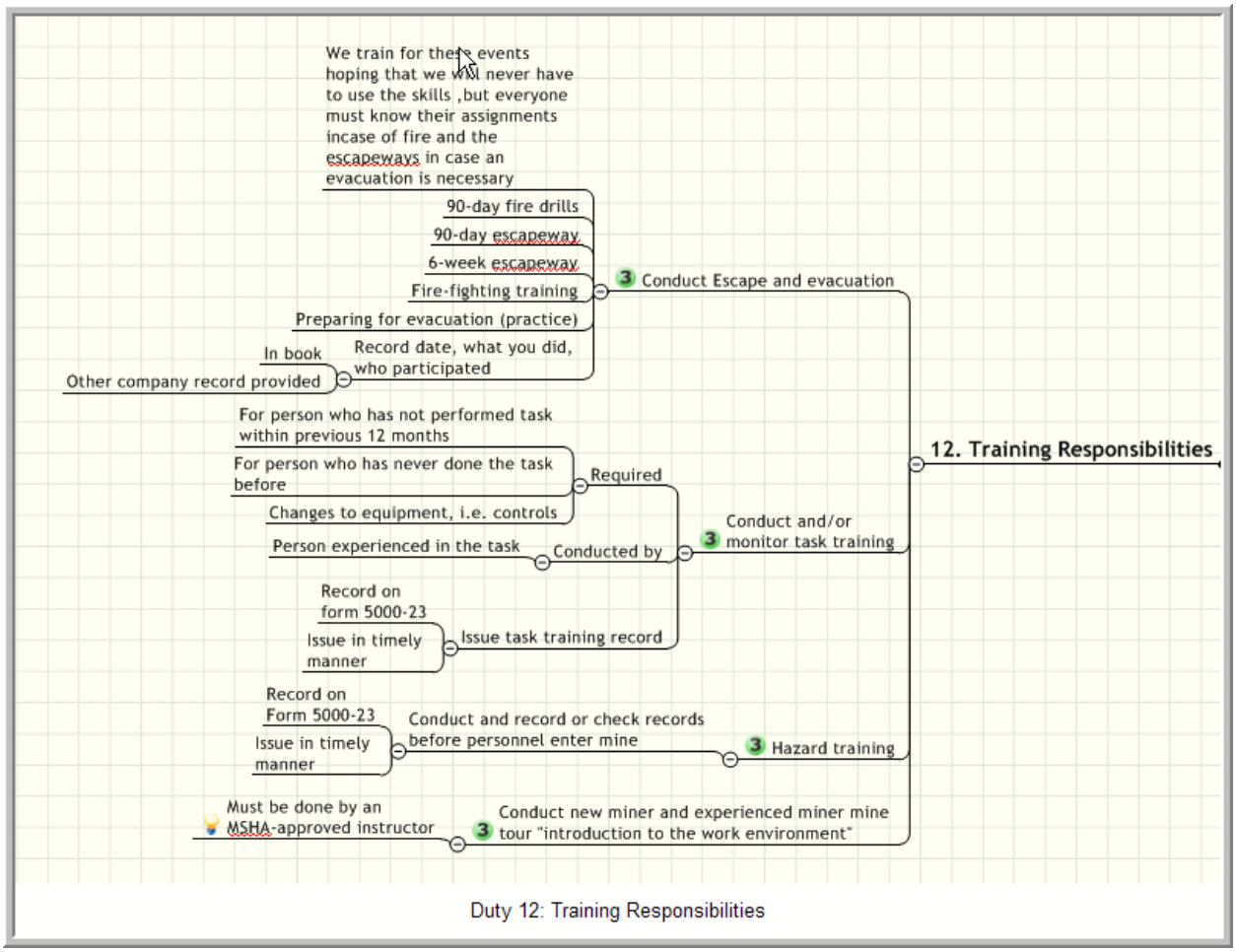


Duty 9: Conduct Pre-Shift Examination (for the next shift)



Duty 10: End of Shift


11. Emergencies and Unusual Situations
Account for all personnel
Ensure that all employees know where to gather
Ensure communications
Notify surface personnel
Provide accurate information
Request Assistance (if needed)
Request transportation as necessary
Provide communications (phone) at site, if possible
Maintain constant communications
Make sure that all SCSRs are gathered and available
Assess situation
Don't minimize possible seriousness of situation
Remove all personnel outby affected areas
Direct workforce at site
Instruct all employees to do a personal assessment for hazards as they approach a problem. Stop, Look, Analyze, Manage
Secure site
Fire/Explosion
Refer to written fire-fighting plan
"First few minutes are the most critical"
Prepare to evacuate if necessary
Don't minimize possible seriousness of situation
Prepare to barricade if necessary
Only as a last resort
Inundations (water, gas)
Withdraw to safe location
Hit emergency stop on power center
Account for all persons
Refer to escapeway and evacuation plan
Water can carry, carbon dioxide (black damp) or hydrogen sulfide (stink damp) with it. Methane detectors may not function properly in low oxygen atmospheres
Ventilate area (Gas)
Serious Injury
Arrange for immediate transportation
Maintain continuous communications with surface
Provide First Aid
Request ambulance
Request MET/backup
Roof Falls (Unintentional)
Account for all people
Check for gas
If gas is detected, hit emergency stop on power center (see gas inundation procedures)
See gas inundation procedures
Danger off all approaches
Prepare to support area
Refer to unintentional roof fall plan
Report to mine management immediately
Training
Conduct safety talks dealing with problem areas as necessary
Have your firefighting and evacuation plans taught to employees
Duty 11: Emergencies and Unusual Situations



Duty 12: Training Responsibilities

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