

Chapter 92

INDUSTRIAL HYGIENE MANAGEMENT IN THE 21ST CENTURY

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Abstract. Increasing concerns of industrial hygiene and worker health issues and resulting regulatory actions, coupled with continuing advances in mining systems, are placing new burdens on the industry and Federal Government; particularly, mine ventilation departments. More encompassing worker health programs are required to respond to Federal promulgation of regulations and to keep abreast of technological advances in the mining industry.

The relationship between the mining industry and Federal agencies involved in rulemaking is presented, along with the rationale of an Industrial Hygiene Management Plan. This plan or strategy focuses on developing partnerships and collaborative research groups to address the controversial health issues facing not only the mining workforce, but our society.

INTRODUCTION

In the past the function of ventilation personnel was to provide mine workers with adequate ventilation air for a safe and healthy mine environment. This was accomplished by diluting known airborne contaminants to within established limits. Today, additional concerns must be addressed. Proposed and future worker health and environmental regulations, liability and compensation issues, the ability to sample and measure airborne contaminants, uncertainty over the health risks of substances, and hazard communication legislation are influencing the actions of mine ventilation personnel. These new concerns require ventilation staffs to have expertise in other health specialties. Along with ventilation engineers, ventilation staffs now include industrial hygienists, occupational health specialists, and administrative personnel.

Awareness of the health issues and resulting regulatory actions coupled with continuing advances in mining systems becoming more mechanized are placing new burdens on the industry and Federal Government; particularly, mine ventilation departments. More

encompassing occupational health programs are required to address Federal rulemaking and keep abreast of technological advances in the mining industry. An Industrial Hygiene Management Plan needs to be designed that focuses on an understanding of hazard characterization, regulatory action, and worker awareness so that known and suspected health issues can be effectively addressed. These industrial hygiene health issues not only affect mine ventilation departments, but all of society. The product of the Plan is a risk management approach that defines decisions and actions based on worker options and the evaluation of consequences and choices.

FEDERAL RULEMAKING

The Federal Government under the Federal Mine Safety and Health Act of 1977 (Public Law 91-173) develops and promulgates mandatory health and safety standards to protect the Nation's coal and hardrock miners, enforces these health and safety standards, and provides assistance and research & development technologies aimed at preventing mine accidents and occupationally caused diseases. Due to the different nature of issues involved, three Federal agencies are primarily tasked with implementation of the 1977 Act:

- o The Department of Health and Human Services, National Institute for Occupational Safety and Health (NIOSH), is authorized to develop and revise recommended occupational health standards for mine workers, and to evaluate worker health conditions in mines.
- o The Department of Labor, Mine Safety and Health Administration (MSHA), is required to develop, promulgate, and revise mandatory health or safety standards for the protection of mine workers. MSHA is also responsible for the enforcement of Federal standards, and provides technical assistance to the industry.

- o The Department of the Interior, U.S. Bureau of Mines (Bureau), conducts research to reduce or eliminate the health and safety hazards in mining and mineral processing operations.

The provisions of the 1977 Act are implemented through the general and final rules published in the Federal Register by MSHA. The rulemaking process involves the issuance of proposed rules by MSHA that are developed into final rules following a public comment period. During this public comment period, the intent and technical basis of the proposed rules can be challenged by interested parties. The resulting rules may be challenged by court litigation, and following this test are published as final rules in the Code of Federal Regulations (CFR) Title 30, Mineral Resources. MSHA then implements procedures to enforce these final rules.

Along with increased awareness of airborne contaminants by society, is the proposed Federal rulemaking regarding exposure standards and right-to-know or hazard communications legislation. The additive or synergistic effects of the contaminants found in the confined, difficult to ventilate underground mine environment are becoming more apparent, and studies are continuing to connect cancer and other diseases to new substances. Federal rulemaking includes new substances never before regulated.

Two currently proposed rules that illustrate the emerging health issues are the Air Quality, Chemical Substances, and Respiratory Protection Standards--30 CFR Part 56 et al.; and the Permissible Exposure Limit for Diesel Particulate--30 CFR Parts 58 and 72.

Among the requirements of the air quality proposed rule are: the regulation of substances that would be controlled for the first time in mine operations; the reduction of existing exposure limits for substances currently regulated; the regulation of substances that will be classified as carcinogens for the first time; and the consideration of substances being more hazardous in the presence of other substances.

The diesel particulate proposed rule seeks to establish a Permissible Exposure Level (PEL) for diesel engine combustion particulate that has been classified by NIOSH as a possible human carcinogen. As diesel particulate is entirely within the respirable dust size range, and since regulations exist for total respirable dust, this proposed rule will now regulate a specific component of the respirable dust size fraction. This type of contaminant specific regulation may be the focus of future regulations as health effects investigations continue to connect contaminants with disease.

THE MINING INDUSTRY

The role of the mining industry is to provide the minerals and materials for a strong National economy and defense. In the 1970's and into the 1980's ventilation departments comprised of engineers were responsible for complying with health and safety standards designed to safeguard the workers. This task generally involved diluting hazardous concentrations of single contaminants, and was limited to the contaminants that could be easily sampled and measured.

In the 1980's and into the 1990's the complexion and management of mine ventilation departments significantly changed in response to both occupational health concerns and advancing technology in mine systems and instrumentation to monitor mine environments. Since early times mine operations have been characterized by advances in the extraction, loading, and transport processes. The horses and animals posed unique problems for ventilation engineers, and would have posed greater issues for industrial hygienists if they had been around in those days. With continued advances in mechanization of underground mining operations throughout the years, the operations have become less dependent on large underground working crews. Today's underground mine environment is characterized by few persons working in scattered locations. Diesel and electric mobile equipment have replaced the animals, and this present day equipment is providing the bridge between today's systems and the more autonomous systems of the future.

Due to the unique underground conditions and reliability required of mine equipment, mine systems experience evolutionary advancements. In comparison, the instrumentation and monitoring systems required to assess the mine environment are undergoing revolutionary advances. Real-time data logging and transmission are available, and research continues to advance the area of highly reliable, unattended atmospheric monitoring systems. Instrumentation of today is capable of measuring contaminants at levels far below the levels that were detectable in the past. Further, substances never before measured in the mine environment will be able to be sampled and monitored in the future. Staying abreast of the advancing instrumentation is becoming more difficult, particularly in the harsh mine environment.

Ten years ago occupational health was an orphan shared not too enthusiastically by ventilation and safety departments of the large mine operations. Now many of these operations employ industrial hygienists, industrial hygienist technicians, administrative personnel, and ventilation engineers knowledgeable of computer network analysis, expert systems, and advanced sampling and monitoring instrumentation.

Mining technology advances throughout the years have taken place with the commitment of the engineers, specialists, and mine workers in the industry, particularly those employed at the mine sites. The present industry as it is structured is not in a position to fully address the health and regulatory issues that govern their operations. Legal concerns of liability and health care compensation often dominate technical concerns. Industry officials have expressed concerns over the proposed air quality rules regarding the lack of trained specialists to conduct the required sampling; the regulation of dusts considered as "inert;" the lack of information considered in classifying substances as carcinogens and their possible exposure levels to the workers; the use of an additive health effects approach due to exposure to mixed, more than one, contaminant; and the lower permissible exposure limits (PEL's) proposed for some substances.

The industry of yesteryear was primarily concerned with mineral production to support higher employment and growing economies and communities. Today's industry still produces the minerals, but with concern for a safe and healthy mine environment. In the 21st century, it will be the success of coordinating all parties involved that will determine the outcome of the health issues.

THE MANAGEMENT PLAN

An Industrial Hygiene Management Plan or strategy is required to address the real and suspected health concerns that ventilation departments will have to resolve for mining to remain competitive. The Plan needs to include the collaboration, cooperation, and facilitation of all parties -- the health effects scientists, industrial hygienists, researchers involved with contaminant control technology, mine officials and operators, and State and Federal regulatory officials. The product of the Plan is a risk management approach that defines decisions and actions based on worker options and the evaluation of consequences and choices. Topics to be addressed by the plan are:

- Health Hazard Characterization
- Regulatory Standards and Reform
- Worker Awareness of Health Issues
- Risk Management

Health Hazard Characterization. The assessment of airborne contaminant hazards for mine workers depends on both research programs to identify and quantify occupational worker exposures and dose levels, as well as risk assessment based on health effects studies. In situations where no illness data or contaminant dose concentrations exist, health effects are estimated based on modeling exercises. Many

times only animal health effects are known, and often the observed effects appear at very high exposure concentrations due to accelerated testing techniques. Additional problems arise when a substance is labeled a carcinogen or potential carcinogen as the perception of adverse risk may outweigh the actual risk posed from exposure. Substantial differences in hazard characterization result based on whether the substance is classified as acting by genotoxic or epigenetic mechanisms. Genotoxic substances have no threshold for induction to the body, whereas epigenic substances have a threshold value. As an engineer, the author feels the only certain fact of health effects studies is that they will be around for the rest of our lives. The decisions are made based on the available data to date, which is continually being evaluated.

Little is known about worker exposure levels to many contaminants in mining environments, and regulations exist on substances that cannot be accurately monitored in mines. A lack of trained professionals to quantify the mine worker exposure remains a problem that requires coordination from the Federal and private sectors. Surveys often evaluate whether a substance is found in a mine, but do not evaluate worker exposure to airborne concentrations. A knowledge of mining is required to make these assessments, and this is often lacking.

Regulatory Standards and Reform. Proposed standards or rules are based on the health hazard classification's success in identifying the hazard, assessing worker exposure, and determining risk based on health effects. Following review of the proposed rules, the final rulemaking is often challenged in court by opposing parties. Air quality rules are being challenged based on:

- o establishing that existing exposure levels in the workplace present a significant risk of material health impairment or that new standards eliminate or substantially lessen the risk;
- o establishing that new Permissible Exposure Limits (PEL's) are economically feasible; and
- o establishing that new Permissible Exposure Limits (PEL's) are technologically feasible.

The Public Comment period and court challenges give the industry an opportunity to assess the legislation affecting mine operations. Although the mining groups and some of the large operations are involved with this process, a large part of the industry is not equipped to handle these situations. The lack of public knowledge of mining, and the range of knowledge required to address the health issues, make coordinating and adequately responding to the issues difficult. Regulatory

standards and reform are expected to increase in importance with increasing health investigations, public concern, and regulatory emphasis.

Worker Awareness of Health Issues. All persons want to be knowledgeable of the possible hazards that may face them. Unfortunately, to become knowledgeable on any subject, particularly in the health area, requires almost a career commitment. It becomes even harder to understand when experts in the field often do not agree on issues.

Programs are underway to increase the mine workers awareness of hazards. The current hazard identification and Material Safety Data Sheets (MSDS), right-to-know legislation, and training courses all seek to increase the workers' awareness of their environments and the action required to maintain a safe and healthy mine environment. Efforts will continue and require the contribution of the entire workforce including professionals and laborers. In an era of reporting news and events from a public interest viewpoint seasoned with a sensational flavor, objectiveness is difficult. Awareness is even more difficult since no one person can be familiar with all issues. Worker awareness based on health hazard characterization and regulatory intent is necessary to develop the risk management options that may eventually provide solutions.

Risk Management. Risk management is the product of hazard characterization, regulatory rulemaking, and worker awareness. It is the development of options that evaluates the consequences of the hazards, the economic considerations, and the social and political concerns. Risk management is concerned with situations where a zero risk environment does not exist. Final decisions are based on the worth and value of available options. A mandatory requirement is the definition of risk.

The paramount difficulty in developing options and decisions is that risk is not presently defined. Defining or quantifying worker risk is not a current agenda of the industry, and the Federal Government is not evaluating the real or true risks of regulatory actions on society as a whole. Quantifying risk for the mining industry and in the larger picture, for society, leads the theme of this

paper far into the 21st century. The true risk to society will involve economic assessments of competing industries judged on their value to society. Issues not now addressed will have to be evaluated for ultimate resolution. These issues include assessment of the cost of domestic violence due to unemployment, the importance of one industry as mining to support many other industries, and the right of individuals to choose.

SUMMARY

Technology advances will continue to realize more efficient and productive mining systems, while maintaining safe and healthy work environments for the workers. However, increasing awareness of industrial hygiene and occupational health issues, coupled with resulting regulatory actions will challenge the competitiveness resulting from the technological advances. The issues of worker health and regulations, liability and compensation issues, ability to sample and measure airborne contaminants, uncertainty over the health risks of substances, and hazard communication legislation pose economic problems.

Due to the many diverse areas of expertise required in dealing with occupational health issues, the industry as structured is not in a position to fully address the regulatory issues that govern their operations. The Federal Government coordinates the range of issues from the health effects studies, regulations, and research and development among three agencies.

An Industrial Hygiene Management Plan is needed and would focus on developing partnerships and collaborative research groups to address the new and the controversial health issues facing not only the mining workforce, but our society. The ultimate solution is a risk management approach that provides worker options supported by society. The issue of quantifying risk nationally for decision making proposes may not materialize. However, without direction the controversial health issues will be decided without the collective input of all parties -- the health effects scientists, industrial hygienists, researchers involved with contaminant control technology, mine officials and operators, and State and Federal regulators.

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