National Institute for Occupational Safety and Health (NIOSH) Mining Abstracts: Chinese Translations

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The National Institute for Occupational Safety and Health (NIOSH)

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The National Institute for Occupational Safety and Health (NIOSH)
美國國家職業安全與衛生研究所（NIOSH）

The National Institute for Occupational Safety and Health (NIOSH) is the U.S. federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH is part of the Centers for Disease Control and Prevention (CDC) in the Department of Health and Human Services.

美國國家職業安全與衛生研究所（NIOSH）負責從事為預防與工作相關的損傷和疾病的科學研究並提出建議，是美國疾病控制與預防中心(CDC)的一部分，隸屬於美國衛生與公眾服務部。

NIOSH Origins and Mission

The Occupational Safety and Health Act of 1970 created both NIOSH and the Occupational Safety and Health Administration (OSHA). OSHA is in the U.S. Department of Labor and is responsible for developing and enforcing workplace safety and health regulations. NIOSH is in the U.S. Department of Health and Human Services and is an agency established to help assure "safe and healthful working conditionals for working men and women by providing research, information, education, and training in the field of occupational safety and health."

NIOSH的創立和使命

1970年通過的職業安全與衛生法創立了NIOSH和美國職業安全與衛生管理(OSHA)。OSHA隸屬於美國勞工部,負責制定和執行工作場所安全與衛生法規。NIOSH隸屬於美國衛生與公眾服務部, "通過提供職業安全與衛生領域的科研、信息、教育和人員培訓,協助確保全國勞工安全和健康的工作條件" 。

NIOSH provides national and world leadership to prevent work-related illness, injury, disability, and death by gathering information, conducting scientific research, and translating the knowledge gained into products and services.

通過收集信息、進行科學研究和將所獲得的成果轉化為產品和服務, NIOSH在預防與工作相關的疾病、傷害、殘廢和死亡方面擔負著全國和全球的領導地位。

Strategic Goals

The Institute's responsibilities include:

- Conducting a focused program of research to reduce injuries and illnesses among workers in high-priority areas and high-risk sectors.
- Implementing and maintaining a system of surveillance for major workplace illnesses, injuries, exposures, and health and safety hazards.
- Increasing prevention activities through workplace evaluations, interventions, and recommendations.
- Providing workers, employers, the public, and the occupational safety and health community with information, training, and capacity to prevent occupational injuries and illnesses.

戰略目標

- 進行重點項目的科學研究以減少高優先領域和高風險行業工人的工傷和疾病;
- 實施和維持工作場所重大疾病、傷害、有害物質接觸、以及健康和安全危害的監測系統;
- 通過對工作場所的評價以及提出相應的干預措施和建議,增加對工作場所疾病和傷害預防的力度;
- 為工人、雇主、公眾和職業安全及衛生社團提供信息和人員培訓，以提高預防職業傷害和疾病的能力。

NIOSH Locations

NIOSH has a staff of over 1,400 people. NIOSH is headquartered in Washington, DC, with research laboratories and offices in Cincinnati, Ohio, Morgantown, West Virginia, Pittsburgh, Pennsylvania, Spokane, Washington, Atlanta, Georgia, and Denver, Colorado.

NIOSH所在地

NIOSH共有1400多工作人員,總部設在華盛頓。研究實驗室和辦公室位於俄亥俄州的辛辛那提市、西維吉尼亞州的摩根城、賓夕法尼亞州的匹茲堡市、華盛頓州的斯波坎市、喬治亞州的亞特蘭大市和科羅拉多州的丹佛市。

NIOSH Research

NIOSH scientists carry out a focused program of intramural and extramural research to prevent or reduce work-related injury and illness. The National Occupational Research Agenda (NORA) provides a framework to guide the efforts of the occupational safety and health community in selected priority research areas, such as agriculture, forestry & fishing, construction, healthcare & social assistance, manufacturing, mining, services, transportation, warehousing & utilities, and wholesale and retail trade.

NIOSH研究

NIOSH科研人員從事研究所內外的重點研究項目以防止或減少與工作相關的損傷和疾病。國家職業研究議程（NORA）為指導職業安全及衛生社團選擇重點研究領域提供一個總的框架。該重點研究領域涵蓋農業、林業和漁業、建築、醫療保健及社會救助、製造業、採礦業、服務業、交通運輸、倉儲及公用事業以及批發和零售貿易。

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Fax: 513-533-8573, or visit the NIOSH Web site at: www.cdc.gov/niosh
欲了解更多信息，請洽1-800-CDC-INFO。
傳真號碼：513-533-8573，或瀏覽NIOSH網站: www.cdc.gov/niosh

Focus on Prevention:
Conducting a Hazard Risk Assessment

Michael J. Brnich, Jr., CMSP and Launa G. Mallett, Ph.D.

Focus on Prevention: Conducting a Hazard Risk Assessment
http://www.cdc.gov/niosh/mining/pubs/pdfs/2003-139.pdf

Overview: The first step to emergency preparedness and maintaining a safe workplace is defining and analyzing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time. Risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be considered later.

Purpose: This training package was developed to assist instructors as they (1) determine how to use risk assessment to improve safety preparedness and (2) present risk assessment concepts and tools to trainees. The concepts and tools presented here can be applied to any mine hazard.

Audience: Information in this package is appropriate for workers from all types of mines. A risk analysis can be conducted by anyone familiar with the location being studied.

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Michael J. Brnich, Jr., CMSP ' Launa G. Mallett %

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PROCEEDINGS OF THE SECOND INTERNATIONAL WORKSHOP ON COAL PILLAR MECHANICS AND DESIGN

http://www.cdc.gov/niosh/mining/pubs/pdfs/tn492.pdf

Edited by Christopher Mark, Ph.D.,[1] Keith A. Heasley, Ph.D.,[1] Anthony T. Iannacchione, Ph.D.,[2] and Robert J. Tuchman[3]

ABSTRACT

Pillar design is the first line of defense against rock falls—the greatest single safety hazard faced by underground coal miners in the United States and abroad. To help advance the state of the art in this fundamental mining science, the National Institute for Occupational Safety and Health organized the Second International Workshop on Coal Pillar Mechanics and Design. The workshop was held in Vail, CO, on June 6, 1999, in association with the 37th U.S. Rock Mechanics Symposium. The proceedings include 15 papers from leading ground control specialists in the United States, Canada, Australia, the United Kingdom, and the Republic of South Africa. The papers address the entire range of issues associated with coal pillars and have a decidedly practical flavor. Topics include numerical modeling, empirical design formulas based on case histories, field measurements, and post failure mechanics.

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Christopher Mark %é, Keith A. Heasley %é,
Anthony T. Iannacchione %é, Robert J. Tuchman Êw

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FIRE RESPONSE PREPAREDNESS FOR UNDERGROUND MINES

http://www.cdc.gov/niosh/mining/pubs/pdfs/2006-105.pdf

By Ronald S. Conti,[1] Linda L. Chasko,[2] William J. Wiehagen,[3] and Charles P. Lazzara, Ph.D.[4]

ABSTRACT

Fire has long been a concern for underground mine workers. A mine fire can occur at any time and can result in a partial or total evacuation of mine personnel and the loss of lives. Fires can grow rapidly. Time is the critical element. Prompt detection, timely and accurate warnings to those potentially affected, and a proficient response by underground miners can have a tremendous impact on the social and economic consequence of a small underground fire. Fire preparedness and response have components of technology and people. These components can work synergistically to reduce the time it takes to bring the system back in balance. This report deals with the preparedness of miners to respond to underground mine fires. It is intended to aid the mining industry in understanding the various roles of emergency responders and the training techniques used to increase their skill levels. The report also presents a technology overview to assist in effective response to mine fires.

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Ronald S. Conti, Linda L. Chasko,
William J. Wiehagen, Charles P. Lazzara %é

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AN UNDERGROUND COAL MINE FIRE PREPAREDNESS AND RESPONSE CHECKLIST: THE INSTRUMENT

http://www.cdc.gov/niosh/mining/pubs/pdfs/ic9452.pdf

By Ronald S. Conti,[1] Linda L. Chasko,[2] Charles P. Lazzara, Ph.D.[3] and Gary Braselton[4]

ABSTRACT

Preparedness is an important element of any underground mine's strategic plan in dealing with an unexpected event, such as a fire. A fully implemented fire preparedness and response plan is essential in reducing the probability and seriousness of a mine fire. This report describes the development of an underground coal mine fire preparedness and response checklist (MFPRC). The checklist is a data collection instrument for profiling both the fire prevention and response capabilities of a mine site and usually requires 3 to 4 days to complete. The checklist encompasses conditions, procedures, and equipment that have frequently been identified as the primary or contributing causes of underground coal mine fires. At least 1 day is needed underground to evaluate the water system. This entails measurements of waterflows and pressures at fire hydrants, and water throw distances of fire hose and nozzles at several locations (mains and branch lines). A few of the other topics that are discussed with mine personnel include detection and suppression systems, combustible materials, mine rescue and fire brigades, and firefighting equipment.

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Ronald S. Conti, Linda L. Chasko,

Charles P. Lazzara %é, Gary Braselton

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ROOF AND RIB FALL INCIDENTS AND STATISTICS: A RECENT PROFILE (No link available)

By Deno M. Pappas,[1] Eric R. Bauer,[2] and Christopher Mark, Ph.D.[3]

ABSTRACT

During 1998-99, groundfall incidents resulted in 27 fatalities and were responsible for over 70% of all deaths in U.S. underground coal mines. To obtain a better understanding of where and why these incidents occurred, a comprehensive analysis of groundfall injuries and fatalities was conducted. The first portion of the study examined various factors associated with roof and rib fall injuries and reportable roof fall noninjuries that occurred during 1995-98. The study found that the room-and-pillar mining method has twice the groundfall incident rate than the longwall method. Mine locations with high groundfall rates seem to correlate to regions where there is a higher concentration of problematic coalbeds. For example, the Illinois Basin has very high groundfall rates, which can be traced back to several key coalbeds-Kentucky No. 13, Herrin/No. 6/ Kentucky No. 11, and Springfield No. 5/Kentucky No. 9. High rib fall rates were found in mines located in thick seams. Groundfall rates were found to be 30% to 40% higher during the months of July through September, possibly due to high humidity that may cause the shale mine roof to deteriorate. The second part of the study examined the root causes of failure by reviewing all groundfall fatality reports for 1996-99. Primary and secondary hazard factors were assigned to each groundfall incident. The primary factors resulting in these groundfall fatalities were pillar extraction, traveling under unsupported roof, skin failure, construction, longwall faces, intersections, and geologic discontinuities. Defining prominent ground control incident trends and hazards will identify areas where additional study is needed and where innovative solutions need to be developed to reduce these severe occupational hazards.

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HANDBOOK FOR DUST CONTROL IN MINING
(No link available)

Fred N. Kissell, Ph.D.,[1] Editor

ABOUT THIS HANDBOOK

This handbook describes effective methods for the control of mineral dusts in mines and tunnels. It assumes the reader is familiar with mining. The first chapter deals solely with dust control methods, regardless of the application. It is a brief tutorial on mining dust control and will be of help to the reader whose dust control problem does not conveniently fit any of the mining equipment niches described in later chapters.

The subsequent chapters describe dust control methods for different kinds of mines and mining equipment. This includes underground coal and hard-rock mines, as well as surface mines, stone mines, and hard-rock tunnels. Because dust sampling has so many pitfalls, a chapter on methods used to sample dust is included. For those occasions when there is no practical engineering control, a chapter on respirators is also included.

Except for those listed as “future possibilities” in the longwall chapter, the dust control methods described are practical and cost-effective for most mine operators. If controlling dust were a simple matter, dust problems in tunnels and mines would have been eradicated years ago. Unfortunately, most underground dust control methods yield only 25% to 50% reductions in respirable-sized dust. Often, 25% to 50% reductions are not enough to achieve compliance with dust standards. Thus, mine operators must use several methods simultaneously, usually without knowing for sure how well any individual method is working. In fact, given a 25% error in dust sampling and day-to-day variations in dust generation of 50% or more, certainty about which control methods are most effective can be wanting. Nevertheless, over the years, some consensus has emerged on the best dust control practices. This handbook summarizes those practices.

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HANDBOOK FOR METHANE CONTROL IN MINING

http://www.cdc.gov/niosh/mining/pubs/pubreference/outputid1779.htm

Fred N. Kissell, Ph.D.,[1] Editor

ABOUT THIS HANDBOOK

This handbook describes effective methods for the control of methane gas in mines and tunnels. It assumes the reader is familiar with mining. The first chapter covers facts about methane important to mine safety, such as the explosibility of gas mixtures. The second chapter covers methane sampling, which is crucial because many methane explosions have been attributed to sampling deficiencies. Subsequent chapters describe methane control methods for different kinds of mines and mining equipment, primarily for U.S. coal mines. These coal mine chapters include continuous miners and longwalls, including bleeders. Coal seam degasification is covered extensively. Other coal mine chapters deal with methane emission forecasting and predicting the excess gas from troublesome geologic features like faults. Additional coal chapters contain methane controls for shaft sinking and shaft filling, for surface highwall mines, and for coal storage silos. Major coal mine explosion disasters have always involved the combustion of coal dust, originally triggered by methane. Thus, a chapter is included on making coal dust inert so it cannot explode. Methane is surprisingly common in metal and nonmetal mines around the world, as well as in many tunnels as they are excavated. Accordingly, a chapter is included on metal and nonmetal mines and another on tunnels.
Proper ventilation plays the major role in keeping mines free of hazardous methane accumulations. The ventilation discussed in this handbook, except for the chapter on bleeder systems, deals only with so-called face ventilation, i.e., ventilation of the immediate working face area, not ventilation of the mine as a whole. The omission of whole-mine ventilation was necessary to keep this handbook to a reasonable size and because a huge amount of excellent information is available on the subject.

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LABORATORY AND FIELD PERFORMANCE OF A CONTINUOUSLY MEASURING PERSONAL RESPIRABLE DUST MONITOR

http://www.cdc.gov/niosh/mining/pubs/pdfs/ri9669.pdf

By Jon C. Volkwein,[1] Robert P. Vinson,[2] Steven J. Page,[3] Linda J. McWilliams,[4] Gerald J. Joy,[5] Steven E. Mischler,[6] and Donald P. Tuchman[5]

ABSTRACT

The National Institute for Occupational Safety and Health (NIOSH), through an informal partnership with industry, labor, and the Mine Safety and Health Administration, has developed and tested a new type of instrument known as the personal dust monitor (PDM). The dust monitor is an integral part of the cap lamp that a miner normally carries to work and provides continuous information about the amount of respirable coal mine dust in the breathing zone of that individual. Testing was conducted on 25 prototype instruments in the laboratory to verify the instruments' accuracy as received from the manufacturer and after a period of underground use. The laboratory testing verified previous work; there is a 95% confidence that the individual PDM measurements were within ±25% of reference measurements. In-mine testing determined the precision, durability, and miner acceptance. Data from the mines showed a field precision of 0.078% relative standard deviation for the PDM and 0.052% for the recognized standard—the coal mine dust personal sampler unit. The PDM had about 90% availability for collecting valid information in over 8,000 hr of underground use. Anecdotal comments by miners indicated that they found the PDM more convenient to wear for sampling than currently used instruments because of the integration of the sampler into the normally worn cap lamp. The means of the instruments' pre- and postmine accuracy verification test values were statistically equivalent. Additional data were collected to measure the equivalency of the PDM to the U.K. Mining Research Establishment sampler, as required by U.S. law. However, analysis of the data was more complex than originally anticipated because the variance with increasing concentration required use of a more sophisticated statistical model. Explanation of and results from this work will be the subject of a second publication. Under the broad range of test conditions covered in this work, the PDM functioned as well as the current sampler in terms of availability for use, accuracy, precision, and miner acceptance.

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Jon C. Volkwein, Robert P. Vinson, Steven J. Page, Linda J. McWilliams, Gerald J. Joy, Steven E. Mischler, Donald P. Tuchman

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Experimental mine and laboratory dust explosion research at NIOSH

Michael J. Sapko , Eric S. Weiss, Kenneth L. Cashdollar, Isaac A. Zlochower

Pittsburgh Research Laboratory, National Institute for Occupational Safety and Health, Pittsburgh, PA 15236, USA

Abstract

This paper describes dust explosion research conducted in an experimental mine and in a 20-L laboratory chamber at the Pittsburgh Research Laboratory (PRL) of the National Institute for Occupational Safety and Health (NIOSH). The primary purpose of this research is to improve safety in mining, but the data are also useful to other industries that manufacture, process, or use combustible dusts. Explosion characteristics such as the minimum explosible concentration and the rock dust inerting requirements were measured for various combustible dusts from the mining industries. These dusts included bituminous coals, gilsonite, oil shales, and sulfide ores. The full-scale tests were conducted in the Lake Lynn experimental mine of NIOSH. The mine tests were initiated by a methane–air explosion at the face (closed end) that both entrained and ignited the dust. The laboratory-scale tests were conducted in the 20-L chamber using ignitors of various energies. One purpose of the laboratory and mine comparison is to determine the conditions under which the laboratory tests best simulate the full-scale tests. The results of this research showed relatively good agreement between the laboratory and the large-scale tests in determining explosion limits. Full-scale experiments in the experimental mine were also conducted to evaluate the explosion resistance characteristics of seals that are used to separate non-ventilated, inactive workings from active workings of a mine. Results of these explosion tests show significant increases in explosion overpressure due to added coal dust and indications of pressure piling.

Keywords: Explosion; Mining; Flame propagation; Deflagration

1. Introduction

There has been a notable decline in the frequency and severity of mine explosions since the early part of the twentieth century. Among the major safety measures responsible for this decline are the use of general rock dusting, development of permissible explosives and electrical equipment, improved ventilation, and improved methods for detecting hazardous conditions. Although these advances in mine safety are noteworthy, the problem of mine explosion prevention is not completely solved, for serious mine explosions still occur (Sapko, Greninger & Watson, 1989; Dobroski, Stephan & Conti, 1996). For many mines, the almost continual deposition of fine-sized float coal dust on the floor, ribs, and roof of mine entries and returns, coupled with the intermittent application of rock dust, has resulted in stratified layers of dust (Sapko, Weiss & Watson, 1987a). Over the years, changes in mining technology have produced increased amounts of finer float coal dust, which has compounded safety matters (Sapko, Weiss & Watson, 1987a). Frictional ignitions of methane are also a serious concern, and their potential for disastrous consequences is well known.

Much knowledge has been obtained from the full-scale explosion research conducted by mine safety research establishments during the past two decades (Sapko et al., 1989, 1987a; Weiss, Greninger & Sapko, 1989; Cashdollar, Sapko, Weiss & Hertzberg, 1987; Nagy, 1981; Michelis, Margenburg, Müller & Kleine, 1987; Reeh & Michelis, 1989; Sobala, 1987; Cashdollar, Weiss, Greninger & Chatrathi, 1992; Greninger, Cashdollar, Weiss & Sapko, 1990; Sapko, Weiss & Watson, 1987b; Lebecki, 1991; Michelis, 1996). This research has provided important practical data and a better understanding of the fundamental explosion processes. Previous Pittsburgh Research Laboratory[1] (PRL) experi-

[1] The Pittsburgh Research Laboratory was part of the U.S. Bureau of Mines before its transfer to the National Institute for Occupational Safety and Health (NIOSH) in October 1996.

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Michael J. Sapko, Eric S. Weiss, Kenneth L. Cashdollar,
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Technology News
No. 461 NIOSH July 1997

Coal Dust Explosibility Meter

http://www.cdc.gov/niosh/mining/pubs/pubreference/outputid290.htm

Objective

To enable mine operators and mine inspectors to make quick and accurate measurements of the explosible nature of coal and rock dust mixtures.

The Problem

Past research has shown that the accumulation of coal dust in underground coal mines can be rendered nonexplosible by adding sufficient quantities of inert rock dust, such as limestone dust. Federal regulations for underground coal mines require mine operators to dust mine corridors with an inert rock dust and maintain a total incombustible content of at least 65% in the entries and at least 80% in the returns, where the coal dust is expected to be finer in size. Currently, samples of the deposited coal and rock dust are collected for aboveground analysis of the inert percentage, which consists of rock dust, ash, and moisture. The processing time for this analysis can be as long as 2 weeks. In addition, research has shown that measuring the incombustible percentage is not always sufficient to determine the explosibility of a sample, especially for finer coal dust. The National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Center (PRC), has devised a prototype handheld instrument that can provide a direct assessment of the potential explosibility of a coal and rock dust mixture.

How It Works

The coal dust explosibility meter (CDEM) is a portable optical device that determines whether or not a coal and rock dust mixture is explosible (figure 1). It consists of an optical probe connected to a small electronics box with a digital display. The principle of operation of the CDEM is based on the measurement of infrared radiation reflected from the surface of a homogeneous mixture of two substances with different optical reflectances, such as light colored rock dust and dark coal dust (figure 2). Near-infrared radiation is emitted by a light-emitting diode in the optical module located behind the window of the optical probe. When the meter is inserted in the dust mixture, the infrared radiation reflects off the dust's surface and back to the silicon photodiode sensor, also located in the optical module. For a given coal volatility, the normalized optical reflectance of such mixtures is relatively constant at the limit of explosibility (the amount of rock dust required to inert) and independent of the coal dust particle size. Samples whose normalized reflectance measures below the threshold would be identified as explosible; samples with reflectances greater than the threshold would be nonexplosible.

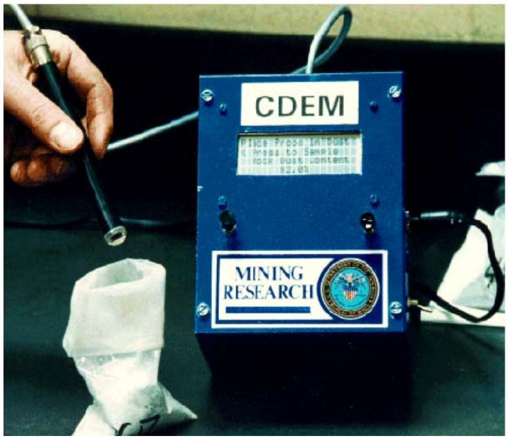

Figure 1. – The CDEM is used to analyze the composition of a coal and rock dust mixture.

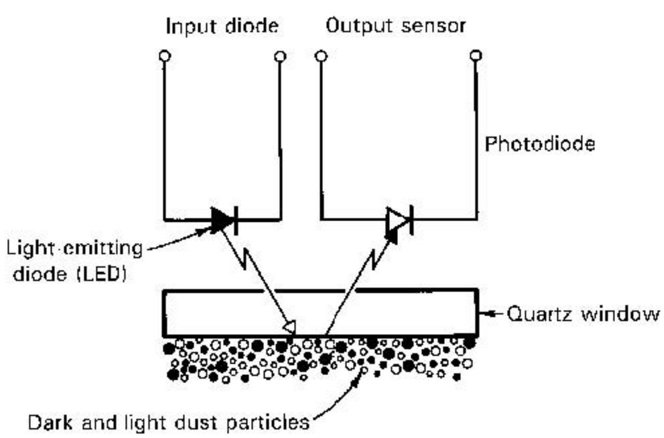

Figure 2.—Drawing depicting principle for measuring the optical reflectivity of a coal and rock dust sample.

Test Results

The limit of explosibility for many coals was determined in PRC's 20-liter explosibility chamber using several types of rock dust. As expected, the percentage of rock dust required to inert the coal dust increases for finer coal dust size. Coals with mass median particle sizes in the range of 10 to 70 µm required 90% to 60% rock dust, respectively, to be inerted. At the finest particle sizes, mixtures are still explosible even above the federally mandated 80% rock dust requirement for return airways, confirming the fact that measuring the rock dust concentration is not sufficient to determine the explosibility of a sample. For each mixture, the CDEM optical reflectance was measured at the limit of flammability and was found to be constant over the range of particle sizes for a given coal volatility. In practice, the normalized reflectance to which the meter alarm would be set would depend on the volatility of the coal seam in which the instrument was being used.

The CDEM thus provides a measurement of the explosibility of a dust sample over the entire range of coal dust sizes, rather than being restricted to the two coal sizes (intake and return) in current regulations.

Continued Efforts

Currently, the CDEM could provide an efficient method to determine the explosibility of air-dried, homogeneous samples at aboveground laboratories at the mine site. Research is in progress to measure and correct for the presence of moisture in the samples by measuring the electrical resistivity in addition to the reflectivity. This correction would allow the CDEM to be used on samples directly from the mine and possibly to provide an in situ explosibility measurement to eliminate the danger of operating under hazardous conditions while samples are processed. The CDEM could provide mine operators and safety inspectors with a valuable means for determining the explosible nature of coal and rock dust deposits.

Efforts are currently underway to commercialize the CDEM, along with a related instrument, the reflectance rock dust meter, which provides a direct measurement of the rock dust percentage in mine dust samples.

For More Information

To obtain a free copy of a technical paper on the CDEM or answers to technical questions about the device, contact Carrie E. Lucci or Kenneth L. Cashdollar, National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Center, Cochrans Mill Rd., P. O. Box 18070, Pittsburgh, PA 15236-0070, phone (412) 892-4308 or (412) 892-6753, fax (412) 892-6595, e-mail: **chl4@cdc.gov** or **kgc0@cdc.gov**

To receive additional information about mining issues or other occupational safety and health problems, call **1-800-35-NIOSH (1-800-356-4674)**, or visit the NIOSH Home Page on the World Wide Web at http://www.cdc.gov/niosh/homepage.html

As of October 1996, the safety and health research functions of the former U.S. Bureau of Mines are located in the National Institute for Occupational Safety and Health (NIOSH).

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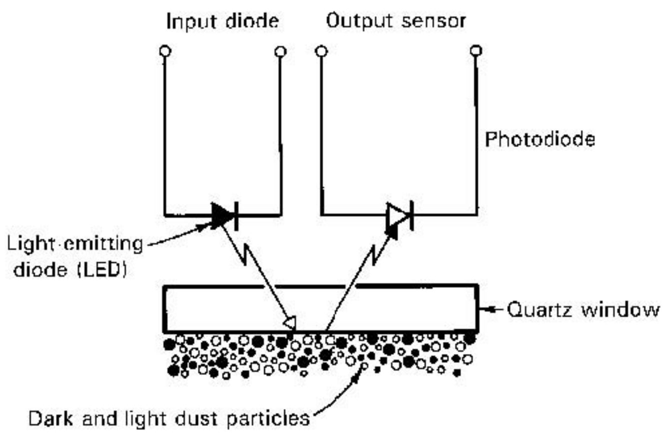

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Milestones in Mining Safety and Health Technology

Float Coal Dust Explosion Hazards

http://www.cdc.gov/niosh/mining/pubs/pdfs/2006-125.pdf

Objective

To increase awareness of float coal dust explosion hazards in the mining industry.

Background

In underground coal mining, dust is produced at the face, at conveyors, at transfer points, and by the normal movement of workers and machines. The coarse coal dust particles settle rapidly. However, the fine coal particles remain airborne much longer, and the ventilating air can move this fine dust relatively long distances into the returns before settling. This fine dust is called float coal dust. It generally consists of particles of coal that pass a 200-mesh sieve (particles smaller than 75 µm).

Generalized rock dusting is currently the primary means of defense against coal dust explosions in U.S. mines. 30 CFR 75, Subpart E (Combustible Materials and Rock Dusting), requires the use of rock dust in bituminous coal mines (30 CFR 75.402). The regulations state that rock dust shall be distributed upon the top, floor, and sides of all underground areas of a coal mine in such quantities that the incombustible content of the combined coal dust, rock dust, and other dust shall be not less than 65%, and the incombustible content in the return air courses (where the dust is expected to be finer) shall be no less than 80% (30 CFR 75.403). These incombustible concentrations assume that the coal and rock dust are not layered, but are intimately mixed. Float coal dust is a serious explosion hazard if it accumulates on top of the rock dust and is not mixed thoroughly with the rock dust. An example of this is shown in Figure 1.

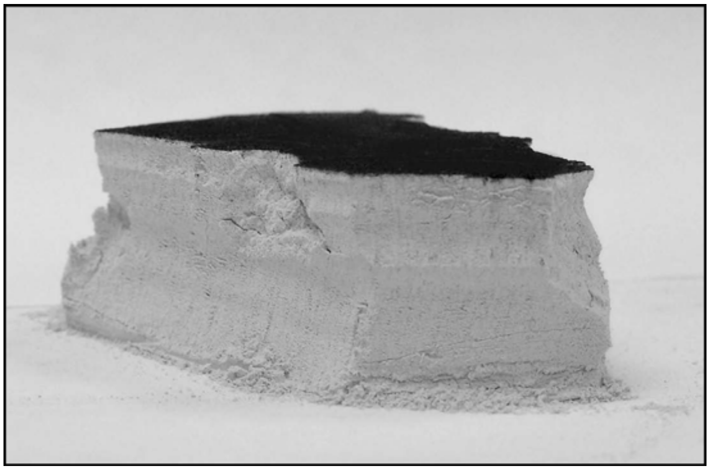

Figure 1.—Cross-section of a very thin (0.01-inch) explosible float coal dust layer deposited on top of a 3/4-inch (20-mm) thick layer of rock dust.

Approach and Results

The explosion hazards of float coal dust have been studied over many decades in the Experimental Mine at Bruceton, PA. The position of coal dust along the perimeter of an entry is a more important factor affecting explosion propagation than is often recognized. The dust on the ribs, roof, and other elevated surfaces (overhead dust) can be dispersed much more readily by an explosion than dust on the floor. If the overhead dust is mainly coal dust, the explosion hazard is intensified. If the overhead dust is primarily rock dust, the explosion hazard is reduced. Depending on the quantity, the overhead rock dust can compensate somewhat for a deficiency of rock dust on the floor. However, thick layers of rock dust on the floor cannot compensate for float coal dust on overhead surfaces.

For some of the Experimental Mine explosion tests, trays of color-coded dust layers were substituted for the floor layer in strategic locations throughout the test zone. The results showed that, for a typical float coal dust explosion, only the top 3/32 to 5/32 inches (2 to 4 mm) of the floor dust layer is stripped off or entrained in the air. It was also found that a minimum 5/l,000- inch (0.12-mm) thick layer (about the thickness of a sheet of paper) of pulverized float coal dust deposited on top of a 3/8-inch-thick uniform concentration of 80% rock dust and 20% float coal dust would propagate an explosion. The thicker the float coal floor layer, the more violent the explosion.

Recommendations

Research has shown that when the overhead dust is primarily rock dust, the explosion hazard is reduced. Depending on quantity, the overhead rock dust can compensate for a deficiency of rock dust on the floor. However, since rock dust on the floor cannot compensate for the float coal dust on surfaces above the floor, special attention toward increasing the rock dust content on these elevated surfaces is recommended.

Float coal dust deposits can be neutralized by new applications of rock dust (such as trickle rock dusting or bulk rock dusting), by mixing the float coal dust with the underlying rock dust, by general cleanup, and/or by washing down the rib and roof surface.

For More Information

For more information on the explosion hazards of float coal dust, contact Michael J. Sapko (412–386– 6619, MSapko@cdc.gov), Eric S. Weiss (412–386– 5050, EWeiss@cdc.gov), or Kenneth L. Cashdollar (412–386–6753, KCashdollar@cdc.gov), NIOSH Pittsburgh Research Laboratory, Cochrans Mill Rd., P.O. Box 18070, Pittsburgh, PA 15236–0070; fax: 412–386–6718.

To receive other information about occupational safety and health topics, call 1–800–35–NIOSH (1–800–356–4674), or visit the NIOSH Website at www.cdc.gov/niosh

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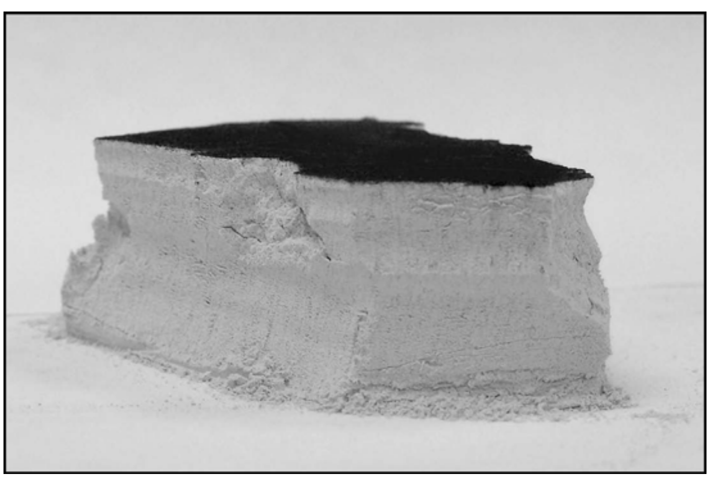

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REMOTELY INSTALLED MINE SEALS FOR MINE FIRE CONTROL

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Michael A. Trevits NIOSH, Pittsburgh, PA
Alex C. Smith, NIOSH, Pittsburgh, PA
Thomas A. Gray, GAI Consultants, Inc., Homestead, PA
Lynn M. Crayne, Howard Concrete Pumping Co., Cuddy, PA
Phil Glogowski, GAI Consultants, Inc., Homestead, PA

Abstract
Mine fires constitute one of the greatest threats to the health and safety of those working in the underground environment and each event has the potential for disastrous consequences. Of the major mine fires and thermal events that have occurred in the United States in the last 6 years, it is estimated that remotely installed seals could have been used in 63% of the events to control fire growth or to aid in fire suppression work. The National Institute for Occupational Safety and Health (NIOSH) is conducting full-scale tests at the NIOSH Lake Lynn Experimental Mine to evaluate and improve remote mine seal construction technology. The main focus of this work is to develop reliable technology that will completely close the mine opening from floor-to-roof and rib-to-rib. This paper presents the results of remote seal installations using grout-based materials.

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