REPORT OF THE
JOINT SUBCOMMITTEE STUDYING

The Health Effects of Using Diesel Engines in Underground Coal Mines

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

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Report of the
Joint Subcommittee Studying the
Health Effects of Using Diesel Engines
in Underground Coal Mines
To
The Governor and the General Assembly of Virginia
Richmond, Virginia
January, 1989

TO: Honorable Gerald L. Baliles, Governor of Virginia,

and

The General Assembly of Virginia

I. INTRODUCTION

The 1988 General Assembly adopted HJR 110, which established a joint subcommittee to study the health effects of using diesel engines in underground coal mines. The study was initiated due to increasing concern over the health of miners who are exposed to diesel exhaust in the underground coal mines of the Commonwealth.

During the course of this study, the subcommittee toured a Virginia mine in which diesel equipment was being operated and held several meetings, including a public hearing in southwest Virginia. The subcommittee heard from miners, representatives of health organizations, government agencies, the mining industry, equipment manufacturers and reviewed numerous reports and other writings concerning exposure to diesel exhaust.

II. BACKGROUND

A. HISTORY OF DIESEL USE

Prior to 1981, upon the approval of the Chief of the Division of Mines, the use of internal combustion engines was allowed in Virginia's underground coal mines. However, in 1981, concern over the possible health hazards of engine exhausts prompted a repeal of the section permitting their use. In 1984, legislative action was taken to permit the use of diesel powered equipment in underground coal mines (H.B. 277). This legislation directed the Chief to promulgate regulations for diesel use.

The use of diesel engines in underground coal mines is becoming more prevalent due to increased mechanization and safety factors. According to figures obtained from the Department of Mines, Minerals and Energy, 114 pieces of diesel equipment are presently being operated in Virginia coal mines. Only fifty-two pieces of diesel equipment were being used in Virginia coal mines as of January, 1987.

Proponents of diesel engine use argue that diesels are preferable to gasoline engines or electricity from a health and safety standpoint. A gasoline engine presents a fire hazard due to the high volatility of its fuel and its spark-ignition system. Gasoline engines also emit large amounts of carbon monoxide. The removal of trolley wires, power supplies, cables and electric vehicles greatly reduces the exposure of miners to electrical health hazards, among the most common causes of injury and death to miners. Additionally, diesel equipment is more efficient to operate than electrical equipment.

Nevertheless, recent health studies have failed to rule out diesel emissions as an occupational health problem. In past years, testimony before the House Mining Committee has indicated that miners who work with diesel equipment in coal mines complain of headaches, eye-irritation, nausea and drowsiness.

B. CONSTITUENTS OF DIESEL EXHAUST

A miner working in an underground coal mine with diesel equipment is exposed to a variety of pollutants emitted in diesel exhaust. These pollutants include carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, sulfur dioxide, formaldehyde, particulate matter and a wide variety of organic compounds.

Carbon monoxide (CO) is a colorless, odorless and tasteless gas which is a product of incomplete combustion in the diesel engine cylinder. It has 200-250 times more capability than oxygen of combining with hemoglobin to form carboxyhemoglobin, which interferes with the oxygen-carrying capacity of blood, resulting in a state of tissue hypoxia. Carbon monoxide emissions from diesel engines can be reduced by making fuel injection adjustments or through the use of catalytic converters.

Carbon dioxide (CO_2) is a colorless, odorless, noncombustible gas which is a product of the complete combustion of liquid hydrocarbon fuels. It is a simple asphyxiant and increased levels produce unconsciousness and death from oxygen deficiency. At lower concentrations it can cause shortness of breath, headaches, and altered rates of breathing. The CO_2 contained in diesel exhaust is directly proportional to the amount of fuel burned and cannot be reduced by emission control devices. Ventilation is, therefore, the only way to lower CO_2 emissions to acceptable levels in mines.

The oxides of nitrogen (NO_x) include nitric oxide (NO) and nitrogen dioxide (NO_2). The major portion of NO_x produced is NO, usually comprising over ninety percent of the NO_x. NO_x can cause irritation of the eyes, nose and throat. NO_2 causes inflammation of lung tissue which can lead to pulmonary edema and is considered more toxic than NO. NO_x can be reduced by exhaust gas recirculation, fuel injection modification and water injection.

Sulfur dioxide (SO_2) is a colorless gas with a characteristic suffocating odor. SO_2 results from the oxidation of sulfur in the diesel fuel. It is particularly irritating to the mucous membranes of the upper respiratory tract. As SO_2 in the exhaust is proportionate to the sulfur content of the fuel, SO_2 emissions can be controlled by minimizing the amount of sulfur in the fuel.

The effect of diesel particulate matter on a miner's health is of particular concern because it is almost entirely respirable in size and is able to absorb other chemical substances, including potentially carcinogenic matter. The particulate matter acts as a carrier to bring these substances into the lung where they may leach to other regions of the body and cause damage to other target organs besides the lung. Animal studies suggest chronic exposure to diesel particulate matter can cause impaired pulmonary function, reduced growth rate, increased susceptibility to lung infections, and decreased clearance of lung particulate matter. Particulate emissions are controlled by turbocharging, power limitation and a catalytic scrubber and/or water scrubbing combination. Proper maintenance is also critical in controlling particulate emissions.

The combined effect of these pollutants on the health of a miner may be the same as or greater than the effect of any single pollutant alone. Additionally, in attempting to reduce specific components of diesel exhaust it is important to realize that the use of one control technique may result in increased emissions of another component. For example, the exhaust gas recirculation reduces No_x emissions but increases CO and unburnt hydrocarbon emissions.

C. VIRGINIA'S REGULATIONS

Of the thirteen states which allow the use of diesel engines in underground coal mines, Virginia is one of three states which have developed health and safety regulations regarding their use. West Virginia, Ohio and Pennsylvania do not allow diesel engines to be used in their coal mines. In June of 1985, regulations were adopted by the Chief of Virginia's Division of Mines which set Threshold Limit Values (TLV's) on the gaseous constituents of diesel exhaust. These TLV's were based upon the standards and recommendations of the U.S. Mine Safety and Health Administration (MSHA) for diesel equipment in mines other than coal mines. These standards were published by the American Conference of Governmental Industrial Hygienists and are considered the best available standards. MSHA has yet to adopt such standards for coal mines. Virginia is the only state with specific standards for gaseous constituents of diesel exhaust in coal mines. No standards have been adopted for allowable concentrations of particulate matter in coal mine air by MSHA or Virginia. In fact, no work place diesel particulate standards have been developed or recommended for any industry.

DMME regulates the usage of diesel equipment in Virginia's underground coal mines. Current regulations require that all diesel equipment and the mine's ventilation be inspected and approved prior to the installation or operation of such equipment. These regulations are based on performance measures which ensure that air quality is maintained at a safe, healthy level. Equipment operated near the working face (where coal is being removed and explosive gases are sometimes released) must be maintained in a condition permissible for mining conditions, according to standards established by MSHA. Other diesel equipment must meet MSHA approval standards. Diesel equipment must be equipped with fire-protection devices and extinguishers. Operators who store diesel fuel underground must follow strict regulations to prevent fires and spills. Diesel equipment is permitted to be operated only in areas where positive ventilation is provided. Ventilating air must be provided in the proper quantities, and the various constituents of the air must be present in the proper concentrations. Standards for proper concentration include TLVs for the gaseous constituents of diesel exhausts such as CO, CO_2, NO, NO_2, SO_2 and formaldehyde. The operator must test the air on every working shift and keep detailed records of the tests. Should the test results indicate the presence of a higher concentration of any of these pollutants than is permissible under the regulation, the machine may not be operated until it has been repaired or until the quantity of air cursed over the machine has been increased to reduce the gas concentration below the TLV. Test results are required to be forwarded to the DMME. Operators must maintain their equipment according to the manufacturer's standards which are designed for efficient and clean operation, and must keep maintenance records.

Virginia regulations also specify the type of diesel fuel to be used underground. While MSHA's regulations specify that the sulfur content of such fuel must not exceed one-half of one percent by weight, Virginia's regulations require that diesel fuel be of a "low sulfur type."

DMME has recently promulgated regulations requiring the training and certification of mechanics who work on diesel mining equipment. Proper maintenance is considered one of the best ways of reducing harmful emissions from diesel engines. The certification program is designed to help ensure that the engines are operated in proper mechanical condition. Virginia is scheduled to begin certifying diesel mechanics in 1989.

D. COMPLIANCE WITH VIRGINIA REGULATIONS

In January of 1987, the Division of Mines of DMME initiated a special testing program to determine if coal operators were complying with air quality regulations. These tests were conducted by the Division in addition to the regular air quality testing required under Virginia's regulations. Exhaust gases on each piece of diesel equipment in use were measured. At that time, fifty-two pieces of diesel equipment were in use in a total of fourteen Virginia coal mines. Various locations in each mine were also tested while the diesel equipment was in operation. Tests were

performed to determine concentrations of CO, CO_2, NO, NO_2, SO_2 and formaldehyde. Only one piece of equipment was found not to be in compliance and it tested negatively for only one of these six constituents of diesel exhaust. In December of 1987 the same tests were conducted on all diesel equipment in use in Virginia coal mines. At that time, ninety-four pieces of diesel equipment were being used in a total of twenty-two different mines. No piece of equipment was found to be out of compliance.

III. RECENT DEVELOPMENTS

A. HEALTH-RELATED RECOMMENDATIONS

A spokesperson for the National Institute for Occupational Safety and Health (NIOSH) informed the subcommittee that her organization had concluded in July of 1988 that whole diesel exhaust should be regarded as a "potential occupational carcinogen" and that exposure limits should be "reduced to the lowest feasible limit." She explained that NIOSH had for many years been concerned with the chronic health effects of diesel exhaust. In 1986, effects such as eye irritation and reversible changes in lung function were recognized by NIOSH as among the health effects of diesel exhaust. Until recently, and only after a review of some thirty epidemiological health studies, was NIOSH able to make such a recommendation. She indicated that NIOSH is still precluded from recommending an acceptable exposure limit for diesel exhaust particulates due to limitations in sampling and analytical techniques for diesel particulates.

In June of 1988 the International Agency for Research on Cancer (IARC) issued its findings regarding diesel exhaust. IARC classified diesel exhaust as a "possible human carcinogen." In addition, MSHA's Diesel Advisory Committee concluded in 1988 that "diesel exhaust represents a probable risk of causing human lung cancer."

B. TECHNOLOGICAL ADVANCEMENTS

1. The Ceramic Diesel Particulate

Although wet scrubbers are able to reduce particulate emissions from diesel engines by up to thirty percent, they were primarily designed to arrest flames. However, a new ceramic diesel particulate filter has been developed which, when used in conjunction with a dry scrubber, has the potential for reducing particulate emissions by up to ninety percent. Problems experienced with the regeneration portion of the filter have delayed approval of the product by the Bureau of Mines, but corrections have been made to the regeneration element and the device is now undergoing testing in coal mines to determine its durability and performance characteristics. It is believed that such a filter will be commercially available within the next two to five years. Cost estimates for such a filter are unavailable at this time due to uncertainties about the filter's operating life.

2. Particulate Measuring Devices

A method of measuring particulate concentrations in mine atmospheres is crucial to the enforcement of any particulate standard which may be established. Such a measuring device has been developed, although it is currently undergoing testing by the Bureau of Mines and NIOSH to determine its performance reliability. The device is predicted to be commercially available in the near future.

C. DIESEL FUEL

MSHA's Diesel Advisory Committee has recently recommended that the standard for sulfur content of diesel fuel used in underground mines be lowered to one quarter of one percent by weight in areas of the nation where such fuel is available. The advisory committee, based on information contained in the Niper Report, believed that it might be difficult for certain geographical areas of the nation to obtain diesel fuel with such a low sulfur content. Consequently, it recommended mandatory testing for sulfur dioxide emissions in those areas of the country where such fuel types were hard to obtain. Diesel fuel with a sulfur content by weight of less than one quarter of one percent is readily available to coal companies operating in the Commonwealth.

IV. TESTIMONY RECEIVED BY THE SUBCOMMITTEE

A. MANAGEMENT'S POSITION

Coal operators in the Commonwealth favor the use of diesel equipment in underground mines for a variety of reasons. They believe that diesel equipment, when compared to all other types of equipment, is preferable from safety and productivity standpoints. As compared to electrical equipment which requires trolley wires, diesel equipment facilitates movement of equipment through the mine and reduces not only the amount of labor required by such movement but also the labor which would be required to lay track and install and maintain trolley wires were electrical equipment utilized. From a safety standpoint, electricity was said to be responsible for more fatal accidents in underground coal mines than any other cause except roof failures. Battery powered machinery is also said to present safety and productivity problems for coal operators because the batteries need to be charged so often. Management indicated that the use of diesel powered machinery enabled Virginia operators to remain competitive with foreign coal producers who often mined at cheap labor rates and without the required safety and environmental protections which increase the cost of mining coal in Virginia.

Although mining companies support the research currently being conducted by NIOSH and other groups aimed at establishing safe particulate exposure levels and standard procedures for sampling and determining the quantity of diesel particulates in mine atmospheres, they believe that when

appropriate emission control practices are followed, the operation of diesel powered equipment in the Commonwealth's underground coal mines does not subject miners to health hazards. Management emphasized that Virginia's regulations governing the use of diesel equipment in underground coal mines were probably the most stringent in the nation, and that operators had maintained a good compliance record with these regulations.

B. MINERS' POSITIONS

Miners testifying before the subcommittee almost unanimously opposed the use of diesel powered equipment in Virginia's underground coal mines unless stricter standards for diesel use are enacted. Only one miner voiced support for the use of diesel equipment under current regulatory requirements. Miners working in coal mines where diesel equipment is operated complained of effects such as sore throats, dizziness, nausea and headaches which they believe are a result of diesel exhaust exposure. They indicated that proper research had not been conducted before authorizing the use of diesel equipment in underground coal mines and that the subcommittee should not await MSHA's new regulations before taking action. Miners believe that exposure to diesel exhaust is slowly killing them.

Representatives of the United Mineworkers of America (UMWA) stated that their organization supports a ban on the use of diesel equipment in underground coal mines in view of the recent health-related recommendations of NIOSH, IARC and the Diesel Advisory Committee. Where the use of diesel engines is still permitted, the UMWA officials recommended that this use be further regulated and that diesel emissions be reduced. The setting of new standards for the gaseous and particulate constituents of diesel exhaust, particularly nitrogen dioxide, was encouraged.

According to one UMWA official, nitrogen dioxide contributes to chronic and acute lung disease. Results of recent studies show that people who already work in environments which cause respiratory problems experience more problems when nitrogen dioxide is injected into that environment. Furthermore, persons subjected to nitrogen dioxide have more difficulty in adjusting from well-lighted areas to darker areas. MSHA and Virginia regulations currently prescribe a maximum exposure concentration level of three parts per million nitrogen dioxide. NIOSH has recently recommended a one part per million standard and the World Health Organization has recommended a one-half part per million standard. The UMWA official, after a review of DMME figures which he stated shows that Virginia coal operators would have no difficulty in meeting a one part per million standard, requested that Virginia's nitrogen dioxide standard be lowered to one part per million.

UMWA officials explained that miners need to be educated and trained regarding the hazards of exposure to diesel exhaust. It was suggested that mine inspectors receive this same training so that they will be able to property evaluate exposure levels. It was also suggested that coal mine operators should be required to use the best available control technologies

to reduce harmful particulate emissions so that when a standard is set, they will be in a better position to comply.

C. POSITIONS OF OTHER ORGANIZATIONS

1. The Mining Manufacturing Industry

Representatives of companies engaged in the manufacturing of emission control products agreed that until a particulate measuring device is commercially available, it will be impossible to enforce a particulate standard. One representative explained that the ceramic particulate filter currently being tested had been originally designed for over-the-road type diesel engines and that the device's components were somewhat less than perfect for the mining industry. As a result, he predicted that the new ceramic filter will not be as effective at the lower exhaust gas temperatures required by the mining industry.

2. The American Lung Association of Virginia

A representative of the American Lung Association of Virginia suggested that the subcommittee consider requiring the installation of any and all devices, once available, which demonstrate the promise of genuine reductions in particulate levels. As the Commonwealth already requires best available control technology for the control of ambient air pollution, the organization encourages the implementation of this requirement in coal mines for diesel particulate purposes. Past history, according to the representative, demonstrates that control technology can be pushed in a positive direction through the implementation of such stringent requirements.

3. The Department of Mines, Minerals and Energy

According to a representative of DMME, the Department recognizes the need for a particulate standard and already has the authority to promulgate regulations adopting such a standard. However, the Department maintains that the following events must occur before such a standard can be adopted:

1. a scientific determination must be made as to an acceptable exposure level;
2. a standard must be adopted by an accepted organization such as the American Conference of Governmental Industrial Hygienists; and
3. a reliable method must be developed for measuring diesel particulate concentration in coal mine atmospheres.

V. FINDINGS

The use of diesel powered equipment in Virginia's underground coal mines has increased dramatically since its use was authorized in 1985. While diesel powered equipment helps to increase the productivity of Virginia's coal mines and reduces electrical accidents, the effects of

diesel exhaust on the health of miners is of considerable concern. The different constituents of diesel exhaust, including carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, sulfur dioxide, formaldehyde and particulate matter, when inhaled by a miner in sufficient quantities, may have serious chronic and acute health effects.

While research efforts continue to uncover evidence as to the potentially carcinogenic effects of exposure to diesel particulates, no acceptable exposure level has yet been determined. Furthermore, until the technology is commercially available by which particulate concentrations can be measured in mine atmospheres, it would be virtually impossible to enforce any standard which might be implemented based upon a yet to be determined safe exposure level. Additionally, no technology is currently available by which diesel particulate emissions can be reduced by more than thirty percent. Testing of particulate measuring devices and a ceramic diesel particulate filter is currently being conducted, and both technologies are predicted to be available within the next two to five years.

Most of the Commonwealth's regulatory requirements relating to the use of diesel engines in underground coal mines are as strict or stricter than federal regulations or those of other states. However, current technology would allow for the use of a lower sulfur content type diesel fuel than is currently required. Diesel fuel with a sulfur content by weight of one-quarter of one percent is currently available in the Commonwealth. The Diesel Advisory Committee and NIOSH recommended that the current standard be lowered to one-quarter of one percent sulfur content by weight. The amount of sulfur dioxide emitted by a diesel engine is primarily related to the sulfur content of the diesel fuel used by the engine. Current emission control technology and maintenance procedures would also allow the current maximum exposure level for nitrogen dioxide to be reduced. Testing results at DMME indicate that most coal operators would already be in compliance were a lower standard to be adopted.

VI. RECOMMENDATIONS

1. That the United States Secretary of Labor be requested to expedite the research, design and testing of particulate measuring devices and diesel engine particulate filters for use in underground coal mines. Until such devices are commercially available, it will be impossible for coal operators to comply with any stringent standard which may be adopted relating to particulate emissions concentrations. It will also be impossible for such a standard to be enforced by any regulatory agency until such measuring devices are available. (See Appendix A to this report for draft legislation implementing this recommendation.)

2. That the Department of Mines, Minerals and Energy be requested to adopt a new standard which requires that all diesel fuel used in underground coal mines contain not more than one quarter of one percent sulfur by weight, unless such fuel is unavailable for purchase. (See Appendix B to this report for draft legislation implementing this recommendation.)

3. That the Department of Mines, Minerals and Energy be requested to adopt a new standard for the safe limit of nitrogen dioxide concentration for atmospheres in coal mines utilizing diesel equipment as soon as a well respected organization, such as the American Conference of Governmental Industrial Hygienists, develops a new standard. (See Appendix C to this report for draft legislation implementing this recommendation.)

Respectfully submitted,

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APPENDICES

D 12/22/88 Heard C 12/29/88 smw

APPENDIX A

HOUSE JOINT RESOLUTION NO.....

Requesting that the United States Secretary of Labor expedite the research, design and testing of particulate measuring devices and diesel engine particulate filters for use in underground coal mines.

WHEREAS, the utilization of diesel engines in underground coal mines of the Commonwealth of Virginia is increasing; and

WHEREAS, whole diesel exhaust contains particulate matter which is entirely respirable in size; and

WHEREAS, some of the organic compounds which attach to these particulates are known to cause cancer; and

WHEREAS, the International Agency on Cancer recently classified diesel exhaust as a possible human carcinogen; and

WHEREAS, the National Institute for Occupational Safety and Health has recently recommended that whole diesel exhaust be regarded as a potential occupational carcinogen and that exposure be reduced to the lowest feasible limit; and

WHEREAS, there is no commercially available technology for easily measuring particulate concentration or for reducing particulate emissions by more than thirty percent, although a ceramic filter is currently being tested which is capable of reducing particulate emissions by up to ninety percent; and

WHEREAS, no standards for acceptable levels of exposure to

particulates in coal mine atmospheres have been established to date; and

WHEREAS, the Diesel Advisory Committee of the Mine Safety and Health Administration has recommended that the Secretary of Labor set in motion a mechanism whereby a diesel particulate standard can be set; and

WHEREAS, the Diesel Advisory Committee also recommended that the Secretary of Labor request that the National Institute for Occupational Safety and Health and the Bureau of Mines give the highest priority to research in the development of sampling methods and devices for diesel particulates so that a standard, once established, is enforceable; and

WHEREAS, the Diesel Advisory Committee recommended further that the Secretary of Labor request research to expand and accelerate development of emission control technology so that compliance with a standard, once established, is possible; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the General Assembly of Virginia requests that the United States Secretary of Labor expedite the research, design and testing of particulate measuring devices and diesel engine particulate filters for use in underground coal mines; and, be it

RESOLVED FURTHER, That the Clerk of the House of Delegates transmit a copy of this resolution to the United States Secretary of Labor.

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D 12/22/88 Heard C 12/30/88 wms

APPENDIX B

HOUSE JOINT RESOLUTION NO.....

Requesting the Department of Mines, Minerals and Energy to adopt new standards for sulfur content of diesel fuel used in underground coal mines.

WHEREAS, diesel exhaust contains numerous gaseous constituents, including sulfur dioxide; and

WHEREAS, large concentrations of sulfur dioxide in mine atmospheres can be harmful to the health of miners working in such environs; and

WHEREAS, the amount of sulfur dioxide emitted by a diesel engine depends primarily upon the sulfur content of the diesel fuel used; and

WHEREAS, the regulations of the Department of Mines, Minerals and Energy require that the fuel used by diesel engines underground be of a low sulfur type, meaning less than or equal to one-half of one percent sulfur content by weight; and

WHEREAS, the Diesel Advisory Committee of the Mine Safety Health Administration has recommended that the standard for sulfur content of diesel fuel used in underground mines be lowered to one quarter of one percent by weight in areas of the nation where such fuel is available; and

WHEREAS, diesel fuel with sulfur content of one quarter of one percent is currently available in the Commonwealth; now, therefore, be

it

RESOLVED by the House of Delegates, the Senate concurring, That the Department of Mines, Minerals and Energy is requested to adopt a new standard which requires that diesel fuel used in underground coal mines contain not more than one quarter of one percent sulfur by weight, unless such fuel is unavailable for purchase; and, be it

RESOLVED FURTHER, That the Clerk of the House of Delegates transmit a copy of this resolution to the Director of the Department of Mines, Minerals and Energy.

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RDF 1/18/89 Heard C 1/19/89 jds

APPENDIX C

HOUSE JOINT RESOLUTION NO.....

Requesting the Department of Mines, Minerals and Energy to adopt a new regulatory standard for permissible concentrations of nitrogen dioxide in coal mines where diesel equipment is operated.

WHEREAS, diesel exhaust contains a number of gaseous constituents, including nitrogen dioxide; and

WHEREAS, the presence of large concentrations of nitrogen dioxide in coal mine atmospheres may be detrimental to the health of miners working in those atmospheres; and

WHEREAS, the Department of Mines, Minerals and Energy, by regulation, currently requires that in coal mines where diesel equipment is operated, the concentration of nitrogen dioxide in such mines' atmospheres must be no greater than three parts per million; and

WHEREAS, technology currently exists by which coal mines utilizing diesel equipment can maintain concentrations of nitrogen dioxide at or below one part per million; and

WHEREAS, although the results of recent testing demonstrate that most atmospheres of coal mines in the Commonwealth which utilize diesel equipment contain concentrations of nitrogen dioxide at or below one part per million, a few results have shown higher concentrations; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That as soon as the American Conference of Governmental Industrial Hygienists or other well respected organization develops standards for acceptable concentrations of nitrogen dioxide in mine atmospheres below three parts per million, the Department of Mines, Minerals and Energy is requested to adopt such a regulatory standard for the Commonwealth; and, be it

RESOLVED FURTHER, That a copy of this resolution be delivered by the Clerk of the House to the Director of the Department of Mines, Minerals and Energy.

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