

# Michigan Technological University



1400 Townsend Drive, Houghton, Michigan 49931-1295

College of Engineering  
Department of Mechanical Engineering and  
Engineering Mechanics 906/487-2551, 2561  
FAX: 906/487-2822

October 6, 1993

OCT 12 1993

Richard W. Niemeier, Director  
Division of Standards Development & Technology Transfer  
National Institute for Occupational Safety & Health  
Robert A. Taft Laboratories  
4676 Columbia Parkway  
Cincinnati, OH 45226-1998

Dear Sir:

Enclosed are the comments by our research team on the draft document entitled: Criteria for a Recommended Standard: *Occupational Exposure to Respirable Coal Mine Dust*. Our research team has been actively involved in numerous studies of diesel emissions in underground mines, both metal-nonmetal and coal, since the mid-1970s.

Sincerely,

A handwritten signature in cursive script that reads "John H. Johnson".

John H. Johnson  
Presidential Professor

JHJ/pm

Enclosure

**MTU Comments on Draft Document Entitled: *Criteria for a Recommended Standard: Occupational Exposure to Respirable Coal Mines Dust.***

Our primary concern with the criteria document is that it does not address properly coal mines using diesel equipment and, therefore, completely overlooks the much-studied problem of distinguishing 'respirable diesel particulate' from 'respirable coal dust'. The use of diesel-powered haulage vehicles in underground coal mines is on the increase because of their greater mobility and flexibility, higher productivity, and improved safety. Past studies in diesel underground coal mines (1,2,3) have provided evidence showing that diesel particulate matter (DPM) is all respirable and is frequently present at concentrations greater than those of the respirable coal dust. Furthermore, the personal gravimetric samplers (with cyclone preseparator) used to determine compliance with the respirable coal dust standard do not distinguish coal from diesel particulate. As a result, even a mine that contains no coal dust may be out of compliance with the respirable coal dust standards if diesel particulate matter is not adequately controlled. Recent research reported by the Bureau of Mines (BOM), the University of Minnesota (UM) and Michigan Technological University (MTU) has documented the concentration and composition of DPM in U.S. underground mines (4,5,6). A number of recent publications deal with an apparatus and methodology under development by Michigan Technological University Researchers for monitoring and controlling the concentrations of diesel particulate in the underground coal mine environment (7,8, 9, 10,11).

Currently, the calculation of the respirable coal dust concentration obtained using the personal gravimetric samplers is multiplied by 1.38 to obtain the MRE equivalent value. The proposed  $0.9 \text{ mg/m}^3$  limit would be equivalent to a limit of  $0.9 \times 1.38 = 1.24$  using the current procedures. This, according to our calculations, represents a 38.0 % decrease in the limit. Eliminating the 1.38 multiplication factor will lower the concentration reported such that a sample which currently is reported as  $2 \text{ mg/m}^3$  would, with the proposed limit, be reported as  $1.45 \text{ mg/m}^3$ , or 61 % over the proposed  $0.9 \text{ mg/m}^3$  standard. The report should clarify the effect anticipated by changing from the 2 L/min sampling flowrate to the proposed 1.7 L/min flowrate.

**Answers to Questions 1 through 8**

1. ***Is the derivation of the Recommended Exposure Limit (REL) supported by the scientific data?*** Insufficient experience to make a sound judgment.
2. ***Are the RELs for respirable coal mine dust and respirable crystalline silica technically feasible?*** We think the REL for respirable coal mine dust is technically feasible in diesel underground mines where we have made our measurements. However, the measurement, as it is currently performed, will include diesel particulate matter and this effect needs to be addressed as mentioned in the introductory paragraphs above.

3. ***Should the proposed international definition of respirable dust be recommended as the criteria for sampling respirable coal mine dust and respirable crystalline silica?***  
I agree with the statement on page 121 that "for occupational exposures (including respirable coal mine dust) in which the penetration curves provide a reasonable approximation and are proportional to deposition curves, there is little justification for using the more complicated deposition samplers for routine sampling". The current personal samplers (CMDPSU) have been developed over many years, and are finally becoming sufficiently lightweight and reliable to provide accurate data relatively trouble-free. In all likelihood, significantly higher flowrates would be needed to collect sufficient material for weighing in each of several size cuts (using an inertial impactor size-selective sampler). This would necessitate using larger pumps resulting in a host of associated problems to make an apparatus that is suitable for mounting on a person. The overall effect could be chaotic. Mines already experience difficulty in maintaining personnel and facilities required to comply with new environmental and health and safety requirements and even the current, very simple, personal gravimetric samplers are not always used properly. It is our opinion that concerns about the validity of the current measurements (as compared to size-selective data) should be addressed by developing correction factors where justified.
4. ***Should improvements in the coal mine dust personal sampling unit (CMDPSU), including all-metal construction to minimize charge effects, be recommended? Should performance criteria be developed for the approval of more than one type of sampling device?*** Improvements in the current samplers should be recommended. While, ideally, performance criteria should be developed for the approval of more than one type of sampling device, the mine market for samplers is relatively small and it may be difficult to attract entrepreneurs into the area of developing other types.
5. ***Is the recommended sampling strategy reasonable on the basis of both statistical validity and practical considerations for controlling respirable dust in the coal mine environment?*** Practical considerations for controlling respirable dust may dictate that some samples be also included of the uncontrolled and controlled coal dust source as well as the engineering parameters affecting the mine ambient air concentrations.
6. Is the inclusion of spirometry tests in the medical surveillance program justifiable for the prevention of chronic obstructive lung diseases in underground and surface coal miners? Unable to comment.
7. Is the transfer of miners with evidence of Coal Workers' Pneumoconiosis (CWP) or Chronic Obstructive Pulmonary Diseases (COPD) to low dust areas of the mine medically justifiable at the recommended concentrations of respirable coal mine dust or respirable crystalline silica? Unable to comment.
8. Are there additional issues that need to be considered in the development of this criteria document? Diesel issue - see above comments.

## REFERENCES

1. Carlson, D.H., Cornilsen, B.C., Shan, X. and Johnson, J.H. 1990, "Measurement and Analysis of Respirable Dust and Gaseous Pollutant Concentrations in Three U.S. Underground Coal Mines, "Poster Session and Chapter 48 of Proceedings, Third Symposium on Respirable Dust in the Mineral Industries, Pittsburgh, PA. Oct. 17-19, 1990, Society of Mining, Metallurgy and Exploration, pp 383-392 Caller No. D, Littleton, Colorado 80127
2. Cornilsen, B.C., Shan,X., Johnson, J.H., and Carlson,D.H., "Raman Spectroscopic Analysis of Diesel/Coal Aerosol Mixtures", Proceedings of 3rd Symposium on Respirable Dust in the Mineral Industries,Pittsburgh, PA., Oct. 17-19, 1990, Society of Mining, Metallurgy and Exploration, Caller No. D, Littleton, Colorado, pp 93-95.
3. Cantrell, B.K., Rubow, K.L., Watts, W.F. Jr., and Carlson, D.H. 1992. "Pollutant Levels in Underground Coal Mines Using Diesel Equipment", Paper presented at 1991 SME Annual Meeting & Exhibit , Feb. 25-28, 1991, Denver, Co., 1991 Annual Transactions Volume, Society of Mining, Metallurgy and Exploration, Caller No. D, Littleton, Colorado 80127.
4. Bagley, S.T., Baumgard, K.J., and Gratz, L.D., 1991, "Comparison of In-Mine and Laboratory-Generated Diesel Particulate Matter, Biological Activity, and Polynuclear Aromatic Hydrocarbon Levels," Proceedings of the 3rd Symposium on Respirable Dust in the Mineral Industries, Society for Mining, Metallurgy, and Exploration, Littleton, Colorado, pp. 61-72.
5. Cantrell, B.K., Rubow, K.L., Watts, W.F., and Carlson, D.H., 1991, "Pollutant levels in Underground Coal Mines Using Diesel Equipment," Preprint 91-35, Society for Mining, Metallurgy, and Exploration Annual Meeting, Denver, Colorado, February, Accepted for Publication in Mining Engineering.
6. Cantrell, B.K., Rubow, K.L., Watts, W.F., Jr., Bagley, S.T., and Carlson, D.H., "Pollutant Levels in Underground Coal Mines Using Diesel Equipment", Proceedings of the 6th US Mine Ventilation Symposium, June 21-23, 1993, Salt Lake City, Utah. Society of Mining, Metallurgy, and Exploration, Inc. P.O. Box 625002, Littleton, CO 80162-5002.
7. Chan,L.M., Carlson, D.H., and Johnson, J.H., "Apparatus and Methodology for Controlling Mine Ambient Air Quality Based on Vehicle Tailpipe and Ambient Air Pollutant Measurements", Proceedings of the 6th US Mine Ventilation Symposium, June 21-23, 1993, Salt Lake City, Utah. Society of Mining, Metallurgy, and Exploration, Inc. P.O. Box 625002, Littleton, CO 80162-5002.

8. Chan, L.M., Carlson, D.H., and Johnson, J.H., "Deterioration Criteria for Servicing Mine Diesel Vehicles Based on Tailpipe Pollutant Concentration Data", Mining Engineering, Vol. 44, No. 12, December 1992, pp 1472 - 1476.
9. Chan, L.M., Carlson, D.H., and Johnson, J.H., "Evaluation and Application of a Portable Tailpipe Emissions Measurement Apparatus for Field Use", SAE Technical Paper Series 921647 printed in Diesel Combustion Emissions and Exhaust Aftertreatment, SAE Special Publication Volume SP 931, 1992.
10. Carlson, D.H. Taubert, T.R., Johnson, J.H., "Apparatus for Measuring Diesel Tailpipe Emissions in Underground Mines, United States Department of Interior, Bureau of Mines RI 9422, 1992.
11. Carlson, D.H., Chan, L.M., and Johnson, J.H., "Laboratory Evaluation of the Mine Diesel Tailpipe Emissions Measurement Apparatus", Poster Session and Chapter 47 of Proceedings, Third Symposium on Respirable Dust in the Mineral Industries, Pittsburgh, PA., Oct. 17-19, 1990, Society of Mining, Metallurgy and Exploration, Caller No. D, Littleton, Colorado 80127.