SECTION 6

RESPIRATOR PROGRAM
Section 6 Action Items

Respirator (Dust) Program

1. Eliminate worker exposure to dust. Your money is better spent on controlling dust exposure than on both controls and the respiratory protection program required after you receive an MSHA citation for overexposure.

2. If you are cited, follow the instructions in this section to complete the written Respiratory Protection Program and adhere to your written program. If you are unable to control dust, allow your people to select respirators that are comfortable and fit-tested. Train them on how to protect themselves and the limitations of the respirators provided.
SECTION 6
Respirator Program

Contents of This Section

➢ Pre-Course Quiz
➢ MSHA Material on Respirators
➢ Procedures for Respirable Crystalline Silica Sampling in Metal-Nonmetal Mines, Developing a Written Respiratory Protection Program and Fit Testing.
   o Appendix 1 -- Paragraph Read To Person Prior to Sampling
   o Appendix 2 – Written Agreement Between MTU & Company
   o Appendix 3 -- Calibration of Dust Samplers
   o Appendix 4 – Generic Report to Company
   o Appendix 5 – Fit-Test Procedures
Respiratory Program Quiz – Underline The Correct Answer

1. Every mine must have a written respiratory protection program. True/False.
2. Respiratory protection standards enforced in metal/nonmetal mines were published in 1973. True/False.
3. MSHA requires miners who work near respirable dust to wear respirators. True/False – MSHA does not regulate dust emissions. MSHA regulates worker exposure to dust emissions and requires that engineering controls be put in place when workers are overexposed. Respirators are required as part of a complete Respiratory Protection Program when a mine has been cited for overexposure. Respirators are considered by MSHA to be a temporary corrective measure only while feasible engineering controls are being developed.
4. A good-quality air-purifying respirator will protect you from dust, harmful gasses, and harmful vapors. True/False – You need respirators that are specially designed for the airborne contaminant your workers are exposed to.
5. An air-purifying respirator will protect you from oxygen deprivation. True/False – An air-purifying respirator only filters out the contaminant for which it is designed. It does not add oxygen to the air. For oxygen deprivation you need an air-supplying respirator.
6. A self-contained breathing apparatus (SCBA) is an air-purifying respirator. True/False – A SCBA is an air-supplying respirator in a small package designed for emergencies, and some underground mines require that one be available for each miner. It provides clean air for a short period of time (usually about an hour) while the miner escapes from a hazardous atmosphere.
7. The amount of harm from mineral dusts depends on the particle size and composition. True/False – Particles that are most harmful are the invisible ones that are less than 10 microns. The amount of harm depends on what they contain. For example, the 8 hour time-weighted average worker exposure to some particles is limited to 5 mg/m³, while for crystalline quartz, for example, the limit is 0.1 mg/m³.
8. An air-line respirator is an atmosphere-supplying respirator. True/False – air is supplied to the person through a specially designed regulator/hose/face mask system.
9. Beach sand is largely crystalline quartz. True/False – Beach sand is composed of crystalline quartz, but the particle size is too large to be of concern. If this sand were to be abraded into fine particles less than 10 microns, it would become the very toxic crystalline quartz that causes silicosis.
10. Almost all mine products contain crystalline silica at concentrations greater than 1%. True/False – Crystalline silica, which is usually in the form of quartz, is found in almost all rock formations at concentrations in excess of 1%. However, it is the concentration of the very finely abraded (less than 10 micron) crystalline silica, which becomes airborne, that is of concern to workers. The standard is based on the concentration in the air the miners breathe and not the concentration in the ore that is mined.
11. Mine products containing quartz at concentrations in excess of 1% crystalline silica are considered to be hazardous chemicals. True/False – When mine products contain more than 1% crystalline silica, they are considered to be hazardous chemicals; the mine must have an MSDS for the product and train workers about its hazards and protective measures.
12. Mine air averaging more than 0.1 mg/m³ of crystalline silica is a violation of MSHA standards. True/False – MSHA doesn’t regulate the concentration in the mine air. MSHA regulates the amount a miner is exposed to and measures this by mounting a sampler on the miner for the entire workshift.
13. Mine products containing quartz at concentrations in excess of 1 mg/m³ require the use of a respirator. True/False – MSHA doesn’t regulate the amount in the mine product, but the amount in the air a miner is exposed to. However, the HazCom rule requires that when the mine product
contains more than 1% crystalline silica, the mine must have an MSDS available, on request, to
miners and customers and train the miners in the hazards and protective measures.

14. A miner who is exposed to mine air containing crystalline quartz at concentrations in excess of 0.1
mg/m³ for 8 hours is in violation of MSHA standards. **True**/False.

15. One major source of exposure to respirable dust is improper housekeeping and a poor choice of
 cleanup procedures. **True**/False – As odd as this sounds, this is probably the major source of
 overexposure in many mines. The miner collects the fine toxic silica dust in his clothing and
 brings it into the lunchroom, office, vehicle cabs, control booths, his car, his home, etc. This dust
collects in seat cushions, on the floors, walls etc. If fresh air is not continually ventilating this
enclosed space, every movement the miner or others make, stirs up the fine crystalline silica dust,
which is so fine that it remains airborne for hours. 1 teaspoon of this fine crystalline silica in the
air inside a large great lakes ore carrier would cause the concentration in the air to exceed the
level a miner can legally be exposed to over an 8-hour workshift.

16. Hosing down the ore pile is a good way to reduce dust. **True**/False – This would wash the fine
 silica dust from the rocks before they are transported to the next step in the process.

17. Properly functioning water sprays at critical locations in conveying, crushing, screening and sizing
operations can significantly reduce respirable dust emissions. **True**/False – The placement of sprays
is critical because each time a particle is crushed or abraded, new faces are exposed, which
release the fine crystalline silica dust. The spray should preferably be directed at the particles
while they are being crushed or abraded in other process steps.

18. Dry dust control systems are ineffective. **True**/False – Enclosed systems which draw the dusty air
away are effective means of dust control.

19. Operator isolation is an effective dust exposure control method, if applied correctly. **True**/False –
Operator isolation is effective if precautions are taken to ensure that dusty clothes are not worn
into the control room or other operator station. Good housekeeping and effective ventilation with
fresh clean air will help ensure that a buildup of fine crystalline silica in the operator’s
workspace does not occur.

20. Operator isolation may contribute to overexposure. **True**/False. If the abovementioned precautions
are not taken, operator isolation may very well become a major contributor to operator
overexposure to crystalline silica.

21. Surface drills located out in the open air are a serious dust concern. **True**/False – Inadequate dust
controls on surface drills is a major source of operator overexposure to crystalline silica. MSHA
is very concerned and issues numerous citations.

22. Road dust is: a) a safety concern, b) a health concern, c) **both a & b.** While it is not the visible dust
that causes silicosis, visible dust is unsafe because it limits operator visibility. Also, visible dust is
an indication that the toxic respirable silica dust is also present in excessive concentrations.

23. MSHA will usually not require you to do a dust survey unless you have been cited for an
overexposure condition. **True**/False.

24. An MSHA citation usually brings with it the requirement that the mine operator begin to monitor
dust and establish a respiratory protection program. **True**/False

25. Monitoring dust can be done by anyone with a little training. **True**/False Dust monitoring requires
training and experience. Equipment is expensive and maintenance is time consuming.
Meaningful results require extreme care in following carefully-designed procedures. MSHA uses
only MSHA’s sampling results to determine whether or not an overexposure condition exists.
Once a mine is cited for overexposure, mine operators may be required to sample to ensure that
controls are working.

26. Crystalline silica is the same thing as crystalline quartz. **True**/False – Crystalline quartz is only one
form of crystalline silica. The three types of crystalline silica of main concern are quartz,
tridymite and cristobalite. While the standard limits the average respirable crystalline silica
concentration to which a worker may be exposed over an 8-hour shift to less than 0.1 mg/m³, concentration limits for cristobalite and tridymite are ½ this level or about 0.05 mg/m³.

27. Silicosis is a condition where crystalline silica causes the lung tissue to react by developing fibrotic nodules and scarring around the trapped silica particles. **True/False – Chronic silicosis limits the ability of the lungs to transfer oxygen into the bloodstream through which it is delivered to other parts of the body. Acute silicosis, resulting from extremely high exposures for short periods of time, causes death by severe lung inflammation.**

28. Silicosis is a disease, the effects of which can be reversed, given time. **True/False -- Silicosis is irreversible.**

29. The correct use of dust respirators requires training. **True/False**

30. A person experiencing any difficulty wearing a dust respirator should receive a medical evaluation to determine if the person is capable of wearing one. **True/False -- A medical evaluation will determine whether or not the person is capable of wearing a respirator. Some people cannot wear a respirator and breathe sufficient air to do work.**

31. A dust respirator is not effective if the worker wearing it has beard stubble. **True/False – Beard stubble breaks the seal between the respirator and the worker’s face, and the dusty air simply bypasses the respirator, offering no protection to the worker.**

32. Qualitative fit testing requires a specialist to perform. **True/False -- A kit with instructions is available for less than 100 dollars.**
RESPIRATORS

Is your respirator really protecting you from the hazards in the working environment? The best way to reasonably assure proper filtration is to make sure the respirator is properly selected, fitted, used and maintained in accordance with ANSI Z-88.2, "Practices for Respiratory Protection", which is incorporated by reference in Section 72.710 of 30 CFR. *(Note -- you should not need to purchase the expensive ANSI standards if you use the information provided in this Section.)*

As an individual, you need to be aware of the potential of being exposed to airborne hazards and their properties. A proper size respirator and appropriate filters then need to be chosen. Respirators are not one-size fits all and one-type of filter protects against all airborne contaminants. In order to assure the respirator fits you properly either a qualitative or quantitative test needs to be conducted with the proper filters for the hazards in your occupation. The qualitative testing method is the most common at most mines, with an acceptable respiratory protection program. The miner is subjected to a test atmosphere that can detect an improper fitting respirator. Also, miners that wear respirators must maintain a face piece to face seal which means keeping the face free of facial hair at all points the respirator contacts the face.

Once the miner is fitted and the filters selected, the miner needs to know and follow the proper maintenance and care necessary to maintain the respirator. The respirator needs to be properly inspected for any defects prior to and after each use. The respirator needs to be properly cleaned and disinfected at regular intervals and stored in the proper environment. Once all of this has been accomplished the miner needs to know when to wear the respirator to reduce any potential exposure to airborne contaminants. Of course, in order for the respirator to be effective, it must be worn properly.
OPERATORS – TAKE NOTE OF THE FOLLOWING! YOU SHOULD CONCLUDE THAT YOUR LEAST COSTLY APPROACH TO DUST WILL BE TO CONTROL IT FROM DAY 1.

56/57.5005 Respiratory Protection – From MSHA’s Program Policy Manual (Volume IV)

Standard 56/57.5001(a) requires that a miner's exposure shall not exceed the permissible limit of any substance on the 1973 ACGIH TLV list. When the TLV is exceeded, standard 56/57.5005 mandates that operators install all feasible engineering controls to reduce a miner's exposure to the TLV. Respiratory protection is required when controls are not feasible, as well as when establishing controls, and during occasional entry into hazardous atmospheres to perform short-term maintenance or investigations. Whenever respirators are required, operators must establish a respirator program containing all elements of the standard, which incorporates ANSI Z88.2-1969. The inspector must evaluate the effectiveness of the respiratory protection in order to determine whether miners are protected from overexposure. If the operator's respiratory protection program fails to include proper selection and fit testing, the .5001(a)/.5005 violation is significant and substantial ("S and S").

Respirator selection directly affects the efficiency of the respirator. Respirators are designed to protect wearers from inhalation of hazardous atmospheres. There are many different types of respirators but each is limited in protection and application. A respirator can only protect against atmospheres for which it is designed. Without proper selection a serious health hazard may occur. A serious hazard may also occur if the respirator, even though properly selected, is not fitted as required by the standard. Fit testing is essential in order to assign the correct model and size respirator to a miner. Otherwise, it is likely that the respirator will leak and the miner will be overexposed to the toxic substance.

There are other factors that should be considered by the inspector on a case-by-case basis when determining whether the violation should be "S and S" with regard to an operator's respiratory protection program. These factors include training, cleaning and sanitizing, and maintenance of respirators.

With regard to listed nuisance particulates and silver metal overexposures between 0.01 mg/m3 and 0.1 mg/m3, operators must use engineering controls to reduce exposure to the permissible limit and comply with the respiratory protection requirements of standard 56/57.5005. However, the .5001(a)/.5005 citation for overexposure to nuisance particulates and to silver metal in the above concentration range is not "S and S." Overexposures to soluble compounds of silver, such as silver nitrate, above 0.01 mg/m3 should be considered "S and S" if adequate protection was not worn.
PROCEDURE INSTRUCTION LETTER NO. 100-IV-4

FROM: EARNEST C. TEASTER, JR.
Administrator
Metal and Nonmetal Mine Safety and Health

SUBJECT: Use of Respirators, Respirator Programs, and Engineering Controls

Scope
This letter applies to Metal and Nonmetal Mine Safety and Health (MNMS&H) enforcement personnel.

Purpose
This procedure instruction letter provides guidance on the issuance of citations for overexposure to airborne contaminants and abatement of the violations involving respiratory protection.

Procedure
When a citation is issued for a violation of 30 CFR 56/57.5001/5005 because the miner's exposure exceeds a permissible level, the initial abatement time should reflect the time needed for the mine operator or independent contractor to furnish the miner with a respirator, institute a comprehensive respiratory protection program in accordance with 56/57.5005(b), and train affected employees in respirator use, wear, and maintenance. The abatement time allowed for implementing the respiratory protection program would generally be of a shorter duration than the abatement time for the engineering controls. If the mine operator already has a comprehensive respiratory protection program in place, the initial abatement time should be based on the time needed to implement the necessary engineering controls. If these actions have not been taken by the initial abatement time, the inspector will determine if an extension of the abatement time is warranted.

The abatement time may be extended for a reasonable time period to allow work to resume with employees utilizing respiratory protection until engineering controls have been installed and tested to ensure they reduce the exposure level of the miner to values at or below the permissible limit. No health citation is to be extended beyond 12 months from the date of issue without approval from the Chief, Division of Health.

If the inspector determines that an extension of the abatement time is not warranted, the inspector must issue a Section 104(b) noncompliance order requiring that the affected miner(s) be removed from the area. Once the mine operator or independent contractor satisfies the conditions for respiratory protection, the order should be modified to allow the miner(s) to resume work in the
area until engineering controls that reduce exposures to permissible levels are established. If
respiratory protection violations are repeated during the abatement period, the order that was
issued should be re-modified back to the original and the miner(s) withdrawn again from the
work area. Any such violations should be completely documented.

Respiratory protection citations should be terminated when:

- a written respiratory protection program in accordance with ANSI Z88.2-1969 is
  established as required by 56/57.5005(b);
- the proper respirator is selected and the miner is fit-tested with the selected respirator,
  (fit-testing is required for both disposable respirators and those using replaceable
  cartridges or filters);
- > the proper cartridge, canister, or filter is used;
- the miner has been trained on how to wear, store, and maintain the respirator; and
- storage and cleaning facilities for the respirator have been provided.

In determining the gravity of a violation, the inspector should evaluate the actions the mine
operator has taken to control employee exposure, including operator or contractor sampling, and
the nature and level of the employee’s exposure to the contaminants. The lack of exposure
control measures and the presence of one or more health-threatening contaminants at levels near
or above the permissible limits indicate a serious risk for miners. In determining the number of
persons affected, the inspector should consider the probable exposure of miners on other shifts
who may be performing the same tasks.

Summaries of the key elements of a respiratory protection program and inspection of half-mask
respirators are attached to assist inspectors when determining whether the respiratory protection
or the respiratory protection program is in compliance with 56/57.5005 and ANSI Z88.2-1969,
and evaluating the gravity of the violation (Attachments 1 and 2).

**Background**
Both respiratory protection and engineering controls are usually cited on the same citation under
standards 30 CFR 56/57.5001/.5005. This is a reissue of the procedures established to help
reduce confusion regarding the issuance, abatement, and modification of these citations and
orders.

**Authority**
Section 103(a) of the Federal Mine Safety and Health Act of 1977; 30 CFR 56/57.5001/5005.

**Filing Instructions**
This Procedure Instruction Letter should be filed in the binder for MSHA Program Handbooks
and Procedure Instruction Letters.

**Issuing Office and Contact Person**
Metal and Nonmetal Mine Safety and Health, Health Division
Christopher Findlay, (703) 235-8307

**Distribution**
Program Policy Manual Holders within MNMS&H

**Attachments**
[Attachment 1](#)
[Attachment 2](#)
ATTACHMENT 1 for PIL00-IV-4
Use of Respirators, Respirator Programs, and Engineering Controls

Evaluation of Half-Mask Respirators

Applies to: non-powered, tight-fitting, negative pressure air-purifying respirators provided by mine operators to miners and respirators supplied by MNMS&H to inspectors.

Does not apply to: full-face, supplied air, or powered air-purifying respirators; self-contained breathing apparatus (SCBA); filter-type self-rescuers, or self-contained self-rescuers.

Face Piece
1. No chemical contamination or excessive dirt
2. No cracks, tears, holes, or distortion
3. No broken or cracked holders for cartridges or canisters
4. No missing seals or gaskets; seals fit properly
5. Rubber or silicone face pieces are soft, flexible, pliable

Head Straps
1. No breaks, tears, or straps missing
2. No loss of strap elasticity
3. No broken or malfunctioning strap buckles
4. Straps are securely attached to face piece

Valves
1. No dust, dirt or debris in or under seals
2. No cracked, torn, perforated, distorted, or missing valves, valve membranes, or valve covers
3. Valves are inserted and sealed properly in face piece

Air Purifying Elements (cartridges, canisters)
1. Cartridge, canister, or filter appropriate for the hazard
2. Connections are tight, seal well, and no cross threading
3. Cartridge or canister not cracked, damaged, or missing
4. Cartridge or canister does not cause excessive resistance to breathing; replaced according to manufacturer’s instructions
5. Cartridge or canister shelf life not exceeded
6. Matching manufacturer cartridge or canister for model respirator

Respirator Use
1. All persons wear respirators in areas designated for respirator usage.
2. Persons in occupations required to wear respirators are wearing respirators while in their work place.
3. Respirators are inspected and fit-checked before use, and worn properly:
a. Good face seal: subject is clean-shaven everywhere respirator touches face  
b. Straps: proper number of straps, worn on head and not over the hard hat, not too tight or too loose  
c. Safety glasses do not interfere with respirator fit or face seal

ATTACHMENT 2 for PILE-IV-4  
Use of Respirators, Respirator Programs, and Engineering Controls  
Respiratory Protection Program

Respiratory protection programs should be administered by an individual having sufficient knowledge of the subject to properly supervise the program. This individual should be identified in the program. Standard operating procedures must be written and cover:

a. respirator selection that is appropriate for hazards; and  
b. respirator use.

Employee training: Training must cover all affected employees and supervisors. Training must include (at a minimum):

a. nature of the hazard and why respiratory protection is needed;  
b. engineering controls; and  
c. respirator selection, use, capabilities, and limitations.

Fit-testing: Must be performed for each employee using a respirator. Should include a written record of the following:

a. name of employee tested;  
b. date of testing;  
c. respirator manufacturer, model, style, and size worn;  
d. fit-test protocol and the name of the person administering the test; and e. fit-test results.

Respirator cleaning and disinfecting: Program must include provision for:

a. cleaning and disinfecting respirators on a regular basis, or after each use if they are used by more than one person; and  
b. for disposable respirators, a provision for employees to obtain a new respirator when theirs becomes unusable, unsanitary, or exhibits excessive breathing resistance.

Respirator storage: Program must include provision for convenient, clean, and sanitary storage.

Respirator inspection: Program must make provision for respirator inspection before and after each use and during cleaning:

a. Visual inspection OK; no written record required;  
b. Deficiencies identified must be corrected.

Surveillance: Work area must be periodically checked to ensure respirator use and to
monitor conditions, employee exposure, and employee stress due to breathing resistance or heat.

**Program evaluation:** The respiratory protection program must be evaluated regularly to ensure continued effectiveness.
PROCEDURE INSTRUCTION LETTER NO. 199-V-1

FROM: ROBERT A. ELAM
Administrator
for Coal Mine Safety and Health

SUBJECT: Evaluation of an Acceptable Respiratory Protection Program

Scope
This letter applies to all Coal Mine Safety and Health (CMS&H) enforcement personnel.

Purpose
The purpose of this letter is to inform CMS&H employees of the basic elements of an acceptable respiratory protection program as set forth in American National Standards Institute (ANSI) Z-88.2 which is incorporated into 30 CFR 72.710. This letter does not replace the requirements of Z-88.2 but merely highlights those elements that form the core of an acceptable respiratory program that provides positive and reliable protection. This letter can assist in a determination to extend an abatement time or to classify a violation as non-S&S.

Procedure Instruction
Section 72.710 of 30 CFR provides that approved respirators shall be selected, fitted, used and maintained in accordance with the provisions of ANSI Z-88.2, "Practices for Respiratory Protection." Paragraph 1.3 of Z-88.2 provides that the provisions of Z-88.2 are mandatory in nature where the word "shall" is used and advisory where the word "should" is used.

This letter is provided to guide the inspector through the review of an operator's respirator program to assess whether miners are provided protection against the full extent of exposure to airborne hazards. While all of the listed elements are necessary to have an acceptable program, each incidence must be reviewed in relation to the specific citation or exposure situation to determine that miners were protected from contaminate levels exceeding the appropriate standard. The use of personal respiratory protection will not prevent the issuance of citations for exceeding the applicable respirable dust standard. 30 CFR Parts 70, 71, and 90 require that respirable dust levels be controlled at or below the applicable standard in the mine atmosphere.

The items listed below comprise the minimum requirements necessary to determine that a personal respiratory program is acceptable:
A. Written procedures detailing the selection and use of available respirators which include an evaluation of:
   1. the nature of the hazard;
   2. the limitations of the respiratory protection device;
   3. the job duties potentially requiring the use of respirators;
   4. where the personal protection is needed; and
   5. who is responsible for each respirator program area (training, fit-test, maintenance, selection, etc.).

B. Provisions for training of all persons associated with the use and/or selection of personal respiratory protection which include:
   1. explanation of the type of hazard, i.e., is the hazard quick acting or does it require a long duration exposure;
   2. the limitation of each available personal respiratory protective device;
   3. explanation of when the respirator is to be used;
   4. hands-on experience of putting the respirator on, exercising while wearing the respirator, and testing for proper facepiece-to-face seal; and
   5. the cleaning, disinfecting, and maintenance procedures used and how to determine that the respirator being provided is clean and functioning properly.

C. Provisions for a facepiece fit-test for each miner prior to being expected to utilize each such respirator. The test should be conducted on each miner required to wear a personal respiratory protective device at least every 12 months. The test shall be conducted by subjecting each miner, while wearing the appropriate respirator, to a test atmosphere as specified by a scientifically acceptable test method. Note however, that a fit-test is not necessary for the use of some respirators such as an Airstream helmet. Examples of two widely accepted test methods are:
   1. Qualitative Fit Test - the fit is acceptable if the miner, while wearing a respirator fitted with high efficiency particulate filters, is subjected to a test atmosphere of irritant smoke from a stannic chloride smoke tube and does not cough.
   2. Quantitative Fit Test - the fit is acceptable if the miner, while wearing a fitted respirator which has been outfitted with a sample port, is subjected to a test
atmosphere (usually mineral oil mist) and the concentration of test atmosphere inside the respirator is negligible. The miner must perform exercises while wearing the respirator in the test atmosphere to determine if the respirator is properly fitted. Exercises should simulate at least the work of lifting, bending over, talking, movement of the head in all directions and exhibiting various facial expressions.

D. Provisions require miners who wear a respirator to maintain the facepiece-to-face seal at all times by maintaining the facial surfaces free of hair or other interferences at the face to respirator contact points and in areas that may cause interference with the respirator valves or flow characteristics.

E. A program for the maintenance and care of all respirators which includes:

1. provisions for the inspection of each respirator for defects conducted prior to and after each use;

2. provisions for cleaning and disinfecting each respirator after each use and at periodic intervals if not used for an extended period of time (30 days);

3. provisions for storage of respirators in a convenient, clean and sanitary location; and

4. provisions for a person to perform the maintenance and cleaning of respirators who is trained for such duty and is knowledgeable in the respirator manufacturer recommendations for the use, care and maintenance of each model of respirator provided by the mine operator.

F. Records of actions taken in relation to the respirator program including at least:

1. records of fit-test which identify:

   a. the exact model and size respirator;

   b. date of testing;

   c. the fit-test method; and

   d. whether the miner passed or failed the test.

2. records of training provided which include at least:

   a. identification of miners;
b. date of training; and

c. topics covered.

G. A statement of use which includes:

1. a requirement that an assigned respirator will be worn by miners at all times while in the normal work area such as the face area of an MMU; and

2. a requirement that management personnel will make frequent checks of the work area to ensure that miners, mandated by the mine operator to wear respirators are wearing such respirators.

Background
Provisions of 30 CFR require that respiratory protection be made available to affected miners when an area has been determined to be in noncompliance with the applicable respirable dust standard. Such protection, when utilized properly, may justify extensions of time to abate the excessive respirable dust conditions. Respiratory protection properly provided and utilized may also result in a condition being considered as non-S&S. These requirements detail what MSHA inspectors need to review to assess the adequacy of the operator’s program to provide an appropriate degree of protection for the miners exposed. 30 CFR Section 72.710 requires that respirators be selected, fitted, used and maintained in accordance with the provisions of ANSI Z88.2.

Authority

Filing Instructions
This Procedure Instruction Letter should be filed behind the tab marked "Procedure Instruction Letters" in the binder titled MSHA Program Policy Handbooks and Procedure Instruction Letters.

Issuing Office and Contact Person
Coal Mine Safety and Health, Division of Health
Robert A. Thaxton, (703) 235-1358

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PROCEDURES FOR

Respirable Crystalline Silica Sampling In Metal-Nonmetal Mines, Developing A Written Respiratory Protection Program And Fit Testing

for use by

Michigan Mine Safety & Health Training Program

Michigan Technological University

by

Dave Carlson and Phil Eggerding

June 15, 2002
DUST SAMPLING PROCEDURES

for use by

Michigan Mine Safety & Health Training Program Personnel

NOTE – Immediately upon arriving at a mine site, the technician must receive site-specific hazard-awareness training from the Company contact person.

BACKGROUND

This writeup presents procedures and guidelines for conducting dust surveys, evaluating results, reporting to the Company, developing written respiratory protection programs (RPP), and determining who should be placed in a RPP.

Consultation with Company Contact Person

At least one week prior to sampling, the Company contact person should be consulted by phone to discuss the following:

- Company must provide our technician with site-specific hazard-awareness training,
- Company must inform the persons sampled of scope of work – (read paragraph – Appendix 1),
- What we will provide up front:
  - Assessment of whether or not the measurements are needed
  - Assessment of measurement frequency
  - Assessment of the number of persons who need to be monitored – based on occupations cited
  - Estimate of scope of work, time and associated costs (as in Appendix 2)
  - Written agreement
  - Copy of paragraph explaining scope of work to persons to be sampled.

PROCEDURES FOR DUST MEASUREMENTS

Dust Survey Equipment

All dust surveys will be conducted using personal samplers. The technician will need to wear appropriate PPE. At a minimum, this should include:

- Hard Hat
- Safety Glasses
- Ear Muffs or Plugs
- Appropriate shoes which cover and protect feet – Discuss Company requirements
Snug fitting shirt & trousers (no shorts), etc
No jewelry where there is danger of catching on things

The technician’s equipment should include the following:

- Personal Dust Samplers, chargers, cyclones and cyclone assemblies 6
- Personal Dust Sampler Manual 1
- Pre-weighed filter cassettes (includes 1 spare and 1 control) 7 per day
- Calibrated hand-held rotameter (0-5 LPM) – adapted to cyclone 1
- Copies of procedures and data forms As Needed
- Pencils & clipboards As Needed
- Tools (mainly flowrate adjusting screw driver) As Needed
- Seal-able plastic bags for storing new and used filter cassettes 1

Procedures for laboratory calibration of the hand-held rotameter and personal dust samplers are presented in Appendix 3. Personal sampler rotameters with the complete head assembly and filter attached should be calibrated in the laboratory once/year. The personal sampler rotameter should be marked to indicate the bottom-ball position when the flowrate is at 1.7 liters per minute. The hand-held rotameter, which is used for field calibration, will also be calibrated with the Gilibrator or other primary flowrate standard at least once/year.

When the personal sampler is first placed on the person, the flowrate should be adjusted so that the bottom of the ball is at the marked position. **Note that as the day progresses, the ball position may indicate an increasing flowrate if filter backpressure increases as particulate collects, while the actual flowrate may remain at the initial 1.7 liter per minute setting.** For this reason, it is not recommended that, under normal conditions, the flowrate be lowered to return the ball to the 1.7 liter/minute position. Radical changes in ball position, or any indication of decreasing flowrate should, however, be checked by removing the cyclone grit pot and measuring the flowrate with the calibrated external rotameter (see procedure in Appendix 3).

Personal dust samplers should be checked out and maintained at least annually. **For this reason all samplers on loan must be sent back to the Program office by September 15, so this annual maintenance can be performed.**

Protocol for Dust Measurements

The technician will sample up to 5 persons per day. The samplers will be worn by the persons sampled for the entire “normal” workshift.

Pre-sampling Procedures

1) Always start the day with a freshly-charged sampler
2) Examine all components of the cyclones, and especially the grit pot, to assure that they are clean and free of dust and dirt
3) Examine the inner surface of the cyclone to assure that it is free of scoring
4) Examine the external tubing to assure that it is clean and free of leaks; and
5) Examine the clamping and positioning of the cyclone body, vortex finder and cassette
to assure that they are rigid, in alignment, and firmly in contact.

When the person is ready to accept the sampler, the following steps are taken:

1) The head assembly containing the cyclone, cyclone holder, filter cassette and
   connecting tubing is mounted on the sampler
2) Complete the form in Appendix 4, Table 1 including:
   a. Date
   b. Company
   c. Mine or Plant
   d. Technician
   e. Control Cassette no.

3) For each person sampled complete the following:
   a. Person sampled and Social Security No.
   b. Job description
   c. Sampler no.
   d. Filter no.
   e. Flowrate
   f. Start Time
   g. Stop Time
   h. Flowrate checks
      i. Time
      ii. Flowrate

4) The “control cassette” mentioned in item 3 is a filter cassette from the same batch as
   the others. This cassette should be labeled “control” along with the sampling date.
The control cassette will not be opened or used, but will be returned to the laboratory
for analysis. Any change in the weight of this cassette will be used to correct the
weight increases for the other cassettes from the same batch used to sample dust on
the particular date.
Placing the Sampler on the Person

1) The sampler is turned on, the rotameter set to 1.7 liters per minute, and the start time recorded

2) When attaching the sampling head assembly to the person’s clothing, the inlet of the cyclone should face away from the person’s body

3) The person should be instructed not to cover the inlet with a coat or other garment, and never to allow the cyclone to be inverted (this will invalidate the sample by contaminating it with course particulate from the grit pot)

4) The person should be told to work as normally as possible, and to let the technician know about any changes from normal; also if the sampling equipment is causing any difficulties

5) The person should be told to let the technician know of any unusual interruptions in production affecting his/her duties, and when and how long the person leaves the work area

6) The technician must ensure that the instrument is not presenting a safety hazard. The unit should be placed on the person sampled such that the sampling tubing will not catch on equipment or other objects

7) The technician must inform the person that the sampler should remain on him/her at all locations throughout the day and about when and where the sampler will be removed

8) The technician should check and record the sampler flowrate as frequently as possible throughout the shift.

Sampling Time

The person must wear the sampler for the entire “normal” work shift so the dust collected is representative of that for a typical workday.

Monitoring the Sampling Process

The technician must observe the person being sampled on a frequent basis and take notes. At least 4 times during the shift, the technician should check and record in Appendix 4, Table 1 the flowrate for each of the samplers in use. The technician should take notes on:
1) Activities of the person sampled
2) Mining activity levels (normal mining period, high production period, etc.)
3) Whether or not working conditions and activities are typical (based on discussion with company persons)
4) Potential dust source(s) in the areas the person worked
5) Dust controls
6) Wind directions – where the dust the person is exposed to is coming from.

Post Inspection Procedures

NOTE! never invert the cyclone before the filter cassette is removed and sealed!

At the end of the sampling day do the following:

1. Check the final flowrate on the rotameter. If the flowrate has changed considerably from the 1.7 liter/minute setting, also check the flowrate using an external rotameter attached to the cyclone grit pot. If this is also off by more than about 0.1 liter/minute, this must be recorded and discussed with Dave Carlson and with the Company contact person

2. Remove the filter cassette, seal the ends and place it in a seal-able plastic bag

3. Clean up the instruments and place them on the charger

4. Wash the cyclones with soap and water using care not to scratch internal surfaces (no brushes), stand them on end and allow them to air dry

5. Follow instructions provided by the analytical laboratory in sending the cassettes in for final weighing and calculation, completing any forms the laboratory requires.

Final Report

A final report is presented as in Appendix 4. Once the data and calculations are received from the laboratory, complete Appendix 4, Table 2 and the entire report. Send one copy to the Company, one to the technician, one to the Program Manager and one to the Program Clerk.
APPENDIX 1

Paragraph -- Read to Persons Sampled Prior to Sampling

A technician from Michigan Technological University will be on our site on (day and date) to conduct respirable crystalline quartz exposure measurements. The measurements, required by law, are being paid for by this company and are for our company’s use to determine whether improvements in dust control are needed to protect your health. The technician will be placing battery-powered dust samplers on up to 5 people. To get results that are meaningful, you should not deviate from your normal work routine, except to answer questions the technician may ask. The samplers should remain on the same person at all times throughout the entire work shift, including breaks, lunch etc. The technician will remain in the work area throughout the shift to collect information about your activities to be used later to explain the readings. If possible, let the technician know when you are leaving your normal work area, where you will be, what you will be doing, and when you will return. Also let the technician know if there are any unusual conditions in your work routine on the day of sampling or other abnormal conditions affecting the amount of dust in the air you are breathing. Please do not tamper with the sampler and never turn either the pump or the sampling head upside down; this will invalidate the sample and result in the company having to pay for another day of sampling. If you notice any problems, please inform the technician immediately. After laboratory analysis of the samples is complete, you will be informed of the results and how they affect you.
APPENDIX 2

Dust Sampling Agreement Between Michigan Technological University (MTU) and ___________________________(the Company)

MTU will conduct sampling at _____________________________ to determine if persons specified by the Company are overexposed to dust based on MSHA limits.

The Company will either provide site-specific hazard awareness training for the technician prior to sampling or will accompany the technician throughout the day(s) while sampling is taking place.

The MTU technician will:

1. Place dust samplers on up to five persons and these persons will wear the samplers for the entire normal workshift.

2. Attempt to obtain other information, as time allows, to assist the Company in determining the source(s) of high dust readings including:
   a. Evidence of visible dust from various sources.
   b. Wind directions from source to worker.
   c. Evidence of worker habits that may contribute to overexposure.
   d. Activities and locations of the persons wearing dust samplers at intervals throughout the day.

MTU will send the samples to a commercial laboratory for analysis and will interpret the results. MTU will prepare and submit a written report to the Company containing the data collected.

Costs -- The Company agrees to pay for this service at the rates below including, but not limited to:

1. Technician time charged at the rate of $45 per hour for sampling, reporting and assisting the Company and $35 per hour for travel. It is roughly estimated that the technician will work about 9 hours for each 8-hour day of sampling and about 8 hours for preparing the report and discussing the results with the Company contact person. Hours charged for travel will be determined by the distance from the technician’s home to the sampling site. However, MTU cannot be held to these estimated times if specific conditions at the Company demand more time.

2. Travel costs charged at a rate $0.365 per mile from and to the technician’s home, meals while away from home (using Government-Approved Domestic per Diem rates http://www.policyworks.gov/org/main/mt/homepage /mtt/perdiem/ perd02d.xls), and any tolls, parking and motel charges.

3. Supplies/services including, but not limited to laboratory charges for pre- and final weighing of sampling filters (commercial labs usually charge about $75 per filter to provide the filter and do
both the pre- and post-sampling weighings).

Disclaimers – Because, overall, the costs to Michigan Tech (which include the cost of purchasing the equipment and labor, materials and service fees to maintain and calibrate the equipment) are expected to exceed the costs charged to the Company, any failed measurements, which may need repeating, will be at the Company’s expense. MTU is unable to control the fact that operating conditions and the activities of the Company’s employees may vary considerably from day to day, and, therefore, MTU is unable to guarantee that the results will be the same or near those obtained by others.

I agree to the above conditions:

_________________________ ___________
Company Person’s Signature  Date

_________________________ ___________
MTU Person’s Signature  Date
APPENDIX 3

Calibration of Dust Samplers
LABORATORY AND FIELD CALIBRATION OF PERSONAL SAMPLER

Background

A soap film calibrator equivalent to the Gilibrator, which is simply an automated version of the old inverted burette, may be used as a primary standard for flowrate measurement in laboratory calibration of flow measurement equipment for field use. The principle of the soap film calibrator is quite simple. The personal sampler (with head assembly attached) is connected to the top of a vertical cylinder of accurately-known dimensions. When using an inverted burette, the sampler is attached to the tip (See schematic Figure 1).

The cylinder is open to the air on the bottom end. A soap film is started on the bottom of the cylinder (such as by placing a small dish of soap solution against the bottom) and this soap film rises to the top as the air moves through the cylinder. Times are recorded when the film passes marks at known volume positions; for example, when using a 500 ml burette, the times when the film passes the 500 ml and 0 ml marks would be recorded. The flowrate is then calculated from the known volume between marks (500 ml) and the elapsed time between marks. For the 500 ml (0.5 L) burette, the calculation would be:
Flowrate, L/min = \frac{0.5 \times 60}{\text{Elapsed time, sec}}

A flowrate of 1.7 L/min is required when sampling respirable dust in metal-nonmetal mines (note that coal mine samplers use a flowrate setting of 2.0 L/min and there are other minor, but significant, differences in the procedure). For calibration, it is necessary to use a burette that has a volume of at least 500 ml between timing marks, where the time for the bubble to travel between marks is long enough to reduce the relative errors in starting and stopping the timer to acceptable levels. The Gilibrator automatically times the travel of the soap film between two points along the cylinder and reads the flowrate out on a digital flowmeter. Automatic timing, as done with the Gilibrator and similar devices, allows smaller cylinders to be used such as those provided by the manufacturers of the automated units.

Calibration of each personal sampler must be done with the head assembly (containing the type of filter to be used) attached. The sampler is connected through the sampling head assembly to the top of the flow-measurement cylinder (see Figures 1 and 2). The sampling head assembly causes a slight pressure drop in the system. This pressure drop is detected by the sampler pump, and the pump speed automatically increases to maintain a constant flowrate. Experience has shown that the pump rotameter bottom-ball position may indicate a flowrate that is higher than 1.7 L/min, while, in fact, the flowrate may not have changed at all.

Accurate measurement of the flowrate of air through the sampler is only possible when the measurement is made at the cyclone inlet where the pressure drop due to flow resistance in the head assembly has no effect. (Note that the measurement could also be made at the pump outlet if a fitting was available). It is standard calibration practice to connect the flowmeter to the apex of the cyclone, which becomes the inlet for air to the system when the normal cyclone inlet is blocked (taped over) and the grit pot on the apex is removed. Attachment of the tubing from the flow measurement device to the apex of the cyclone is necessary because there is no easy way to attach tubing from the flow measurement device to the inlet.

Rotameters on all samplers and all rotameters used for field calibration should be calibrated using the Gilibrator or other soap film device to mark the bottom-ball position when the actual flowrate is 1.7 L/min. Such checks should be made at least annually and more frequently (about once every 200 hours of use) if the samplers are used often.

Laboratory Calibration – Step by Step Procedures Using the Gilibrator

Calibrating a Personal Sampler Using the Gilibrator

Follow the instrument’s operating instructions for adding the bubble solution, connecting the tubing and measuring the flowrate. The flowrate is read out electronically.

Figure 2 is a schematic illustrating the setup for laboratory calibration of the sampler rotameters using the Gilibrator.
The steps are as follows:

1) Select the appropriate cylinder based on the manufacturer’s instructions
2) Add film solution to the Gilibrator as follows:
   a) Open the small bottle of film solution
   b) Gently press the bottle outlet tip against the side arm and squeeze to add solution. Press the bottom bulb occasionally to release trapped air
   c) Add solution until the bottom rubber bulb is filled and the solution is just below the arm inlet
3) Wetting the Walls -- The walls of the glass flowmeter must be wet for the film to travel through the cylinder without rupturing. This can be done by turning the entire flowmeter on its side to allow the film solution to run out of the bulb and into the enlarged section. Rotate the flowmeter so that the solution coats the entire inner surface.

![Figure 2. Setup for Calibration Using a Gilibrator Soap Film Calibrator](image)

4) Connect the cylinder to the base
5) Open the bottom tubing fitting on the cylinder (air inlet)
6) Connect tubing from the sampling head assembly to the top fitting on the cylinder (air outlet)
7) Turn the Gilibrator on
8) Connect the pump to the sampling head assembly
9) Push the soap film starter into the soap solution
10) Record the reading
11) When calibration of all samplers is complete, remove the remaining soap solution, rinse the cylinder out with water and allow it to dry.
Laboratory Calibration of the Hand-Held Field-Calibration Rotameter Using the Gilibrator

The rotameter to be used for field calibration of the samplers, should be calibrated in the laboratory to correctly measure the 1.7 L/min flowrate. Leave the system as when calibrating the personal sampler. Set the personal sampler flowrate to 1.70 L/min as determined with the Gilibrator connected as in Figure 2. Disconnect the Gilibrator from the apex of the cyclone and connect the hand-held rotameter (Figure 3). Mark the bottom ball position on the hand-held rotameter at this 1.7 L/min flowrate. This is the position the ball should be at when using the hand-held rotameter to calibrate personal samplers in metal and non-metal mines.

Figure 3. Setup for Field Calibration Using A Calibrated Rotameter.

Field Calibration of Personal Sampler Rotameters

Field calibration may not always be necessary if experience shows that the sampler rotameters retain their calibration over time. Before field calibration, the sampler should be cleaned to remove dust inside and out and examined for physical damage and missing parts (switch covers, screws, etc.). If the rotameter walls appear dirty inside or out, they should be thoroughly cleaned. Low flowrate normally results from a decrease in the efficiency of the pump caused by poor valve operation or air leaks. If the pump cannot be adjusted to a flowrate greater than 2.0 liters per
minute, it is faulty and the cause should either be found and corrected, or the pump replaced with a properly-working one.

The setup for field calibration is that shown in Figure 3 using the laboratory-calibrated rotameter along with the sampler and head assembly (including the filter) to be used for sampling. Perform this procedure in a clean room at the sampling site, if possible, so the filter doesn’t collect significant amounts of particulate during calibration. The procedure follows:

1. The cyclone inlet is taped over, the grit pot removed, and the rotameter attached

2. Adjust the flowrate so that the calibrated rotameter reads 1.7 L/min. The sampler rotameter ball should be very close to the position marked during the laboratory calibration. Note any differences and, if differences persist, it may be necessary to remark the sampler ball position

3. Replace the grit pot and remove the tape covering the inlet. The sampler is now ready for field use.

While sampling, as the day progresses, the filter picks up particulate and the resistance to flow of the sampled air through the filter increases. If this increase is significant, the sampler rotameter may indicate that the flowrate has increased, although this may not be the case. Therefore, if either a dramatic increase or a decrease in flowrate is indicated by the sampler rotameter, perform the field calibration again and readjust the flowrate to 1.7 L/min. Record this in your notes and keep a close eye on the sampler -- it may be necessary to replace the pump with a freshly charged one.
Appendix 4

Generic Report To Company

Developed by

Michigan Technological University
Results from

Dust Measurement Survey

at

________________________

Company

Conducted by:

________________________

Technician Name

Michigan Technological University

Houghton, MI 49931

________________________

Date

Questions Should be Directed Either to Technician or To:

David H. Carlson
Manager, Mine Safety & Health Training Program
Geological and Mining Engineering and Sciences Dept.
Michigan Technological University
Houghton, MI 49931
Phone – 906/487-2453
e-mail – dcarlson@mtu.edu

________________________

Technician’s Signature Date
INTRODUCTION

On date(s), dust sampling was performed at Company name. The employees and occupations sampled were selected in conversations between Michigan Tech and company personnel. Dust samplers were placed on number Company employees to obtain full workshift dust exposure measurements.

While the readings accurately represent operating conditions and worker activities at the time the measurements were made, translating the results into employee exposure over time is only accurate to the extent that worker activities and operating conditions during sampling were typical of normal conditions at the Company. Conversations with Company employees indicate that the person activities and conditions during sampling:

- [ ] were not typical for the persons sampled
- [ ] were typical for the persons sampled
- [ ] were not typical for the following persons and/or measurements.

<table>
<thead>
<tr>
<th>Person Sampled</th>
<th>Location of abnormal activity</th>
<th>Time of Day</th>
<th>Differences from Normal Working Conditions</th>
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RESULTS

The data collected during sampling are presented in Table 1. These data and the laboratory results for each of the employees sampled are summarized in Table 2.

PEL Overexposures

The MSHA standard of primary concern in Company name is the 0.1 mg/m³ time-weighted-average concentration limit for respirable crystalline quartz (RCQ) in the air a person is exposed to. If MSHA cites the Company for overexposure to the 0.1 mg/m³ RCQ PEL, the company must install all feasible engineering controls to reduce a person’s exposure to the PEL. Respiratory protection is required when controls are not feasible, as well as when establishing controls, and during occasional entry into hazardous atmospheres to perform short-term maintenance or investigations. Whenever respirators are required the Company must establish a written respiratory protection program. The MSHA standard which applies (56/57.5005) incorporates ANSI Z88.2-1969.

Table 2 indicates that number persons are overexposed, need respiratory protection, and that the Company may need to work with MSHA on additional feasible controls. To use respiratory protection, the Company needs to have a written respiratory protection program in place. A respiratory protection program has a number of elements listed in Attachment 1 which is a generic written respiratory protection program.

The company can make arrangements for assistance in preparing the written program, fit testing and training by contacting Dave Carlson (906/487-2453). Annual Respirator training can be included in Michigan Tech’s Part 46 and Part 48 annual refresher mine safety training. To schedule fit testing and/or annual refresher training, contact Dave Carlson also.

CONCLUSION

Questions on this report should be directed to Dave Carlson (906/487-2453). Questions on dust control should be directed to MSHA’s Industrial Hygienists for this district – Bill Pomroy or George Schorr in the Duluth, Minnesota District office (phone -- 218/720-5448).
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<th>Cassette #</th>
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<th>Company</th>
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<td>Pump flow set, L/min</td>
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<td>Filter</td>
<td>Flowrate Checks</td>
<td>Technician</td>
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<thead>
<tr>
<th>Person sampled</th>
<th>Job</th>
<th>ple</th>
<th>sette</th>
<th>Time</th>
<th>Cyclone</th>
<th>Comments - What person has been doing, where working, conditions, controls etc.</th>
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<tbody>
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<td>SS #</td>
<td>description</td>
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* RCQ = Respirable Crystalline Quartz
** Note that others with similar duties may also need to be enrolled.
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<th>Date Sampled</th>
<th>Company</th>
<th>Mine or Plant</th>
<th>Technician</th>
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<th>Controls**</th>
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<th>Filter</th>
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<th>Stop</th>
<th>mg/m³</th>
<th>Meas.</th>
<th>PEL</th>
<th>Needed?</th>
<th>where working, conditions, controls, etc.</th>
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<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
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<td>Meas.</td>
<td>PEL</td>
<td>Needed?</td>
<td>where working, conditions, controls, etc.</td>
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* RCQ = Respirable Crystalline Quartz
** Note that others with similar duties may also need to be enrolled..
Appendix 4. Attachment 1

Generic Written Respiratory Protection Program
Respiratory Protection Program

Mine Name: _______________________________ Mine I.D.# __________

1. Written Procedures

a. Hazard Identification & Respirator Selection – Air purifying respirators are designed to protect persons from breathing specific airborne contaminants and often provide little or no protection against other contaminants. Table RPP1 lists for each hazard, the respirators this company will use, their limitations, and job duties/areas of use.

b. Program Administrator -- Respiratory protection programs will be administered by ____________________________, who has sufficient knowledge of the subject to properly supervise the program.

2. Employee training

Training time, min ____ to ____
Teaching Method________________________________________________________
Training Materials _______________________________________________________
Evaluation Method _________________________________________________________
Training will be done by _________________________________________________
Training will cover all affected employees and supervisors. Training will be conducted before the worker begins work in the area where the respirator is needed. Training will include:

1. Engineering and administrative controls, order of priority of controls, proper use and maintenance of these controls
2. Reason respirators are required -- explanation of the hazard and its effects (i.e. acute or chronic)
3. Selection of a respirator -- fit, comfort, one you can breath through.
4. Health conditions that interfere with respirator use
5. How long can you wear a respiratory device, how to detect breakthrough, excessive resistance to flow etc.
6. Types of respirators and limitations of each including N,R, and P and 95, 99 and 100.
7. Respirators used at particular site and proper procedures for mounting, care and maintenance of each
8. Proper fit
   a. No facial hair
   b. Medical conditions affecting skin texture
   c. Self-fit test
   d. Professional fit tests
9. Inspection, cleaning/disinfecting and storage – including reusables and throw-aways.
<table>
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<th>Hazard</th>
<th>Respirator Manufacturer</th>
<th>Model No.</th>
<th>Respirator Limitations</th>
<th>Job Duties/Location Where Protection Will Be Used</th>
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3. **Fit-testing**

1. All persons required to use a respirator will be fit tested first

2. Annual fit testing to be conducted on (date)___________________ by (person/organization conducting test)____________________________________________________________

3. The test will be conducted by subjecting each person, while wearing the appropriate respirator, to the following fit test procedure:

   ___ Qualitative Fit Test by one of the following methods:

   a. Stannic Chloride Smoke____
   b. Bitrex ____
   c. Saccharin____

   ___ Quantitative Fit Test - the fit is acceptable if the person, while wearing a fitted respirator which has been outfitted with a sample port, is subjected to a test atmosphere (usually mineral oil mist) and the concentration of test atmosphere inside the respirator is negligible.

4. The person will perform exercises while wearing the respirator in the test atmosphere to determine if the respirator fits. Exercises will simulate at least the work of lifting, bending over, talking, movement of the head in all directions and exhibiting various facial expressions.

5. A written record form of the following will be maintained for these employees. (See copy of record form at end of this RPP):

   a. Name of employee tested;
   b. Date of testing;
   c. Respirator manufacturer, model, style, and size worn;
   d. Fit-test protocol and the name of the person administering the test;
   e. Fit-test results.

6. If during respiratory fit testing, the employee experiences difficulty breathing through the respirator(s), the employee will be evaluated by a physician to determine his/her medical suitability for wearing a respirator.
4. **Respirator cleaning and disinfecting**

Users will be trained:

1. To inspect respirators prior to each use to determine that they are functioning properly

2. To clean and disinfect or replace the respirator on a regular basis according to manufacturer's recommendations, or after each use if they are used by more than one person. Adequate cleaning and disinfecting facilities will be provided at the following convenient location______________________________

3. To store respirators in the following convenient, clean and sanitary location

   ________________________________________________________________

4. For reusable respirators (person) ______________________________ will be trained to be knowledgeable in the respirator manufacturer recommendations for the use, care and maintenance of each model of respirator provided by the Company

5. Employees will be instructed as to where and how to obtain new disposable respirators or respirator cartridges when theirs become unusable, unsanitary, or exhibit excessive breathing resistance or breakthrough. These respirators will be available at the following locations:

   ________________________________________________________________

   ________________________________________________________________

5. **Records of actions taken**

(See fit testing/training record form at end of this RPP)

1. Records of fit-test which identify:

   a. The exact model and size respirator

   b. Date of testing

   c. The fit-test method and

   d. Whether the person passed or failed the test.

2. Records of training provided which include at least:

   a. Identification of persons

   b. Date of training and

   c. Topics covered.
6. **A statement of use**

1. Assigned respirators will be worn by persons at all times while in the normal work areas where persons may be overexposed; These areas will be posted “Respirator Required” and

2. Work area(s) affected will be periodically checked to ensure that employees are using respirators and to check dust controls, employee exposure, and employee stress due to breathing resistance or heat. The area supervisor will include this check on his/her daily walk-around inspection.
APPENDIX 5

FIT TEST PROCEDURES
Procedures to be used for Qualitative Dust Respirator Fit Testing

Training

1. Controls and their order of priority -- examples of engineering and administrative controls

2. Reasons respirators are required for the persons being trained
   a. Protect health from what?
   b. Remove what from breathing zone?
   c. Acute or chronic effect?
   d. PPE is considered by MSHA to be for temporary use until feasible controls are installed.

3. Selection
   a. Use only the correct respirator for the contaminant of concern.
   b. Make sure the respirator you select is comfortable -- If not, let your supervisor know – you may need to select a different type
   c. Make sure you don’t need to strain to breathe with the respirator on
      (1) If you do, ask your supervisor to schedule a medical examination
      (2) If medical examination shows you can’t wear a respirator, you may need to transfer to a different job

4. Health conditions that interfere with respirator use.
   a. Heart condition
   b. Asthma or other breathing condition
   c. Claustrophobia
   d. Contact lenses
   e. Eye glass temples
   f. Missing teeth
   g. Skullcaps
   h. Other

5. How long can you wear a respirator
   a. Contaminant break through
   b. High breathing resistance

6. Types of respirators
   a. Filtering (air purifying) and air supply
   b. Types of filtering respirators
   c. Types of particulate respirators and classes
      (1) N, R, and P and 95, 99, and 100.
(2) Other toxins
(3) Problems caused when the wrong type is used

7. Types used at this site and proper procedures for putting them on -- Read instructions for and demonstrate each type used

8. Proper fit
   a. How to get a good fit?
      (1) Remove all facial hair; cooperate fully during fit testing.
      (2) How to self fit-test the respirator each time it is put on
         (a) Breathe out with exhaust valve sealed by hand – should feel respirator lift from face
         (b) Breathe in with inhalation valve sealed – respirator should cling with no leaks

9. How to inspect respirator and how to clean reusable type, how to store respirator.

**SACCHARIN/BITREX FIT TESTS** -- Follow the manufacturer’s instructions
(Protocol below contains detailed procedure used by MTU in past testing)

**Items Needed for Test**

1. Selection of respirators to be available at site (the selection should include enough of each type so that each person tested can try one of each and obtain one).
2. Filter cartridges to use when fitting non-dust respirators.
3. Saccharin (or Bitrex) fit test kit including:
   a. Dilute test solution (to test the person’s sensitivity) and concentrated test solution (for fit testing)
   b. Test Hood and collar
   c. Dispensers (nebulizers) for dilute and concentrated solutions and spare parts
   d. Forms to be used as records that people have been fit tested (copy form at end of this section)
      (1) Date
      (2) Fit person’s name
      (3) Type of respirator person is qualified to use (model and serial no)
      (4) Type of test used
      (5) Statement “By my signature, I verify that I did not detect [the sweet taste of saccharin] [the bitter taste of Bitrex] during any of the actions required in fit testing me. However, I did taste the test substance during the sensitivity test”
      (6) Fit person’s signature
      (7) Tester’s name
      (8) Tester’s signature
SACCHARIN/BITREX FIT TESTS (continued)

Room Set up for Qualitative Fit Testing

1. Set up Work Table for materials in fit test area, and a work table in another room or at least 20 feet away for the sensitivity test
2. Set up hood assemblies
3. Pour about one teaspoonful of weak solution (#1) into nebulizer labeled #1
4. Pour about one teaspoonful of strong solution (#2) into nebulizer labeled #2
5. Set up all the different types of respirators that Company wants to fit test and supply each with a dust filter for fit testing using saccharin or Bitrex
6. Mirror(s) for fitting respirator.

Conducting Test

1. Bring in subjects ahead of time, show them how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit
2. Tell them how to select a respirator – hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit
3. Review the following comfort and fit criteria with each person:
   a. Position of mask on the nose
   b. Room for eye protection
   c. Room to talk.
   d. Position of mask on face and cheeks
   e. Chin properly placed
   f. Adequate strap tension, but not too much.
   g. Fit across nose bridge
   h. Respirator of proper size for distance from nose to chin
   i. Tendency of respirator to slip
   j. Self-observation in mirror
4. Instruct subject on how to conduct self-fit test and have him/her conduct one; also that if it works proceed with the fit test, otherwise the subject may need to select another respirator
5. Allow subjects to select respirators from a sufficient number of models and sizes and to self-fit test those selected
6. Read the material on the following page.
SACCHARIN/BITREX FIT TESTS (continued)

Preliminary remarks for test

Saccharin only -- If you’ve used sweetener in the past hour, postpone taking this test until later. This includes chewing gum, candy, drinking pop, drinking coffee with sweetener etc.

Bitrex & Saccharin -- Please tell me if you suspect you’re unable to taste a weak solution. If you’re unable, the test we’re using won’t work and we’ll need to use another test.

Correct respirator fit is serious business. Wearing an improperly-fitting respirator is false security, which makes you think you can go into dusty or other areas without serious consequences.

Dust respirators are for dust only. A dust respirator will not filter out toxic gases. Make sure you’re using the correct respirator.

Persons with facial hair can’t be fit with a respirator, and can’t legally work in areas where a respirator is required. A caring supervisor is obliged to send you home if you’re not clean shaven and need to work in an area requiring a respirator. Repeat court cases have upheld management’s rights to require persons working in respirator-use areas to be clean-shaven or sent home.

How we plan to fit test you

1. You’ll first select a comfortably-fitting respirator by holding it up against your face as it would be when in actual use. This is the respirator you’re legally authorized to use from now on if the remaining steps in the selection procedure are successful.
SACCHARIN/BITREX FIT TESTS (continued)

2. You’ll put the respirator on and properly adjust the straps. Note that if you must wear safety glasses or other head-mounted safety equipment in your work area, you must wear this equipment during these tests.

3. You’ll wear the respirator for at least 5 minutes to determine if it’s comfortable. You’ll need to talk, walk, turn your head from side to side and up and down and make other movements that are similar to movements you make during your work in the respirator area of your workplace.

4. You’re then ready to be fit tested.

5. You’ll put the hood over your head and I’ll blow the test mist into one of the openings in the front of the hood. I’ll blow in more test mist every 30 seconds while you’re performing the following movements for 60 seconds each. During the entire test, you’ll breath through your mouth so you are able to taste any test solution that gets past the respirator.
   
   a. Normal breathing
   b. Deep breathing (if you feel faint, ease up).
   c. Turning head from side to side and inhaling in each position.
   d. Nodding head up and down and inhaling in the up position.
   e. Counting or reading the rainbow passage.
   f. Grimacing while breathing.

6. If during any of the above exercises you taste the test mist, the respirator doesn’t fit and will not provide complete protection. You’ll need to select another respirator and start over.
SACCHARIN/BITREX FIT TESTS (continued)

7. Finally, after you’ve removed the hood, you’ll go to the other end of the room and while you’re breathing through your mouth, I’ll blow a very weak solution of test mist toward your mouth using 10 squeezes of dispenser bulb. If you taste the test mist now, but did not taste it with the respirator on, you’re properly fit.

For your health’s sake, please be honest – if you taste the test mist at any time while wearing the respirator, stop me immediately and select a different respirator to start the test over with.

STANNIC CHLORIDE SMOKE FIT TESTS -- Follow the manufacturer’s instructions (Protocol below contains detailed procedure used by MTU in past testing)

Items Needed for Test

1. Selection of respirators to be available at site
2. Filter cartridges to use when fitting non-dust respirators
3. Fit test kit including:
   a. Stannic Chloride Smoke Tubes, Squeeze Bulb and Tubing
   b. Forms to be used as records that people have been fit tested (copy form at the end of this writeup)
      (1) Date
      (2) Fit person’s name
      (3) Type of respirator person is qualified to use (model and serial no)
      (4) Type of test used
      (5) Tester’s name
      (6) Tester’s signature

Room Set up for Qualitative Fit Testing

1. Set up Work Table for materials in fit test area, and a work table in another room or at least 20 feet away for the sensitivity test
2. Adequate ventilation to remove smoke
3. A suitable number of respirators of each type so that each person to be tested can try out each type and select one that is suitable. For disposable respirators, provide a suitable number dust filtering cartridges for the test. These must be either HEPA or P100 filters when using stannic chloride for the test
4. Mirror(s) for fitting respirator.
STANNIC CHLORIDE SMOKE FIT TEST (continued)

Conducting Test

Note – The technician must always cover the free end of the smoke tube with tubing to minimize the likelihood of injury.

1. Bring in subjects ahead of time, show them how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit.
2. Tell them how to select a respirator – hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
3. Review the following comfort and fit criteria with each person:
   a. Position of mask on the nose
   b. Room for eye protection
   c. Room to talk
   d. Position of mask on face and cheeks
   e. Chin properly placed
   f. Adequate strap tension, but not too much
   g. Fit across nose bridge
   h. Respirator of proper size for distance from nose to chin
   i. Tendency for respirator to slip
   j. Self-observation in mirror
4. Instruct subject on how to conduct self-fit test and have him/her conduct one; also that if it works proceed with the fit test, otherwise the subject may need to select another respirator
5. Allow subjects to select respirators from a sufficient number of models and sizes and to self-fit test those selected
6. Conduct sensitivity test as follows (see instructions next page):
   a. Advise test subjects that the smoke irritates the eyes, lungs, and nasal passages and keep the eyes shut
   b. Carefully direct a small amount of the smoke in the test subject’s direction to determine that he/she can detect it
   c. After detecting the irritant smoke, the subject puts the respirator on and performs the required self-fit check(s)
7. Conduct these tests as on the following pages. The person must still be sensitive after the fit test or the test results are invalid. Complete the test record for each person that is successfully fitted
8. Read the material on the following page
STANNIC CHLORIDE SMOKE FIT TEST (continued)

Preliminary Remarks

Correct respirator fit is serious business. Wearing an improperly fitting respirator is false security, which makes you think you can go into dusty or other areas without serious consequences.

Dust respirators are for dust only. Each respirator has a specific purpose. A dust respirator will not filter out toxic gases. Make sure you’re using the correct respirator.

Persons with facial hair can’t be fit with a respirator, and can’t legally work in areas where a respirator is required. A caring supervisor will feel obliged to send you home if you’re not clean shaven and need to use a respirator. Repeat court cases have upheld management’s rights to require persons working in respirator-use areas to be clean-shaven or sent home.

HOW WE PLAN TO FIT TEST YOU

1. Before you select and put on a respirator, we will need to expose you to a small amount of the irritant smoke to see if you are sensitive to it.

2. You will then select the respirator that seems to fit you best following the procedures below.

3. We will then subject you to irritant smoke with the respirator on and while you are performing certain exercises.

4. Finally we will repeat the exposure to a small amount of irritant smoke with the respirator off.
STANNIC CHLORIDE SMOKE FIT TEST (continued)

Close your eyes now and I’ll blow some in your direction. Let me know what effect it has on you.

1. Now that we’ve determined that you are sensitive to the irritant smoke, you will select a comfortably-fitting respirator by holding it up against your face as it would be when in actual use. **This is the respirator you’ll be legally authorized to use from now on if the remaining steps in the selection procedure are successful.**

2. You’ll put the respirator on and properly adjust the straps. Note that if you must wear safety glasses or other head-mounted safety equipment in your work area, you must wear this equipment during these tests.

3. You’ll wear the respirator for at least 5 minutes to determine if it’s comfortable. You’ll need to talk, walk, turn your head from side to side and up and down and make other movements that are similar to movements you make during your work in the respirator area of your workplace.

4. You’ll do a self-fit test before the stannic chloride fit test. This involves (manufacturer’s recommendations for self-fit testing) ____________________________

5. If the respirator seems to be OK and to fit your face with no leaks, you are ready to be fit tested with the stannic chloride smoke. Remember -- **Breathing stannic chloride smoke is very uncomfortable and will cause you to cough! Also keep your eyes closed during the test – it burns your eyes!**
STANNIC CHLORIDE SMOKE FIT TEST (continued)

6. I’ll blow stannic chloride smoke around the edges of your respirator from about 12 inches distance. If you don’t cough,

   I’ll blow more smoke around your respirator from 9 and then from 6 inches while you’re performing the following movements for 60 seconds each.

   a. Normal breathing
   b. Deep breathing (if you feel faint, ease up).
   c. Turning your head from side to side and inhaling in each position.
   d. Nodding your head up and down and inhaling in the up position.
   e. Counting or reading the rainbow passage.
   f. Grimacing while breathing.

7. If during any of the above exercises the stannic chloride makes you cough, the respirator doesn’t fit and will not protect you. You’ll need to select another respirator and start over.

Since you didn’t cough when subjected to irritant smoke with the respirator on we’ll need to check your sensitivity to irritant smoke once more. Close your eyes now and I’ll blow some in your direction again. Let me know what effect it has on you.

The test indicates that you are still sensitive to the irritant smoke, but were unaffected with the respirator on. These results indicate that the respirator fits. Remember, this is the only respirator you are legally approved to wear. Before you can legally use a different respirator, another fit test will need to be conducted.
Respirator Fit Testing Record

This is to certify that ________________________________, social security number ___________________________ has been trained and fitted in the use, limitations, and maintenance of the following respirator:

Manufacturer________
Model number________
Protection against __________________________

using the following protocol.

Bitrex Solution Aerosol   ____
Saccharin Solution Aerosol  ____
Stannic Chloride Smoke   ____

The following test exercises were performed while being tested for at least 60 seconds each.

1. Normal breathing
2. Breathing deeply
3. Turning head from side to side, inhaling in each position
4. Nodding head up and down, inhaling in the up position
5. Counting or reading the rainbow passage

“I acknowledge that I have received respirator training and have been fit test according to the above instructions. By my signature, I verify:

____Saccharin or Bitrex Protocol -- That I did not detect the test solution during any of the actions required in fit testing me with the respirator on which this test qualifies me for. I did, however, taste the test solution during the sensitivity test”.

____Stannic Chloride Protocol – That I did not smell the stannic chloride smoke with the respirator on and (or) did not need to cough because of it”. I did smell the smoke when tested for sensitivity with the respirator off.

__________________________________________  ____________________________
Signature of Person Fit Tested                        Date

__________________________________________
Signature of Test