Mine Safety and Health Administration

Respirable Dust Certification-Sampling

Coal Mine Dust Personal Sampling Unit (CMDPSU)

Course Outline

- Purpose and Operator Responsibility
- Respirable Dust and Effects On the Body
- New Dust Rule
- Dust Data Card
- Hands On: Pump and Sampling Head
- Testing: Written and Hands-On Examination

Purpose

To provide students with the knowledge and skills required in taking accurate samples of respirable dust and administering a quality dust sampling program.

Sampling: Operator Responsibility

The mine operator has the responsibility of controlling respirable dust to within the applicable standard and the collection of respirable dust to assure compliance with such standard. In addition, the mine operator must comply with **ALL** provisions of any approved dust control plan.

The mine operators are required to take samples in the mine atmosphere during regularly established cycles to determine the amount of respirable dust to which miners are exposed.

Respirable Dust and Effects

Differences:

- Accidents: Visible and sudden
- Health Hazards: Gradual
  - Undetectable until too late (Respirable Coal Mine Dust)

Dust Generation Sources

- Cutting
- Transporting
- Loading and Dumping
- Crushing
- Processing

Respirable Dust and Effects

Unless effective controls are applied, dust can be generated at a rate faster than it can be dealt with by the human lung's natural defense systems.

This leads to fatal diseases.

Pneumoconiosis

- Term used to describe all lung conditions in which the lung has been affected by retained inhaled dust.
  - Greek Term: "Lung Dustiness" or "Dusty Lung"

- Two forms of Pneumoconiosis we are most concerned with in coal mining:
  - Coal Workers Pneumoconiosis (CWP)
  - Silicosis

CWP is directly proportional to weight or mass of dust retained in the lungs. Controlling the dust is the only means of prevention (Reason for Law)

In addition to coal dust, another more toxic dust found in coal mines is "Quartz" or "Silica". It is a crystalline material found in sandstone and other rock formations.

The most damaging dust particles are those which are small enough to penetrate deep into the lung and cause pneumoconiosis. (Respirable Dust)

Pneumoconiosis

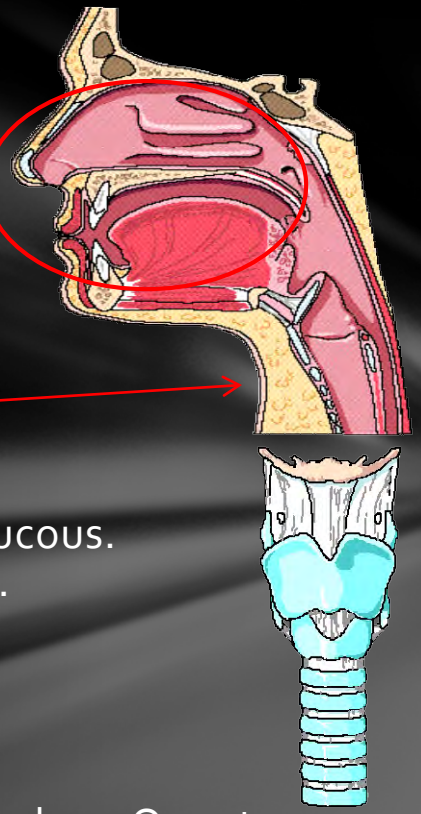
Respirable Coal Mine Dust:

- Presents the greatest danger to the human lungs.
- Comprised of particles 10 micrometer (µm) that are deposited in the lung.
  - Micrometer: .025 of an inch
  - Human eye can detect about 40 micrometers.
  - Human hair is approximately 50 to 70 micrometers thick.

It is not what you can see that will hurt you.

Human Body Defenses

Respiratory System



Mouth and Nose

- Moist linings trap largest particles

Windpipe or Trachea

- Contains ciliated cells: whip-like projections which constantly stir up mucous. Dust particles are pushed up the throat and either swallowed or spit out.

Bronchial Tubes

- "Air Sacs or "Alveoli": Clusters at the end of the bronchial tubes. This is where O_2 enters into the blood stream and CO_2 is expelled. This is also where the greatest damage is done by respirable dust.

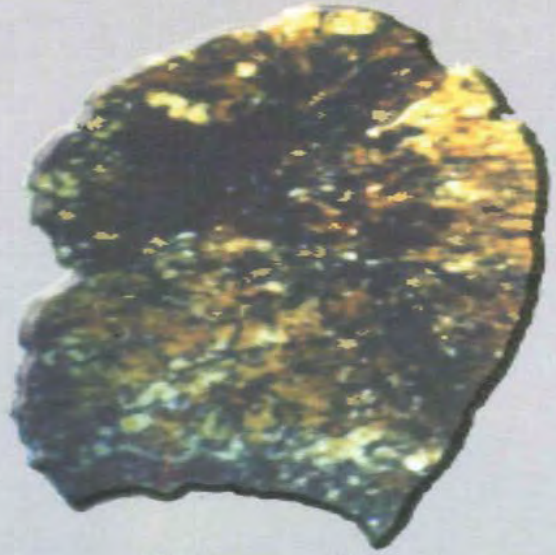
Macrophages:

- Body's last form of defense. These are cells in lungs, similar to enlarged white blood cells, that engulf foreign particles and carry them out. Scientists believe silica kills these cells.

Progression of Black Lung

Normal Lung

Stage 1



Stage 2

Stage 3

Department of Labor
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Means of Controlling Respirable Dust

- Ventilation
- Water
- Well maintained miner scrubbers
- Well maintained surface drill dust controls & cabs
- Well maintained surface mobile equipment & cabs
- Compliance with all aspects of approved dust control plans

U.S. Respirable Dust Standard

- Based in part on a British dust sampling instrument known as MRE.
- Measured and reported to the operator in mg/m^3 (milligrams per cubic meter) of air in the environment at time of sampling.
- Initial standard established at 3.0 mg/m^3 under the 1969 Act.
- Final standard under 1969 Act and continuing until July 31, 2016 is a maximum of 2.0 mg/m^3.
- Maximum dust standard reduces to 1.5 mg/m^3 on August 1, 2016.

U.S. Respirable Dust Standard

- Regulations for underground mines are found in Title 30 CFR, Part 70.

- Regulations for surface mines are found in Title 30 CFR, Part 71.

Quartz

- The maximum concentration of respirable dust quartz that a miner can be exposed to is 100 micrograms per cubic meters or (100 µg/m^3) as measured with an approved device and expressed in terms of equivalent concentration based an MSHA sample
- A reduced standard will be established if respirable quartz dust exceeds 100 µg/m^3 (0.100 mg/m^3)
- A reduced respirable dust standard due to quartz overexposure is determined by dividing the number 10 by the percent quartz
- Ex: Sample is 20% quartz, new reduced standard is 10/20 or 0.5 mg/m^3
- When the dust standard is changed, the new standard becomes effective 7 calendar days after notification from MSHA

Certified Person

- Must obtain a certification from MSHA to sample respirable dust.
  - Attend MSHA dust certification course
  - Pass written (80% minimum) and practical examination (pass/fail) administered by MSHA
  - Must pass an MSHA exam every three years to be recertified.

- Have a moral and legal obligation to collect and submit samples representative of the work environment.
- Certification may be revoked by MSHA via coal regulations

- MSHA has and will continue to prosecute persons charged with falsifying and or tampering with cassettes or data (CMDPSU or CPDM) in any way (i.e. removing dust from cassettes). Punishable by a civil monetary penalty and/or imprisonment.
- Operator may use a contractor that is certified by MSHA.

Sampling

SECTION 201(b) of the Mine Act:

- **……IT IS THE PURPOSE OF THIS TITLE TO PROVIDE, TO THE GREATEST EXTENT POSSIBLE, THAT THE WORKING CONDITIONS IN EACH UNDERGROUND, (or surface), COAL MINE ARE SUFFICIENTLY FREE OF RESPIRABLE DUST CONCENTRATIONS IN THE MINE ATMOSPHERE TO PERMIT EACH MINER THE OPPORTUNITY TO WORK UNDERGROUND, (or the surface), DURING THE PERIOD OF HIS ENTIRE ADULT WORKING LIFE WITHOUT INCURRING ANY DISABILITY FROM PNEUMOCONIOSIS ……**

Sampling

- Sampling device must operate entire shift, including travel time to and from unit being sampled.
- Samples may only be voided by MSHA. Damaged/invalid samples must still be submitted the same as valid samples.
- Gravimetric samples must be sent via mail within 24 hours of the end of the sampling shift.
- Sampling periods begin on the 1st day of the period

Compliance and Records

Operator is responsible for collecting and submitting valid and representative respirable coal mine dust samples to MSHA.

- MSHA monitors this process to ensure integrity of operator's sampling program, detect irregularities and investigate possible causes.

Corrective actions to lower respirable dust concentrations must be made, recorded, and certified by the mine foreman or equivalent official when any sample meets or exceeds the ECV (Excessive Concentration Value).

- Must be retained at least one year on the surface at underground coal mines.

Any status change that affects respirable dust sampling must be reported by operator in writing to the appropriate MSHA office within 3 working days.

- Regulations refer to three different statuses: Producing, non-producing and abandoned.

Compliance and Records

- Records showing the length of each production shift for each underground and surface mine/facility must be retained for at least six months.

- Upon request from the MSHA District Manager, operator must submit the date on which respirable dust samples are being collected.

Compliance and Records

Dust Control Plans (other than for Part 90 Miners) must be posted on the mine bulletin board.

Computer generated reports will be furnished by the Secretary per regulations and must be posted on the bulletin board (other than for Part 90 Miners) for at least 31 days.

Samples collected in addition to those required by regulations are considered invalid samples.

Non-compliance occurs (MSHA will issue citation) when:

- Two or more operator samples meet or exceed ECV for quarterly period
- Average of five operator samples meet or exceed ECV
- Single MSHA sample meets or exceeds ECV

Actions required to terminate citation for non-compliance:

- Immediately take corrective action to lower the concentration to a level at or below the applicable standard.
- Make approved respiratory equipment available to affected miners (72.200)
- Make record of corrective actions - will be retained for one year.
- Begin sampling within 8 calendar days after date citation is issued. All abatement samples must be individually compliant with applicable standard.

DWP Samples:

- Must take one valid sample per DWP per quarterly period.
- Four digit designation (i.e. 004-0)
- Every highwall drill operator is considered a DWP and is NOT subject to withdrawal.
- One Bulldozer operator with the greatest potential of exposure may be selected to represent a group doing work in the same location doing the same task exposed to the same dust generating source at all times (i.e. multiple dozers working on clean coal pile will have one dozer selected as the DWP to represent the group)
- MSHA District Manager may designate additional positions as DWPs and may withdraw them at his/her discretion.
- Any DWP sample that exceeds the applicable standard by 0.1 mg/m^3 will be used to determine concentration regardless of whether normal work shift was achieved.
- Surface samples taken on rainy days may be voided by MSHA if the certified person conducting the sampling believes the rain could have reduced dust concentrations.
  - MSHA District Manager may permit rainy day samples to be processed as normal-production samples.

DWP

If notified by MSHA that any valid representative sample taken from a DWP exceeds the applicable standard, the operator must sample the DWP each normal work shift until 5 valid representative samples are taken

- Within 15 calendar days of notification
- Start the sampling on the first normal work shift after receipt of notification

DA Samples:

- Five samples per DA per quarterly period beginning February 1, 2016.

- Descriptions of sampling locations specified in the approved ventilation plan.
  - Typically includes belt entries.
    - Intake air may also be included.

- Sampling location may be established based on MSHA samples where quartz exceeds 0.1 mg/m^3 (100 µg/m^3).

- Operator must begin sampling on the first day of production following notification from MSHA that any valid sample taken from a DA exceeds the applicable standard.

As of 02/01/16 all sampling on Part 90 miners and MMU's (except for intake air DA if applicable) must be conducted using theCPDM.

Intake Air

Current standard is 1.0 mg/m^3 until July 31, 2016.

Standard changes to 0.5 mg/m^3 as of August 1, 2016.

CMDPSU

Coal **M**ine **D**ust **P**ersonal **S**ampling **U**nit

- Gravimetric personal sampling device approved under 30 CFR Part 74, Subpart B for electrical safety.
- Any personal respirable coal mine dust sampling unit must be approved by MSHA and bear approval labels by both MSHA and NIOSH or HHS.
- Must be checked immediately (3 hours or less) before sampling shift under actual load to confirm flow rate of 2.0 lpm and voltage of at least 4.8 VDC.
  - This check may be performed by a person certified in sampling or maintenance/calibration or both.
- Flow rate of CMDPSU must be checked during the second hour of operation and the last hour of operation by a person certified in dust sampling.
  - Improper flow rate observed during last hour check should be noted on the dust data card and the sample transmitted to MSHA

CMDPSU Components

Zefon International Escort Elf® pump unit

- Only device approved for personal respirable dust sampling in coal mines.
- Shielded from radio frequencies to maintain constant flow rate.
- Questions regarding specifics of operation or radio frequency interference should be directed to manufacturer.
- Must be switched out with another unit prior to 13th hour of operation.
- Does **not** have a float-type flow rate meter.

Battery Pack

- Contains 4 nickel cadmium cells. Cutoff voltage for each cell is 1 VDC. Charging the battery when voltage is lower than 1.0 VDC may result in explosion.
- When charged, gains a "surface charge" that will yield artificially high voltmeter readings. This typically dissipates within 15 minutes after pump is turned on.
- All screws must be present and properly tightened or the unit is non-permissible.

CMDPSU Components

Zefon International Escort Elf® pump unit

Battery Pack

Display Screen
Shows time in minutes and flow rate in liters per minute.

CMDPSU Components

Filter Cassette:

- Porous membrane in plastic housing – collects respirable dust for lab analysis. Identified by unique number which **must** match number on dust data card.

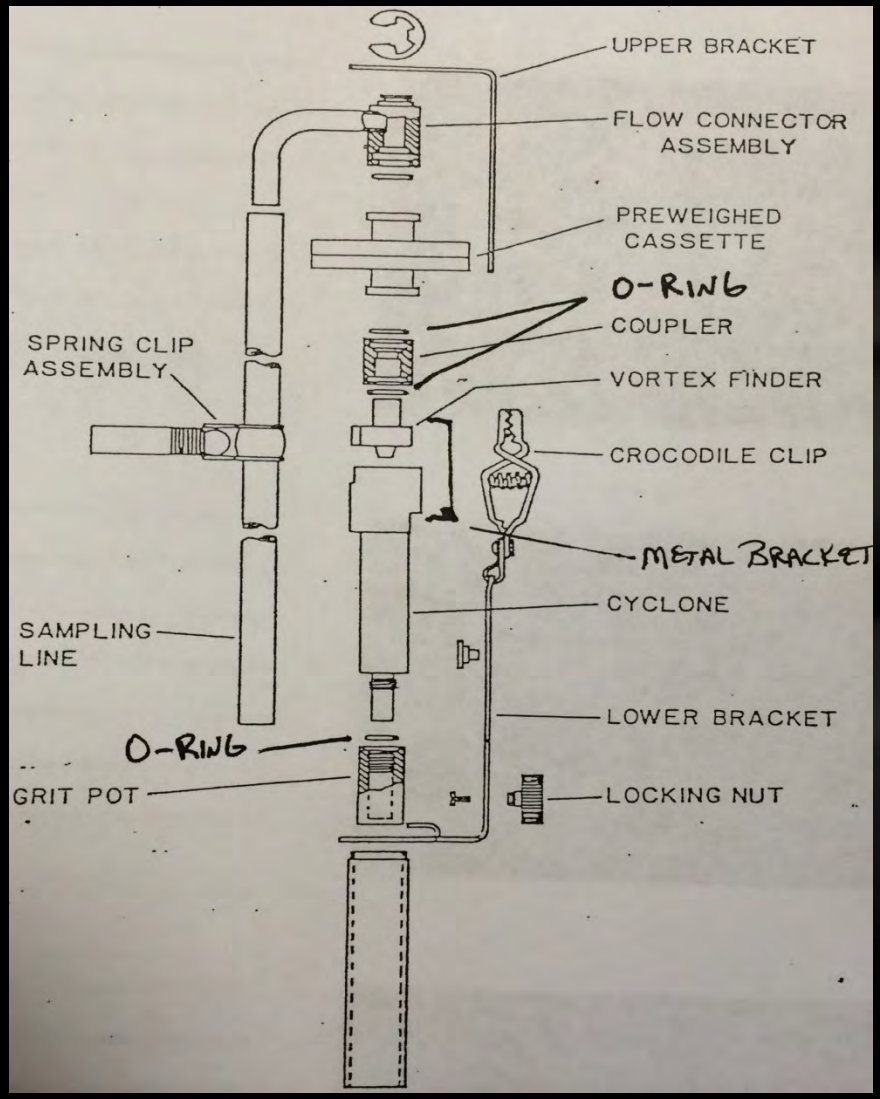
CMDPSU Components

Sampling Head Assembly

- No modifications permitted at any time.

- Turning upside down may contaminate the sample and is a common cause of voided samples.

Sampling Head Assembly Diagram



Parts of a sampling head assembly:

Nylon Cyclone

- Separates respirable and non-respirable dust.
- Scratches on the inside of the cyclone are called **scoring,** which requires the cyclone to be discarded and replaced.

Metal Brackets

Provide alignment and firmness.

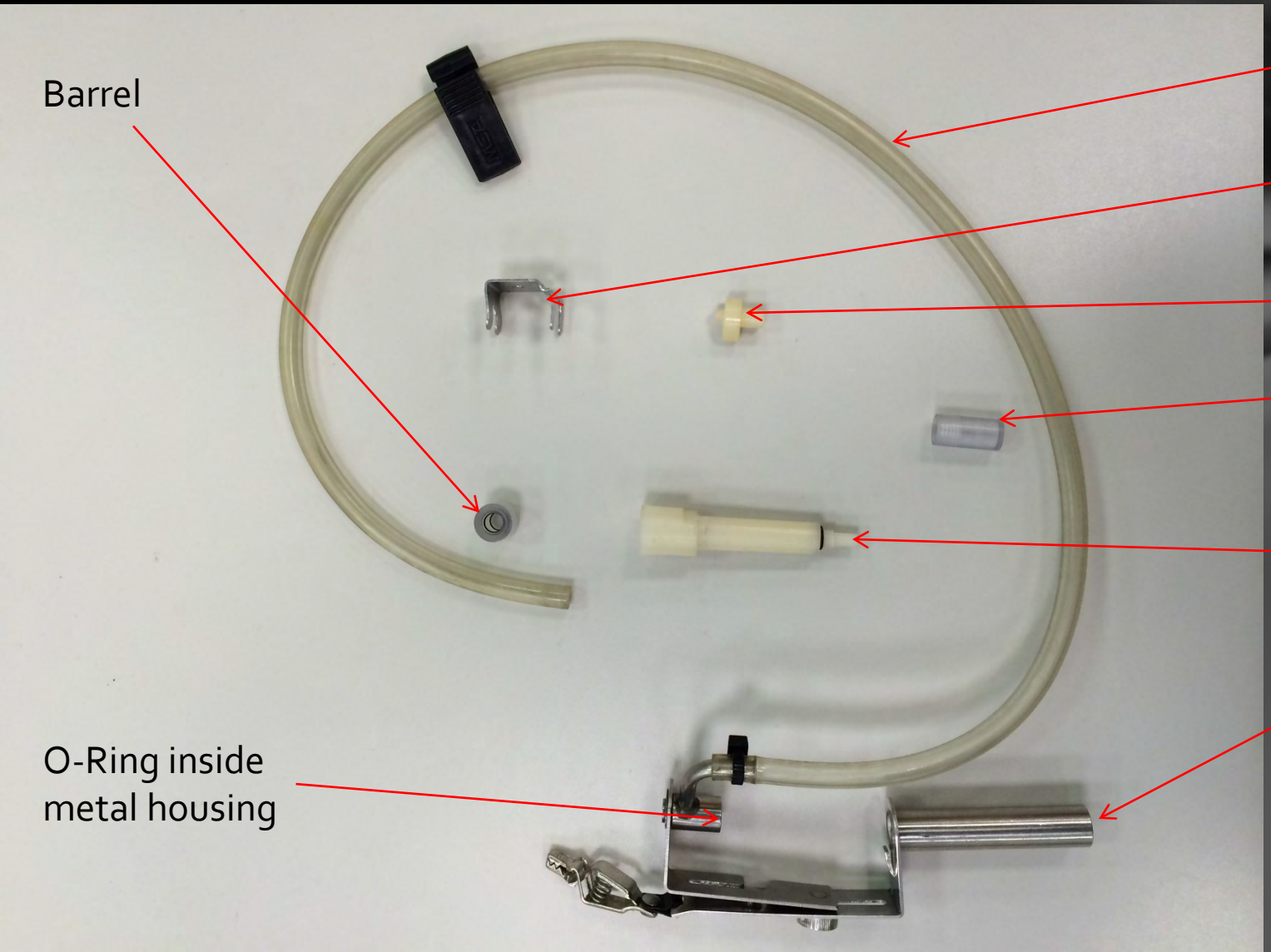
Grit Pot

- Holds larger particles that are not respirable.

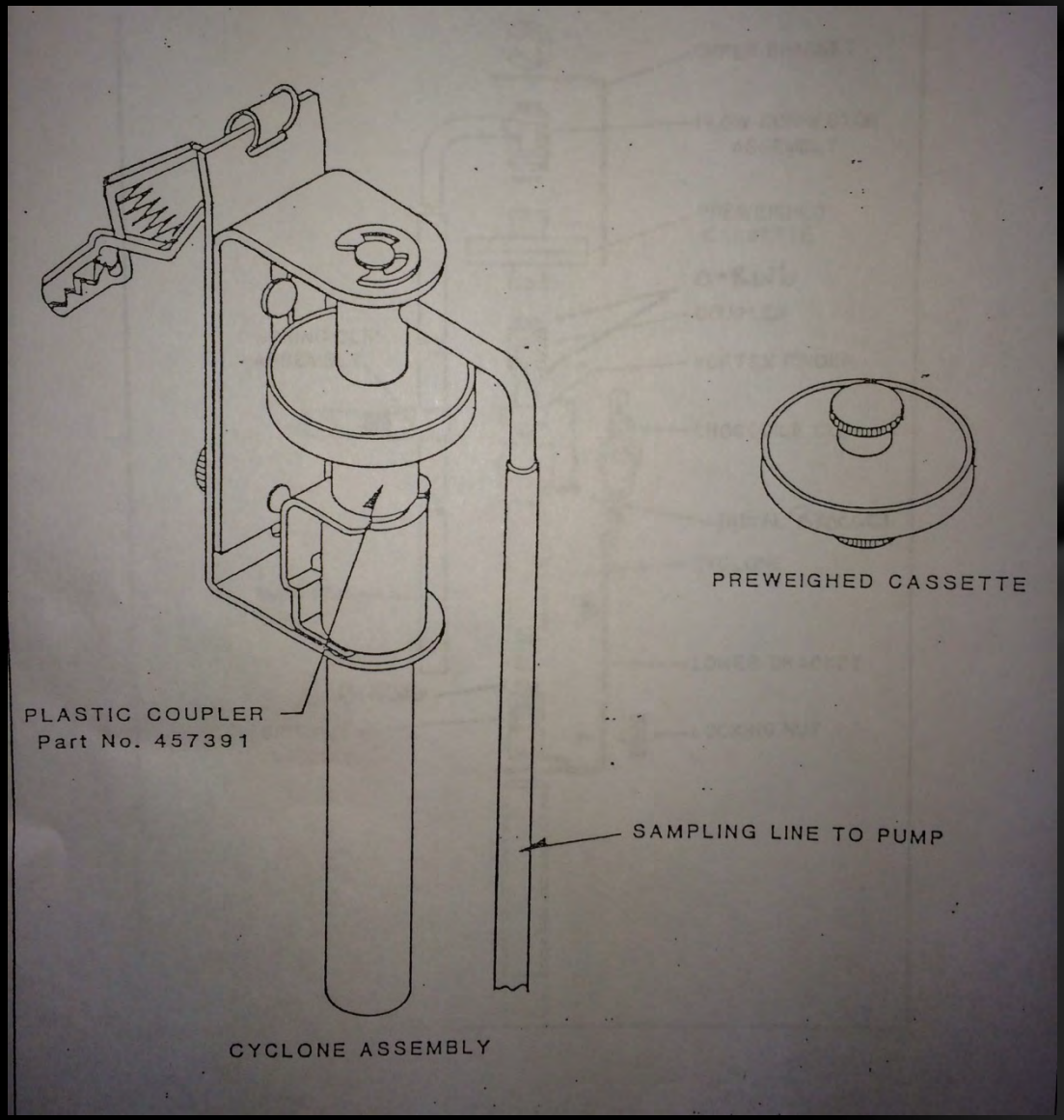
Hose

- Must be 36 inches long with no more than +/- 1/16”

Parts of a sampling head assembly:



Sampling Head Assembly Diagram



Pre-shift exam for Respirable Dust Sampling

- Check Pump and Equipment for the Following:
- All parts for cleanliness and/or Damage
- All pump parts, cyclones, and head assemblies must be original equipment (approved)
- Legible pump approval labels
- Pump housing screws
- Cracks in pump casing
- Pump for interior rattling
- Face plate for cracks or cuts
- On-off cover for cracks or damage
- Inlet filter cover for cracks or dust
- Slider clamp on hose
- O-Ring on inside of head assembly
- Vortex finder cone tip for smoothness
- Barrel connector for both O-rings
- Inlet filter for cleanliness
- Weld on gooseneck connection
- Belt Clip
- Cyclone for scoring
- Grit pot for scoring or cracks
- Hose for hole or cracks
- Firmness and rigid alignment
- Flow Rate
- Check for Leaks
- Battery voltage under load (assembled) should be 4.8 VDC or greater

Pump Placement

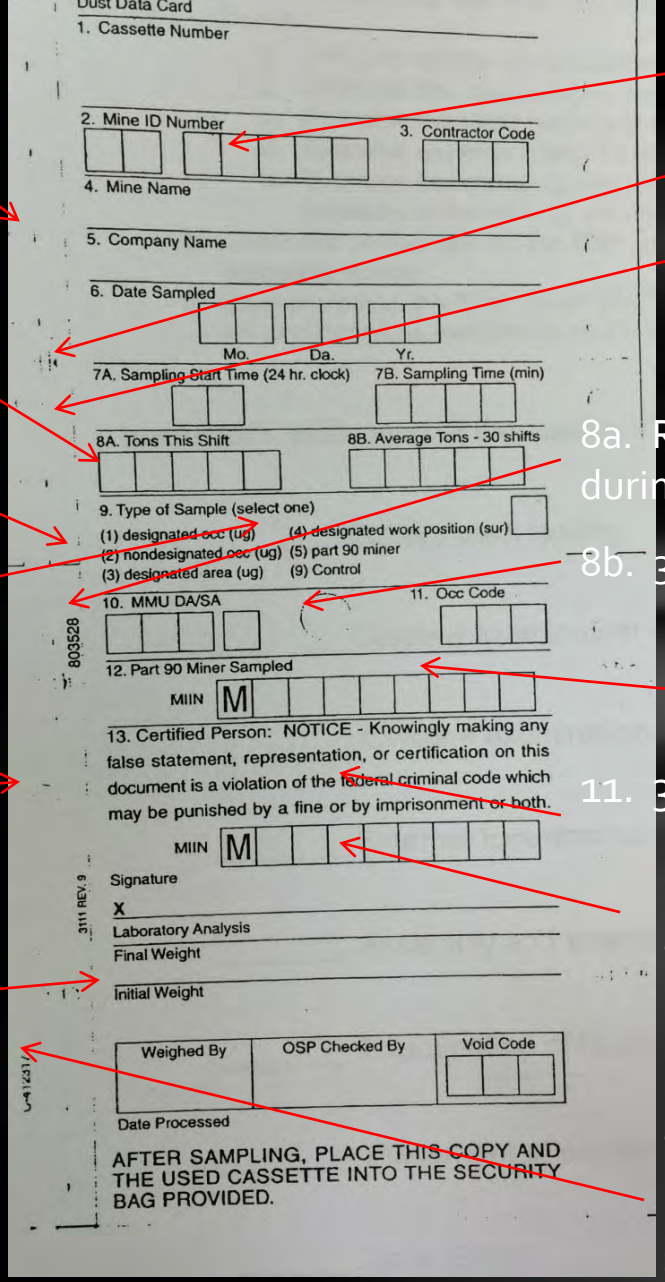
- Pump clipped to belt on opposite side of person's normal use. (Right-handed person should have pump placed on left side)
- Assembly head clipped to shirt collar.
- Hose clip attached to shirt with excess hose placed out of the way.

Other Items for Proper Pump Maintenance

- Cycle pumps regularly if not used
- Hoses cannot be connected to pumps prior to pre-shift exam
- All pumps must be maintained unless tagged out
- Internal orange valve must be in place to allow correct pressure to be maintained and released
- Internal O-ring must be in place on interior of face plate
- Battery pack must have O-ring
- Pump tubing must be clear vinyl tubing with an inside diameter of ¼ inch, 36 inches long with +/- 1/16 inch
- Do not put anything in cyclone to clean it (Pipe cleaner, steel wire, etc.)
- Sampling records
- Calibration records

Dust Data Card

- Unique identification number
- The number on the dust data card must match the number on the cassette.
- Stamped with pre-weight date
- Failure to properly complete will result in voided sample.
- Person certified for sampling must complete, sign and include MIIN number before mailing to MSHA.



1. Cassette number

2. Mine ID

6. Date of Sample

7a Start time (24 hour clock)

7b. Sample time In minutes

10. Entity sampled (MMU/DA/SA)

13. MIIN of Certified Person who Conducted sampling (Performed checks on CMDPSU)

Card number

4. Name of Mine

5. Company Name

8a. Raw tons produced during sampling shift

8b. 30 shift average

Taken from records

9. Type of sample

11. 3 digit occupation code (Example: 036 = CM operator)

12. MIIN for only Part 90 Miners sampled

13. Signature of Certified Person who conducted sampling(Performed checks on CMDPSU)

Control Filter Instructions

- The blank filter must be carried in the same area where the sample(s) are being collected and it must remain capped during the entire sampling shift.

- At the end of the sampling shift, the operator will then complete items 2, 4, 5, 6, 10 and 13, record a "9" in item 9 and mark a large capital "C" in the middle of the blank filter dust data card. It is best to fill out the card the same as the sample taken.

- The blank filter/cassette must be attached to the data card and transmitted to MSHA in the same mailing box as the valid sample collected.

Part 72
Medical Monitoring

- Chest X-rays and spirometry examination for all coal miners (Surface and Underground)
  - Required by MSHA
  - Must use NIOSH approved facility
  - Provided at frequency of at least 5 years (Voluntary)
  - New Miners – within 30 days of first work (Mandatory)
  - Operators to develop plan for examinations
    - Plan must be approved by NIOSH
    - Plan submittal must include a roster of employees
  - Approved plan must be posted on mine bulletin board at all times

Part 90

Miners showing evidence of pneumoconiosis as a result of Chest X-ray must be offered an opportunity to transfer to a less dusty area if the reduced standard cannot be maintained in the current work environment, whether Surface or Underground.

- MSHA's responsibility to notify miner
- Operator Sampling Requirements:
  - Five (5) valid respirable dust samples for that miner within 15 days after 20 day grace period for initial transfer.
  - Five (5) samples within 15 days after any subsequent transfer.
  - Submit five (5) valid samples every calendar quarter on consecutive work days.
  - Part 90 samples must be collected during the full working shift.

Dust standard for Part 90 miners is 1.0 mg/m^3 until July 31, 2016.

On August 1, 2016, the dust standard for Part 90 miners will be 0.5 mg/m^3.

Part 90

- The operator must submit and have approved by the MSHA District Manager a respirable dust control plan for a Part 90 miner within 15 days following termination of a citation if the operator is cited for the miner's overexposure and corrective actions are implemented.

- No information about a Part 90 miner (i.e. dust control plan, sample reports) should ever be posted on the mine bulletin board. A copy of the computer report furnished to the operator must be provided to the Part 90 miner by the mine operator.

- When sampling a Part 90 Miner, the miner's MIIN should be entered on line 12 of the Dust Data Card.

- The operator is obligated to pay a Part 90 miner no less than his/her rate at the time he/she was officially identified as a Part 90 miner.

Part 90

Part 90 dust samples are considered non-compliant when two or more samples or the average of all valid representative samples meet or exceed the ECV (Excessive Concentration Value) corresponding to the applicable standard.