



Part 451.

Respiratory Protection

Student Materials
Level Two MTI Compliance Course
Consultation Education and Training Division
Michigan Occupational Safety and Health Administration
Michigan Department of Labor and Economic Opportunity
www.michigan.gov/miosha
517-284-7720

PART 451. RESPIRATORY PROTECTION

PRESENTED BY:
CONSULTATION EDUCATION AND TRAINING DIVISION
MICHIGAN OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
MICHIGAN DEPARTMENT OF LABOR AND ECONOMIC OPPORTUNITY
WWW.MICHIGAN.GOV/MIOSHA
517-284-7720



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THE AIR WE BREATHE...

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OBJECTIVES

- EXPLAIN PERMISSIBLE PRACTICES FOR RESPIRATORS.
- DEVELOP AND IMPLEMENT A WRITTEN RESPIRATORY PROTECTION PROGRAM.
- IDENTIFY THE CORRECT RESPIRATOR SELECTION FOR EMPLOYEE PROTECTION.
- IDENTIFY POTENTIAL RESPIRATOR VIOLATIONS.

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OVERVIEW

- PERMISSIBLE PRACTICE
- DEFINITIONS
- RESPIRATORY PROTECTION PROGRAM
- SELECTION OF RESPIRATORS
- MEDICAL EVALUATION
- FIT TESTING
- USE OF RESPIRATORS
- MAINTENANCE AND CARE OF RESPIRATORS
- BREATHING AIR QUALITY AND USE
- IDENTIFICATION OF FILTERS, CARTRIDGES, AND CANISTERS
- TRAINING AND INFORMATION
- PROGRAM EVALUATION
- RECORDKEEPING
- APPENDICES



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SUBSTANCE-SPECIFIC STANDARDS ADDRESSING RESPIRATORS



- PART 305 – ASBESTOS FOR GENERAL INDUSTRY
- PART 306 – FORMALDEHYDE
- PART 307 – ACRYLONITRILE
- PART 308 – INORGANIC ARSENIC
- PART 309 – CADMIUM
- PART 310 – LEAD
- PART 311 – BENZENE
- PART 312 – 1,3-BUTADIENE
- PART 313 – METHYLENE CHLORIDE

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SUBSTANCE-SPECIFIC STANDARDS ADDRESSING RESPIRATORS – CONT.

- PART 314 – COKE OVEN EMISSIONS
- PART 315 – HEXAVALENT CHROMIUM
- PART 431 – HAZARDOUS WORK IN LABORATORIES
- PART 432 – HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE
- PART 523 – ABRASIVE BLASTING
- PART 529 – WELDING, CUTTING, & BRAZING
- PART 590 – RESPIRABLE CRYSTALLINE SILICA (GI)
- PART 602 – ASBESTOS FOR CONSTRUCTION
- PART 603 – LEAD IN CONSTRUCTION
- PART 690 – RESPIRABLE CRYSTALLINE SILICA (CONSTRUCTION)
- MIOSHA TB GUIDELINES

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PART 350 – CARCINOGENS

4-Nitrobiphenyl
alpha-Naphthylamine
methyl chloromethyl ether
3,3'-Dichlorobenzidine (and its salts)
bis-Chloromethyl ether
beta-Naphthylamine
Benzidine
4-Aminodiphenyl
Ethyleneimine
beta-Propiolactone
2-Acetylaminofluorene;
4-Dimethylaminoazo-benzene
N-Nitrosodimethylamine

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Standards specifically focused on, or addressing, a particular industry or safety and health topic.

Always takes precedence over horizontal standards when both address the same issue.

Examples: Asbestos, Formaldehyde, Lead.

These standards address the needed respiratory protection – usually more stringent.

VERTICAL STANDARDS

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HORIZONTAL STANDARDS

- STANDARDS REGARDING A TOPIC THAT GENERALLY APPLY TO ALL GENERAL INDUSTRY AND/OR CONSTRUCTION EMPLOYERS.
- TAKES PRECEDENCE OVER A VERTICAL STANDARD WHEN A HORIZONTAL RULE IS NOT ADDRESSED BY THE VERTICAL STANDARD.
- EXAMPLES: RESPIRATORY PROTECTION, NOISE, PERSONAL PROTECTIVE EQUIPMENT (PPE).

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COMMON RESPIRATOR VIOLATIONS

- WRITTEN/IMPLEMENTED SITE SPECIFIC PROGRAM.
- MEDICAL EVALUATION.
- ANNUAL FIT TESTING.
- ANNUAL TRAINING.
- INTERFERENCE WITH SEALING SURFACES.
- TRAINING ON APPENDIX D FOR COMFORT RESPIRATORS.
- IMPROPER RESPIRATOR SELECTION.
- IMPROPER RESPIRATOR STORAGE.



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2021 MIOSHA STATISTICS – TOP 10 SERIOUS CITATIONS

- PART 451 CITATIONS IN 2021
 - TOTAL CITATIONS = 201 (CONSTRUCTION AND GI)
 - \$305,500 IN PENALTIES
 - ~\$1520.00/CITATION



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ARE EMPLOYEES OVEREXPOSED?

- KNOW PROPERTIES OF THE CHEMICAL AND HOW IT IS BEING USED
- REVIEW THE SAFETY DATA SHEET (SDS)
- CHECK OCCUPATIONAL EXPOSURE LIMITS:
 - MIOSHA - PERMISSIBLE EXPOSURE LIMIT (PELs)
 - AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) - THRESHOLD LIMIT VALUES (TLVs)
 - NATIONAL INSTITUTE OF SAFETY AND HEALTH - RECOMMENDED EXPOSURE LIMITS (RELs)
 - OTHERS
 - COMPARE & ASSESS DIFFERENCES BETWEEN PELs AND OTHERS
- WARNING PROPERTIES AND SYMPTOMS
- CONDUCT AIR MONITORING

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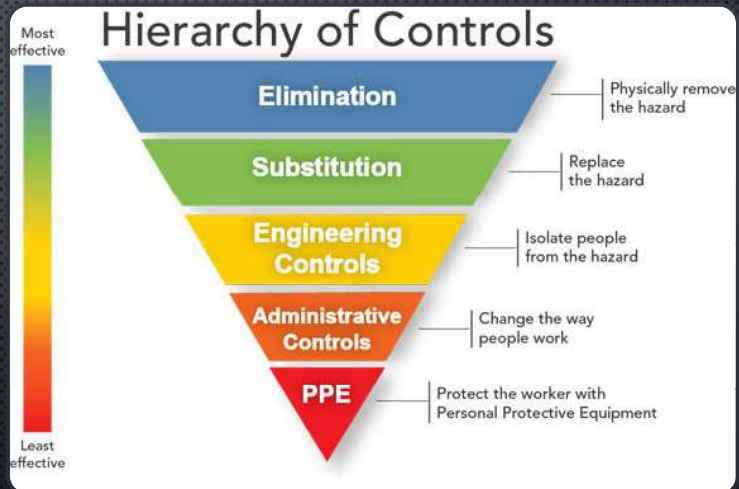
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CONTROLLING EXPOSURES

• HIERARCHY OF CONTROLS

- ENGINEERING CONTROLS
 - ELIMINATION, SUBSTITUTION, ENCLOSURE, VENTILATION
- ADMINISTRATIVE CONTROLS
 - JOB ROTATION, WORK INSTRUCTIONS
- PERSONAL PROTECTIVE EQUIPMENT

WHAT TYPE OF CONTROL WILL WORK BEST?



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PERMISSIBLE PRACTICE

- 1910.134 (A)(1) – IN THE CONTROL OF THOSE OCCUPATIONAL DISEASES CAUSED BY BREATHING AIR CONTAMINATED WITH HARMFUL DUSTS, FOGS, FUMES, MISTS, GASES, SMOKES, SPRAYS, OR VAPORS, THE PRIMARY OBJECTIVE SHALL BE TO PREVENT ATMOSPHERIC CONTAMINATION. THIS SHALL BE ACCOMPLISHED AS FAR AS FEASIBLE BY ACCEPTED ENGINEERING CONTROL MEASURES. WHEN EFFECTIVE ENGINEERING CONTROLS ARE NOT FEASIBLE, OR WHILE THEY ARE BEING INSTITUTED, APPROPRIATE RESPIRATORS SHALL BE USED PURSUANT TO THIS SECTION.

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PERMISSIBLE PRACTICE

Regarding rule 1910.134(a)(1), Feasible engineering, work practice, or administrative controls **must be instituted** even though they may not be sufficient to reduce exposure to or below the OSHA/MIOSHA permissible exposure limit (PEL).

Respirators **must be used in conjunction with feasible controls** whenever exposures cannot be controlled at or below permissible limits.

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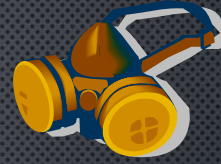
PERMISSIBLE PRACTICE

- 1910.134 (A)(2) – RESPIRATORS **SHALL** BE PROVIDED BY THE EMPLOYER WHEN SUCH EQUIPMENT IS NECESSARY TO PROTECT THE HEALTH OF THE EMPLOYEE. THE EMPLOYER **SHALL** PROVIDE THE RESPIRATORS WHICH ARE APPLICABLE AND SUITABLE FOR THE PURPOSE INTENDED. THE EMPLOYER **SHALL** BE RESPONSIBLE FOR THE ESTABLISHMENT AND MAINTENANCE OF A RESPIRATORY PROTECTION PROGRAM WHICH **SHALL** INCLUDE THE REQUIREMENTS OUTLINED IN PARAGRAPH (C) OF THIS SECTION.

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KEY DEFINITIONS



- AIR-PURIFYING RESPIRATORS
- ATMOSPHERE-SUPPLY RESPIRATORS
- POWERED AIR-PURIFYING RESPIRATORS
- EMPLOYEE EXPOSURES
- FIT TESTING
- COMFORT USE RESPIRATORS
- HEPA
- IDLH
- OXYGEN DEFICIENT ATMOSPHERE
- RESPIRATORY PROTECTION PROGRAM
- PLHCP
- FILTERING FACE-PIECE
- POOR WARNING PROPERTIES

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AIR-PURIFYING RESPIRATORS



Positive Pressure



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ATMOSPHERE-SUPPLYING RESPIRATORS



- POSITIVE PRESSURE:
- - SELF-CONTAINED BREATHING APPARATUS (SCBA)
- - SUPPLIED AIR RESPIRATOR (SAR)

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POWERED AIR-PURIFYING RESP. (PAPR)

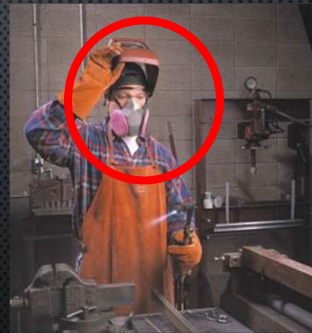


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EMPLOYEE EXPOSURE

CONCENTRATION OF CONTAMINANT IN
BREATHING ZONE



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FIT TESTING

Port-a-Count
Quantitative - QNFT



Controlled Negative
Pressure (CNP) - QNFT



Aerosol Method
Qualitative - QLFT



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HIGH EFFICIENCY PARTICULATE AIR (HEPA)

- 99.97% EFFICIENCY AT ≥ 0.3 MICRONS

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POOR WARNING PROPERTIES

- A SUBSTANCE WHOSE ODOR, TASTE, OR IRRITATION EFFECTS ARE NOT DETECTABLE OR NOT PERSISTENT AT CONCENTRATIONS AT OR BELOW THE EXPOSURE LIMIT.
- INDIVIDUAL ODOR DETECTION = SUBJECTIVE (COMPLICATION)
- EXAMPLES: DIISOCYANATES (MDI, TDI, HDI), CARBON MONOXIDE, HYDROGEN SULFIDE, METHYLENE CHLORIDE, HYDROGEN CYANIDE, METHANOL, FORMIC ACID.

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IDLH

□ IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH):

AN ATMOSPHERE THAT POSES AN IMMEDIATE THREAT TO LIFE, WOULD CAUSE IRREVERSIBLE ADVERSE HEALTH EFFECTS, OR WOULD IMPAIR AN INDIVIDUAL'S ABILITY TO ESCAPE FROM A DANGEROUS ATMOSPHERE.



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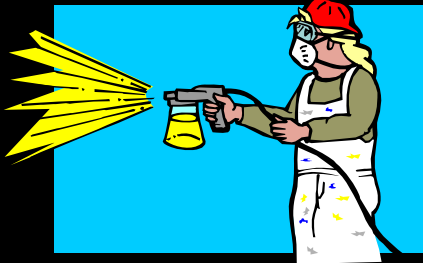
OXYGEN DEFICIENT ATMOSPHERE

OXYGEN DEFICIENT MEANS AN ATMOSPHERE WITH AN OXYGEN CONTENT BELOW 19.5% BY VOLUME.

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RESPIRATORY PROTECTION PROGRAM



- DESIGNATE QUALIFIED PROGRAM ADMINISTRATOR
- PROVIDE RESPIRATORS, TRAINING, AND MEDICAL SURVEILLANCE AT NO COST TO EMPLOYEES

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RESPIRATORY PROTECTION PROGRAM (CONT.)

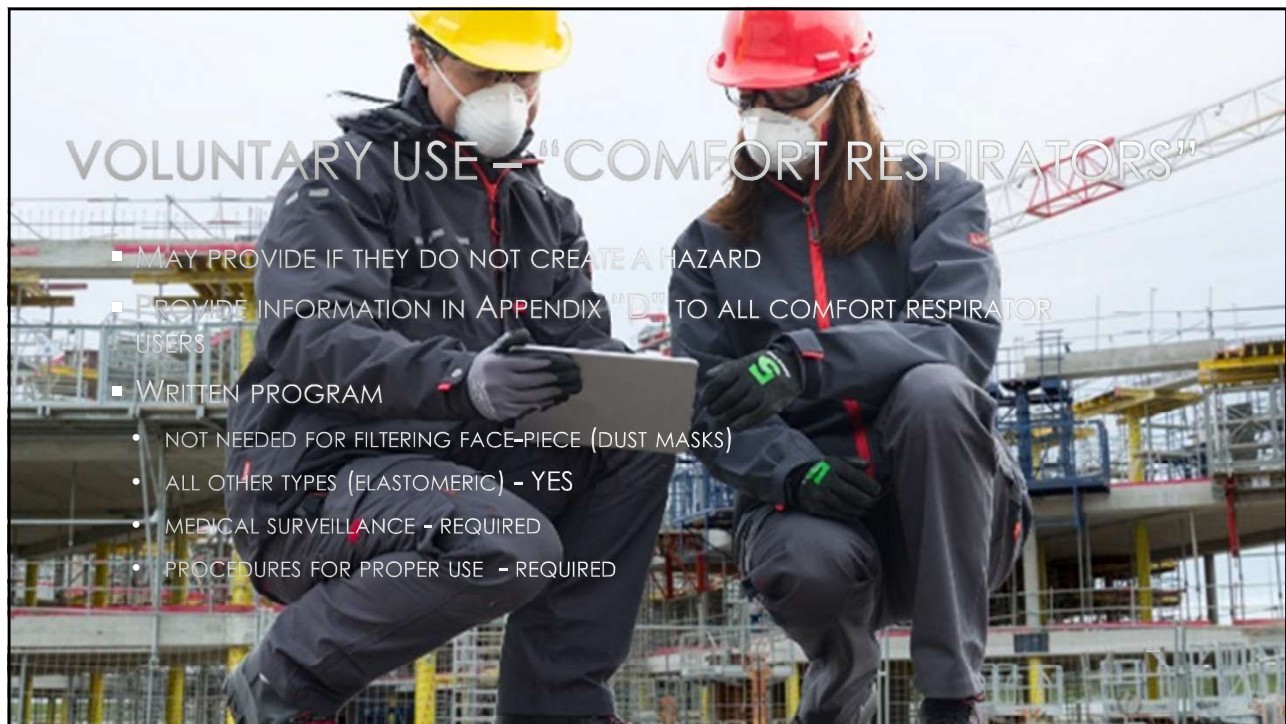
Written Program - Key Components:

- Selection
- Medical evaluation
- Fit testing
- Procedures for proper use and maintenance
- Procedures for cleaning, disinfecting, storing, etc.
- Procedures to ensure adequate air quality, quantity and flow
- Employee training
- Program evaluation

Needs to be site specific!

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VOLUNTARY USE – “COMFORT RESPIRATORS”

- MAY PROVIDE IF THEY DO NOT CREATE A HAZARD
- PROVIDE INFORMATION IN APPENDIX “D” TO ALL COMFORT RESPIRATOR USERS
- WRITTEN PROGRAM
 - NOT NEEDED FOR FILTERING FACE-PIECE (DUST MASKS)
 - ALL OTHER TYPES (ELASTOMERIC) - YES
 - MEDICAL SURVEILLANCE - REQUIRED
 - PROCEDURES FOR PROPER USE - REQUIRED

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POTENTIAL ADVERSE HEALTH CONDITIONS – VOLUNTARY USE

- EMPLOYEE HEALTH IS BEING JEOPARDIZED BY WEARING.
 - CARDIAC AND/OR PULMONARY DISORDER
- WEARING A DIRTY RESPIRATOR THAT CAN CAUSE DERMATITIS OR INGESTION OF A HAZARDOUS CHEMICAL.
 - HEAVY METALS, OILS, PESTICIDES
- THE SHARING OF A RESPIRATOR THAT COULD LEAD TO TRANSMITTAL OF DISEASE.
 - COLDS/FLU, TB, EBOLA, MRSA

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FILTERING FACE-PIECE (DUST MASKS)

- LETTER RATINGS:
 - N – NOT OIL PROOF
 - R – OIL RESISTANT
 - P – OIL PROOF
- EFFICIENCY:
 - 95%
 - 99%
 - 99.97% = HEPA "100%"
- EXAMPLES:
 - N-95, R-99, P-100
(ACTUALLY 99.97%)



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APPENDIX D

- **INFORMATION FOR EMPLOYEES USING RESPIRATORS WHEN NOT REQUIRED UNDER THE STANDARD (MANDATORY)**
- RESPIRATORS ARE AN EFFECTIVE METHOD OF PROTECTION AGAINST DESIGNATED HAZARDS WHEN PROPERLY SELECTED AND WORN. RESPIRATOR USE IS ENCOURAGED, EVEN WHEN EXPOSURES ARE BELOW THE EXPOSURE LIMIT, TO PROVIDE AN ADDITIONAL LEVEL OF COMFORT AND PROTECTION FOR WORKERS. HOWEVER, IF A RESPIRATOR IS USED IMPROPERLY OR NOT KEPT CLEAN, THE RESPIRATOR ITSELF CAN BECOME A HAZARD TO THE WORKER. SOMETIMES, WORKERS MAY WEAR RESPIRATORS TO AVOID EXPOSURES TO HAZARDS, EVEN IF THE AMOUNT OF HAZARDOUS SUBSTANCE DOES NOT EXCEED THE LIMITS SET BY OSHA STANDARDS. IF YOUR EMPLOYER PROVIDES RESPIRATORS FOR YOUR VOLUNTARY USE, OR IF YOU PROVIDE YOUR OWN RESPIRATOR, YOU NEED TO TAKE CERTAIN PRECAUTIONS TO BE SURE THAT THE RESPIRATOR ITSELF DOES NOT PRESENT A HAZARD.
- YOU SHOULD DO THE FOLLOWING:
 1. READ AND HEED ALL INSTRUCTIONS PROVIDED BY THE MANUFACTURER ON USE, MAINTENANCE, CLEANING AND CARE, AND WARNINGS REGARDING THE RESPIRATOR'S LIMITATIONS.
 2. CHOOSE RESPIRATORS CERTIFIED FOR USE TO PROTECT AGAINST THE CONTAMINANT OF CONCERN. NIOSH, THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH OF THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, CERTIFIES RESPIRATORS. A LABEL OR STATEMENT OF CERTIFICATION SHOULD APPEAR ON THE RESPIRATOR OR RESPIRATOR PACKAGING. IT WILL TELL YOU WHAT THE RESPIRATOR IS DESIGNED FOR AND HOW MUCH IT WILL PROTECT YOU.
 3. DO NOT WEAR YOUR RESPIRATOR INTO ATMOSPHERES CONTAINING CONTAMINANTS FOR WHICH YOUR RESPIRATOR IS NOT DESIGNED TO PROTECT AGAINST. FOR EXAMPLE, A RESPIRATOR DESIGNED TO FILTER DUST PARTICLES WILL NOT PROTECT YOU AGAINST GASES, VAPORS, OR VERY SMALL SOLID PARTICLES OF FUMES OR SMOKE.
 4. KEEP TRACK OF YOUR RESPIRATOR SO THAT YOU DO NOT MISTAKENLY USE SOMEONE ELSE'S RESPIRATOR.

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WHAT'S
WRONG
WITH THIS
PICTURE?

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WHAT'S
WRONG
WITH THIS
PICTURE?

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WHAT'S WRONG WITH THIS PICTURE?



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WHAT'S
WRONG WITH
THIS PICTURE?



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WHAT'S
WRONG
WITH THIS
PICTURE?

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SELECTION OF RESPIRATORS

- USE NIOSH CERTIFIED RESPIRATORS
- IDENTIFY AND EVALUATE RESPIRATORY HAZARDS
 - REASONABLE ESTIMATE OF EXPOSURE LEVEL
 - CHEMICAL STATE AND PHYSICAL FORM
 - CAN NOT IDENTIFY OR ESTIMATE = IDLH
- SUFFICIENT NUMBER OF MODELS AND SIZES
- RESPIRATORS FOR IDLH ATMOSPHERES
- RESPIRATORS FOR NON-IDLH ATMOSPHERES

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Personal air sampling

Environmental screening

Historical data

Objective data

Mathematical approaches

Safety Data Sheets (GHS –
clues/information)

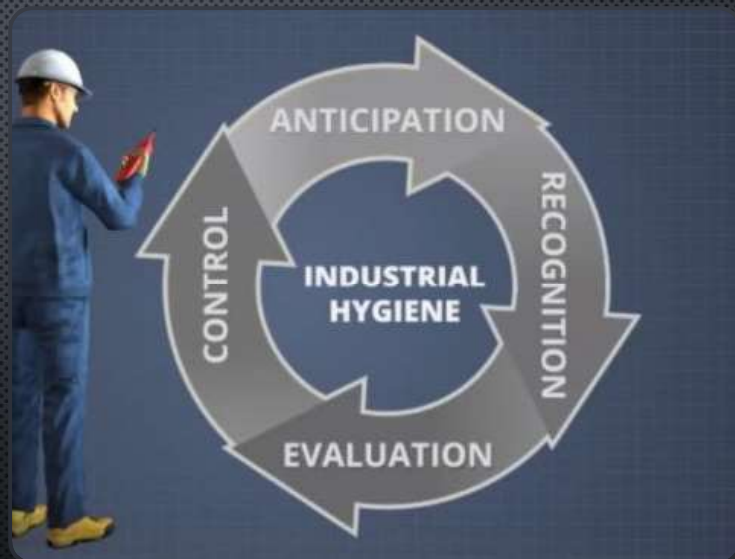
WORKPLACE HAZARD ASSESSMENT – OSHA'S CLARIFICATION

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PERSONAL AIR SAMPLING

- BREATHING ZONE SAMPLE
- **MOST RELIABLE AND ACCURATE METHOD**
- MUST USED VALIDATED METHODS
- REFLECT EXPOSURES OF EMPLOYEES
 - EACH SHIFT
 - EACH JOB CLASSIFICATION
 - EACH WORK AREA W/ REASONABLE POTENTIAL FOR EXPOSURE



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ENVIRONMENTAL SCREENING

- ESTIMATING EMPLOYEE EXPOSURE
- LESS ACCURATE FOR CHARACTERIZING EXPOSURES
- MAY USE DIRECT READING INSTRUMENTATION
- SHOULD DETERMINE WORST-CASE EXPOSURE SCENARIO
- SCREENING EQUIPMENT MUST BE PROPERLY CALIBRATED AND ABLE TO DETECT SUSPECT AIRBORNE HAZARDS



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HISTORICAL DATA

- PREVIOUSLY OBTAINED DATA
- CURRENT CONDITIONS MUST RESEMBLE OLDER DATA CONDITIONS
- MUST REPRESENT THE HIGHEST EXPOSURES LIKELY TO OCCUR
- EMPLOYER MUST DOCUMENT THE USE OF HISTORICAL DATA AS PART OF ITS WRITTEN PROGRAM



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OBJECTIVE DATA

- DATA OBTAINED FROM:
 - INDUSTRY STUDIES
 - TRADE ASSOCIATIONS
 - TESTS CONDUCTED BY CHEMICAL MFG.
- MUST REPRESENT THE HIGHEST EXPOSURES LIKELY TO OCCUR UNDER REASONABLY FORESEEABLE CONDITIONS
 - STORAGE/PROCESSING
 - USE/HANDLING
- EMPLOYER MUST DOCUMENT USE OF OBJECTIVE DATA IN THE WRITTEN PROGRAM



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MATHEMATICAL APPROACHES

- DATA ON PHYSICAL AND CHEMICAL PROPERTIES (SDS)
- ROOM DIMENSIONS
- AIR EXCHANGE RATES IN THE ROOM
- CONTAMINANT RELEASE RATES
- PERTINENT DATA
 - EXPOSURE PATTERNS (END OF SHIFT, CLEAN-UP, MAINTENANCE)
 - **VOLUME (ML) = [CONC.(PPM) X VOL L (CONTAINER) X MOLEC. Wt. X 298°K X P (MMHG)] / [10⁶ X P (DENSITY G/ML) X 24.45L X T°K (ACTUAL TEMP) X 760 MMHG]**

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SAFETY DATA SHEETS

- SUBSTANCE'S HAZARD CLASSIFICATION
- PHYSICAL AND CHEMICAL CHARACTERISTICS
- TOXICOLOGICAL INFORMATION
- GENERAL CONTROL MEASURES
- RECOMMENDATIONS ON APPROPRIATE RESPIRATORY PROTECTION
 - ACUTE TOXICITY INHALATION – **CATEGORY 1**
 - ACUTE TOXICITY INHALATION – **CATEGORY 2**
 - SENSITIZATION RESPIRATORY – **CATEGORY 1 (INCLUDES 1A & 1B)**



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NON-CERTIFIED

NON-CERTIFIED DUST MASK



SURGICAL MASK



Single-strap

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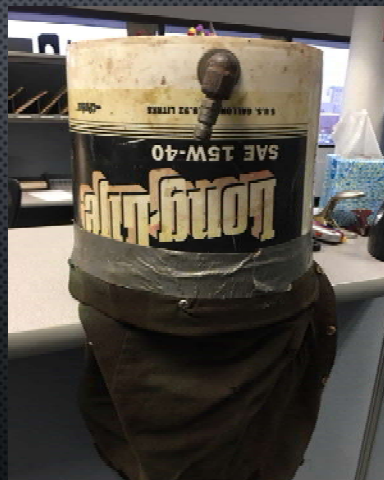


NON-CERTIFIED RESPIRATOR

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NON-CERTIFIED SUPPLIED AIR RESPIRATOR

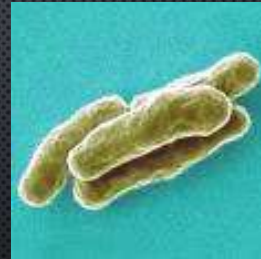


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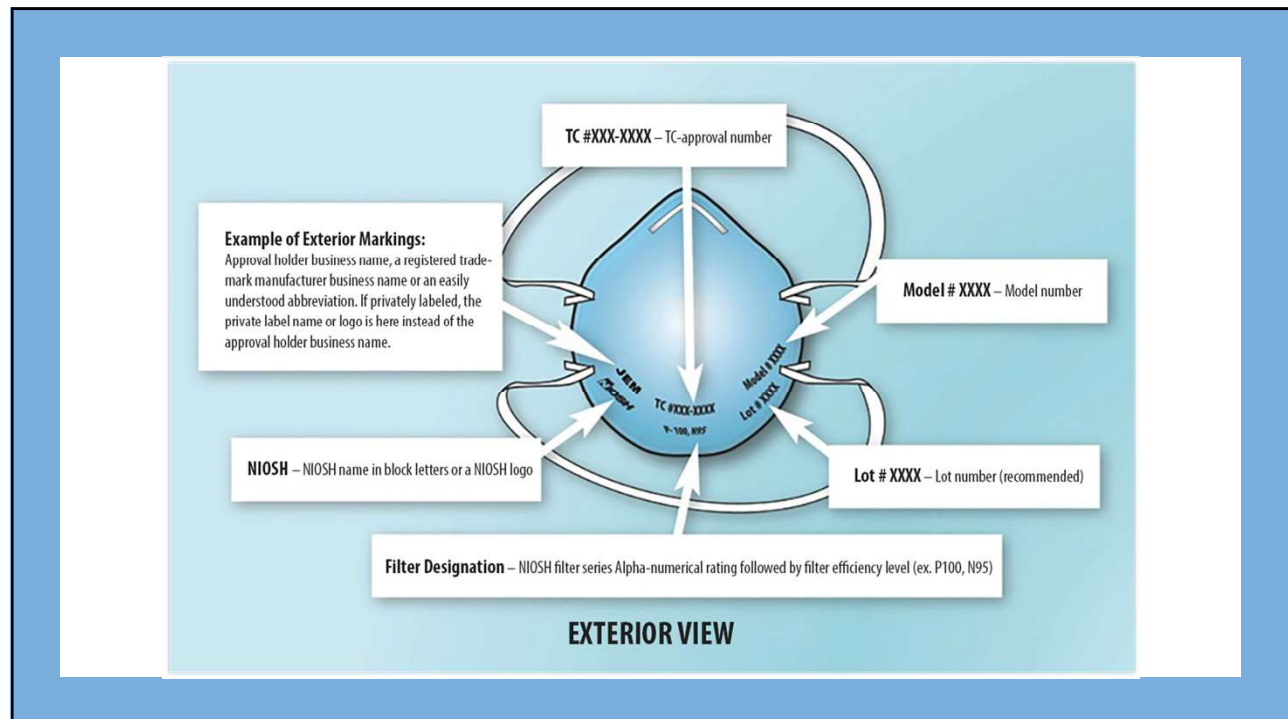
SELECTION FOR M. TUBERCULOSIS (T.B.)

- AIRBORNE TRANSMISSION PRIMARY CONCERN
- 1 – 5 MICRONS IN SIZE
- WORN FOR EMPLOYEE PROTECTION (MANDATORY)
- WRITTEN RESPIRATOR PROGRAM NECESSARY
- ACTIVE/SUSPECT TB CASES
- N-95 FILTERING FACE PIECE OR BETTER
- FIT TEST MANDATORY
- SITE SPECIFIC INFECTION CONTROL PROTOCOL
- STATE DIRECTIVE – GISHD-COM-05-2R5



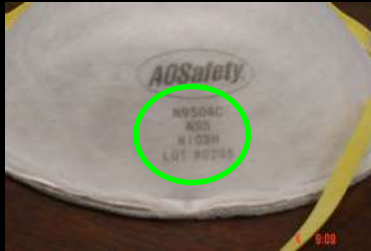
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Examples of Filtering Face Piece Markings



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RESPIRATORS SELECTION FOR IDLH ATMOSPHERES

- APPROVED RESPIRATORS
 - FULL-FACE, PRESSURE DEMAND SCBA - MINIMUM SERVICE LIFE OF 30 MINUTES
 - COMBINATION FULL-FACE PRESSURE DEMAND SAR WITH AUXILIARY SCBA
 - ESCAPE RESPIRATORS — FOR ESCAPE USE ONLY!
- OXYGEN CONTENT AND IDLH ATMOSPHERES
 - < 19.5% O₂ BY VOLUME (OXYGEN DEFICIENT)
 - > 23.5 % O₂ BY VOLUME (OXYGEN RICH)

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RESPIRATORS SELECTION: GASES AND VAPORS (OTHER THAN IDLH)

- ATMOSPHERE-SUPPLYING RESPIRATOR
- AIR-PURIFYING RESPIRATOR
 - END-OF-SERVICE-LIFE INDICATOR (ESLI)
 - IF NO ESLI, THEN IMPLEMENT CHANGE SCHEDULE
- CHANGE SCHEDULE WEBSITE ASSISTANCE:
 - [HTTP://WWW.OSHA.GOV/SLTC/ETOOLS/RESPIRATORY/DECISIONLOGIC/FLOWCHARTV.HTML](http://www.osha.gov/SLTC/ETOOLS/RESPIRATORY/DECISIONLOGIC/FLOWCHARTV.HTML)
- RESPIRATOR MANUFACTURERS WEBSITES



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FACTORS AFFECTING CARTRIDGE LIFE

- EXERTION LEVEL (I.E., BREATHING RATE)
- CARTRIDGE VARIABILITY (I.E., DIMENSIONS)
- TEMPERATURE — HIGH TEMPERATURES REDUCE LIFE
- RELATIVE HUMIDITY
 - ACTIVATED CHARCOAL — ORGANIC VAPORS
- BREAKTHROUGH LEVEL
- MULTIPLE CONTAMINANTS



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GAS & VAPOR

- GAS
 - A FORMLESS FLUID THAT EXPANDS TO OCCUPY THE SPACE OR ENCLOSURE IN WHICH THEY ARE CONFINED
 - CARBON MONOXIDE, OXYGEN, ACETYLENE
- VAPOR
 - VOLATILE FORM OF SUBSTANCES WHICH ARE NORMALLY LIQUID OR SOLID AT ROOM TEMPERATURE AND PRESSURE
 - METHYL ALCOHOL, AMMONIA, TOLUENE



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PARTICULATES

Dusts

Mists

Fumes

Fibers

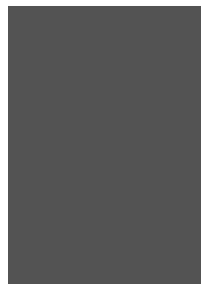
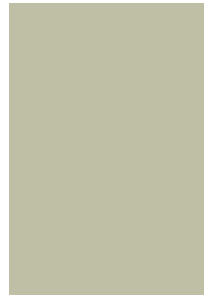
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PARTICULATES – DUSTS

DUST

- SUSPENDED SOLID PARTICLES
- GENERALLY, 0.01 TO 100 MICRONS IN DIAMETER
 - NON-RESPIRABLE (≥ 10 MICRONS)
 - RESPIRABLE (< 10 MICRONS)

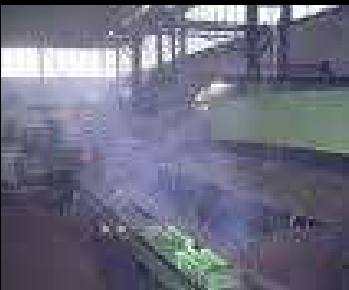


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PARTICULATES: MISTS

MIST

- SUSPENDED LIQUID DROPLETS
- GENERALLY, 0.01 TO 100 MICRONS IN DIAMETER

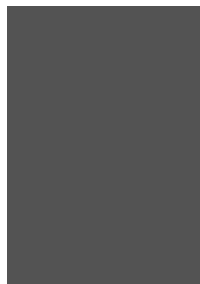
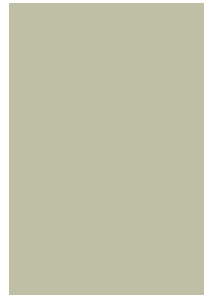


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PARTICULATES: FUMES

FUME

- FORMED WHEN MATERIAL FROM A VOLATILIZED SOLID CONDENSES IN COOL AIR
- GENERALLY, 0.01 TO 1 MICRONS IN DIAMETER



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PARTICULATES: FIBERS

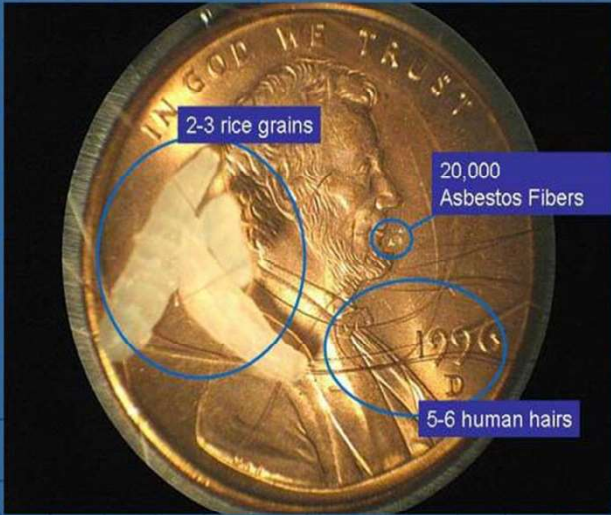
FIBERS

- SOLID PARTICLES HAVING A SLENDER, ELONGATED STRUCTURE WITH A LENGTH SEVERAL TIMES GREATER THAN ITS DIAMETER

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How small is asbestos?



2-3 rice grains

20,000 Asbestos Fibers

5-6 human hairs

2010 ADAO

ADAO
Asbestos Disease Awareness Organization
Voice of the Victim


FIBERS

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ASSIGNED PROTECTION FACTORS (APFS)

- WORKPLACE LEVEL OF RESPIRATORY PROTECTION THAT A RESPIRATOR OR CLASS OF RESPIRATORS IS EXPECTED TO PROVIDE TO EMPLOYEES
- EMPLOYER MUST HAVE A CONTINUING, EFFECTIVE RESPIRATORY PROTECTION PROGRAM



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USE OF APFS

MUST USE APF'S LISTED IN MIOSHA PART 451, TABLE 1 TO SELECT A RESPIRATOR THAT MEETS OR EXCEEDS THE REQUIRED LEVEL OF PROTECTION

IF USING A COMBINATION **RESPIRATOR** (AIRLINE WITH AN AIR-PURIFYING FILTER), MUST ENSURE THAT THE APF IS APPROPRIATE TO THE MODE OF OPERATION FOR HOW THE RESPIRATOR BEING USED



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TABLE 1 – ASSIGNED PROTECTION FACTORS⁵

Respirator Type ^{1, 2}	Quarter Mask	Half Mask	Full Face	Helmet/Hood	Loose-Fitting
Air Purifying	5	³ 10	50	-----	-----
PAPR	-----	50	1,000	⁴ 25/1,000	25
SAR					
■ Demand	-----	10	50	-----	-----
■ Continuous Flow	-----	50	1,000	⁴ 25/1,000	25
■ Pressure Demand/ other (+) pressure	-----	50	1,000	-----	-----
SCBA					
■ Demand	-----	10	50	50	-----
■ Pressure Demand/ other (+) pressure	-----	-----	10,000	10,000	-----

¹ May use respirators assigned for higher concentrations in lower concentrations or when required use is independent of concentration.

² These APF's are only effective when employer has a continuing, effective respirator program per 1910.134.

³ This APF category includes filtering face pieces and elastomeric face pieces.

⁴ Must have manufacturer test evidence to support an APF of 1,000 or else these respirators receive an APF of 25.

⁵ These APFs do not apply to escape-only respirators. Escape respirators must conform to 1910.134(d)(2)(ii) or OSHA's (i.e., MIOSHA's) substance specific standards, if used with those substances.

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Negative Pressure



APF - 10

APF - 10

APF - 50



AIR-PURIFYING RESPIRATORS: ASSIGNED PROTECTION FACTORS

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MAXIMUM USE CONCENTRATIONS (MUCS)

- MAXIMUM ATMOSPHERIC CONCENTRATION OF A HAZARDOUS SUBSTANCE
- FUNCTION OF:
 - APF OF THE RESPIRATOR OR CLASS OF RESPIRATORS AND
 - EXPOSURE LIMIT OF THE HAZARDOUS SUBSTANCE
 - IF NO MIOSHA EXPOSURE LIMIT AVAILABLE
 - DETERMINE BASED ON RELEVANT INFORMATION AVAILABLE AND
 - INFORMED PROFESSIONAL JUDGMENT
- MULTIPLY THE APF BY THE APPLICABLE MIOSHA PERMISSIBLE EXPOSURE LIMIT: $MUC = (APF \times PEL)$
- MUC MAY NOT EXCEED THE IMMEDIATELY DANGEROUS TO LIFE AND HEALTH VALUE FOR A SUBSTANCE

66

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EXAMPLE: USE OF MUC

GOAL

- SELECT RESPIRATOR THAT MAINTAINS EXPOSURE AT OR BELOW THE MUC

SCENARIO

- SUBSTANCE: LEAD (GENERAL INDUSTRY)
- PEL = 0.05 MG/M³, 8-HR TWA, T



$$\begin{aligned}\text{APF} &= 10 \\ \text{MUC} &= \text{APF} \times \text{PEL} \\ &= 10 \times 0.05 \text{ mg/m}^3 \\ &= 0.5 \text{ mg/m}^3\end{aligned}$$



$$\begin{aligned}\text{APF} &= 50 \\ \text{MUC} &= \text{APF} \times \text{PEL} \\ &= 50 \times 0.05 \text{ mg/m}^3 \\ &= 2.5 \text{ mg/m}^3\end{aligned}$$

67

MUCS AND IDLH LEVELS

IF CALCULATED MUC EXCEEDS THE IDLH LEVEL FOR A HAZARDOUS SUBSTANCE, OR THE PERFORMANCE LIMITS OF THE CARTRIDGE OR CANISTER...

MUST SET THE MUC AT THAT LOWER LIMIT

Example – Toluene

PEL = 100 ppm

IDLH = 500 ppm

Full-face PAPR Selected

APF = 1,000

MUC = APF × PEL

= 1,000 × 100 ppm

= 100,000 ppm, but must use 500 ppm



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FILTER/CARTRIDGE SELECTION

- MUST SELECT RESPIRATOR APPROPRIATE FOR THE CHEMICAL STATE AND PHYSICAL FORM OF THE CONTAMINANT
- EXAMPLE: APR FOR EXPOSURE TO SILICA & ACETONE (EXCESSIVE EXPOSURE TO BOTH SUBSTANCES)

Acetone



Silica



Silica and Acetone



69

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CLASS EXERCISE

- SANDING DUST PARTICULATE — WESTERN RED CEDAR
- PERMISSIBLE EXPOSURE LIMIT (PEL) = 2.5 mg/m^3
- NO LOCAL EXHAUST
- AIR MONITORING INDICATES EXPOSURE = 22 mg/m^3
- RESPIRATOR SELECTION = ???
- ANY OTHER ISSUES?



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CLASS EXERCISE

- SPRAY FINISH — XYLENE PAINT THINNER
- PEL = 435 MG/M^3
- SHORT TERM EXPOSURE LIMIT (STEL) = 655 MG/M^3
- SPRAY BOOTH FACE VELOCITY = 30 FPM
- AIR MONITORING RESULTS FOR PEL = 250 MG/M^3
- AIR MONITORING RESULTS FOR STEL = 785 MG/M^3
- RESPIRATOR SELECTION = ???
- ANY OTHER ISSUES?



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CLASS EXERCISE

- SPRAY-ON TRUCK BED LINER APPLICATION
- METHYLENE BISPHENYL ISOCYANATE (MDI) - ORGANIC VAPOR
- CEILING LIMIT = 0.2 MG/M^3 - FIVE-MINUTE EXPOSURE LIMIT
- NO LOCAL EXHAUST VENTILATION
- NO AIR MONITORING RESULTS
- ODOR THRESHOLD $\geq 0.2 \text{ MG/M}^3$
- RESPIRATOR SELECTION = ???
- ANY OTHER ISSUES?



72

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CLASS EXERCISE

- FOUNDRY MOLD DEPARTMENT
- NO LOCAL EXHAUST VENTILATION
- FORMALDEHYDE ACTION LEVEL = 0.5 PPM
- FORMALDEHYDE PEL = 0.75 PPM
- FORMALDEHYDE STEL = 2 PPM
- AIR MONITORING RESULTS = 6 PPM STEL/2 PPM PEL
- CONCENTRATIONS OF 3-5 PPM CAUSE EYE IRRITATIONS
- RESPIRATOR SELECTION = ???
- ANY OTHER ISSUES?



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CLASS EXERCISE

- CONSTRUCTION CONCRETE CUTTING — DRY, OUTDOORS
- SILICA, CRYSTALLINE QUARTZ, RESPIRABLE DUST
- PEL = 0.050 MG/M³
- AIR MONITORING RESULTS = 2.2 MG/M³
- WHAT IS THE BEST RESPIRATOR SELECTION FOR EMPLOYEE PROTECTION?
- VOLUNTARY USE RESPIRATOR OR MANDATORY USE?
- ANY OTHER ISSUES?



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CLASS EXERCISES

- FLOOR FINISHING (STAINING)
- SOLVENT BASES STAIN
- NO LOCAL EXHAUST VENTILATION
- NO AIR MONITORING RESULTS
- WHAT IS THE BEST RESPIRATOR SELECTION FOR EMPLOYEE PROTECTION?
- VOLUNTARY USE RESPIRATOR OR MANDATORY USE?
- ANY OTHER ISSUES?

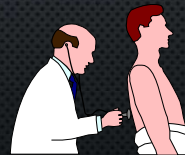


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MEDICAL EVALUATION

- MUST PROVIDE BEFORE FIT TESTING AND USE
- IDENTIFY PHYSICIAN OR OTHER PROFESSIONAL LICENSED HEALTH CARE PROVIDER (PLHCP) TO PERFORM USING
 - MEDICAL QUESTIONNAIRE (APPENDIX C)
 - INITIAL MEDICAL EVALUATION OBTAINING SAME INFORMATION AS MEDICAL QUESTIONNAIRE - FOLLOW-UP EXAM ON POSITIVE RESPONSE TO QUESTIONNAIRE
- FOLLOW-UP MEDICAL EXAM
- WRITTEN RECOMMENDATION



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ADMINISTRATION OF QUESTIONNAIRE

- ADMINISTERED CONFIDENTIALLY
- DURING NORMAL WORKING HOURS (EMPLOYEE CONVENIENT)
- EMPLOYEE MUST UNDERSTAND CONTENTS
- OPPORTUNITY TO DISCUSS WITH PLHCP (PHYSICIAN OR OTHER LICENSED HEALTH CARE PROFESSIONAL)



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SUPPLEMENTAL INFORMATION FOR PLHCP



Information
provided
before
evaluation


Type and
weight of
respirator to
be used


Duration,
frequency of
use (include
rescue/escap
e)


Expected
physical
workload


Additional PPE
and
equipment
worn


Temp and
humidity
extremes


Copy of:

employer's
written respiratory
program
this section of the
standard [(e)(5)]

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MEDICAL DETERMINATION

- OBTAIN A WRITTEN RECOMMENDATION THAT CONTAINS
 - INFORMATION ONLY ABOUT THE EMPLOYEE'S ABILITY TO WEAR A RESPIRATOR
 - ANY LIMITATIONS ON RESPIRATOR USE
 - THE NEED, IF ANY, FOR A FOLLOW-UP MEDICAL EVALUATION
 - STATEMENT THAT PLHCP HAS PROVIDED EMPLOYEE WITH COPY OF WRITTEN RECOMMENDATION
 - NEGATIVE PRESSURE RESPIRATOR THAT MAY CAUSE ADDITIONAL HEALTH ISSUES TO EMPLOYEE = PAPR IF ACCEPTABLE

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MEDICAL EVALUATION - FREQUENCY

- ADDITIONAL EVALUATIONS REQUIRED WHEN
 - EMPLOYEE REPORTS SIGNS OR SYMPTOMS
 - PLHCP, PROGRAM ADMINISTRATOR, OR SUPERVISOR RECOMMENDS
 - INFORMATION FROM THE RESPIRATOR PROGRAM INDICATES A NEED
 - CHANGES IN WORKPLACE CONDITIONS



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FIT TESTING

Must fit test all required use respirators with tight-fitting face pieces

When is a fit test required?

- Required respirators
- Prior to initial use
- Whenever a different respirator face-piece is used
- At least annually thereafter
- Report of changes in physical conditions

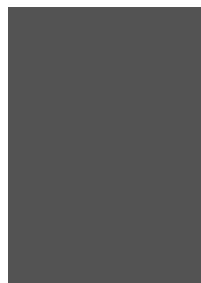
Fit test protocol in Appendix A

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OSHA-ACCEPTED QLFT AND QNFT PROTOCOL - APPENDIX A

- QLFT PROTOCOL (QUALITATIVE)
 - ISOAMYL ACETATE (BANANA OIL)
 - SACCHARIN MIST
 - BITREX™
 - IRRITANT SMOKE
- QNFT PROTOCOL (QUANTITATIVE)
 - GENERATED AEROSOL (CORN OIL, SALT, DEHP)
 - CONDENSATION NUCLEI COUNTER (PORTACOUNT)
 - MODIFIED AMBIENT AEROSOL CONDENSATION NUCLEI COUNTER (CNC) - NEW
 - CONTROLLED NEGATIVE-PRESSURE (DYNATECH FIT TESTER 3000)



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Use irritant smoke in a well ventilated area. High concentrations may cause serious injury. Do not inhale smoke directly.

FIT TEST CAUTION!

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THE FIT TESTING DILEMMA

Qualitative? Quantitative?

84

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FIT TESTING

- HALF-MASK STYLE RESPIRATOR
 - QUALITATIVE, OR
 - QUANTITATIVE
- FULL-FACE STYLE RESPIRATOR
 - QUANTITATIVE
 - QUALITATIVE EXCEPTION

ACCEPTABLE WHEN HAZARD REQUIRES A RESPIRATOR WITH A FIT FACTOR OF 100 OR LESS (HALF-MASK APR), BUT FULL-FACE IS USED

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Which respirators need fit testing?



10x P.F.



10x P.F.



25 – 50x P.F.

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FIT TESTING PROCEDURES

GENERAL REQUIREMENTS

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FIT TESTING - GENERAL

- TEST SUBJECT ALLOWED TO PICK MOST ACCEPTABLE RESPIRATOR.
- SUFFICIENT NUMBER OF RESPIRATOR MODELS AND SIZES.
- MUST BE ACCEPTABLE AND CORRECTLY FIT THE USER.



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FIT TESTING - GENERAL

- PRIOR TO SELECTION:
 - INSTRUCT TEST SUBJECT HOW TO PUT RESPIRATOR ON.
 - HOW IT SHOULD BE POSITIONED ON THE FACE.
 - HOW TO SET STRAP TENSION.
 - HOW TO DETERMINE ACCEPTABLE FIT.
 - A MIRROR SHALL BE AVAILABLE TO ASSIST SUBJECT WITH FIT AND POSITIONING.
 - THIS DOES NOT CONSTITUTE FORMAL TRAINING.

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FIT TESTING - GENERAL

- TEST SUBJECT SHALL BE INFORMED THAT HE/SHE IS BEING ASKED TO SELECT A RESPIRATOR THAT PROVIDES THE MOST ACCEPTABLE FIT.
- EACH RESPIRATOR REPRESENTS A DIFFERENT SIZE AND SHAPE, AND IF FITTED AND USED PROPERLY, WILL PROVIDE ADEQUATE PROTECTION.

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FIT TESTING - GENERAL

- TEST SUBJECT SHALL BE INSTRUCTED TO HOLD EACH CHOSEN FACE-PIECE UP TO THE FACE AND ELIMINATE THOSE THAT OBVIOUSLY DO NOT GIVE AN ACCEPTABLE FIT.
- MORE ACCEPTABLE FACE-PIECES ARE NOTED.
 - IN CASE THE SELECTED MODEL PROVES UNACCEPTABLE.
 - MOST COMFORTABLE WORN AT LEAST FIVE MINUTES.
 - FIVE MINUTES = ASSESS RESPIRATOR COMFORT.

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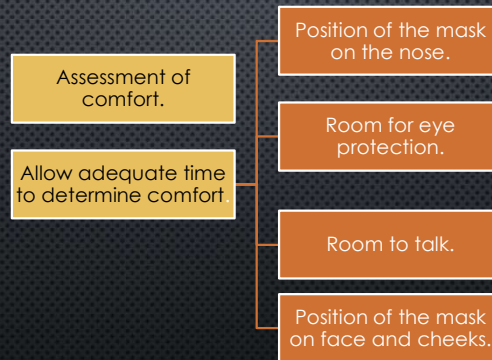
FIT TESTING - GENERAL

- INEXPERIENCED RESPIRATOR WEARER.
 - DON MASK SEVERAL TIMES.
 - ADJUST STRAPS EACH TIME TO BECOME ADEPT AT SETTING PROPER TENSION.
 - PRACTICE, PRACTICE, PRACTICE.

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FIT TESTING - GENERAL



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FIT TESTING - GENERAL

- ADEQUACY OF RESPIRATOR FIT:
 - CHIN PROPERLY PLACED.
 - ADEQUATE STRAP TENSION, NOT OVERLY TIGHTENED.
 - FIT ACROSS NOSE BRIDGE.
 - RESPIRATOR OF PROPER SIZE TO SPAN DISTANCE FROM NOSE TO CHIN.
 - TENDENCY OF RESPIRATOR TO SLIP ON FACE.
 - SELF OBSERVATION IN MIRROR TO EVALUATE FIT AND RESPIRATOR POSITION.

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FIT TESTING - GENERAL

- USER SEAL CHECK.
- EITHER NEGATIVE AND POSITIVE PRESSURE SEAL CHECKS.
- OR THOSE RECOMMENDED BY RESPIRATOR MFG.
- BEFORE PERFORMING PRESSURE SEAL CHECKS:
 - SUBJECT WILL SEAT MASK ON FACE.
 - MOVING THE HEAD FROM SIDE TO SIDE, SLOWLY.
 - MOVING THE HEAD UP AND DOWN, SLOWLY.
 - TAKING IN A FEW SLOW DEEP BREATHS.
- ANOTHER FACE-PIECE SHALL BE SELECTED AND RETESTED IF TEST SUBJECT FAILS THE USER SEAL CHECK TESTS.

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POSITIVE AND NEGATIVE PRESSURE CHECKS

POSITIVE PRESSURE



NEGATIVE PRESSURE



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FIT TESTING - GENERAL

- THE TEST SHALL NOT BE CONDUCTED IF THERE IS ANY HAIR GROWTH BETWEEN THE SKIN AND FACE-PIECE SEALING SURFACE
 - STUBBLE BEARD GROWTH.
 - BEARD.
 - MUSTACHE.
 - SIDEBURNS (A.K.A. MUTTON CHOPS).
 - APPAREL (UNIFORM, COVERALLS, PPE).



A passing fit test with facial hair is not considered compliant with the standard!

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FIT TESTING - GENERAL

- IF TEST SUBJECT EXHIBITS DIFFICULTY BREATHING DURING TEST HE/SHE SHALL BE REFERRED TO A PHYSICIAN OR OTHER PLHCP TO DETERMINE WHETHER TEST SUBJECT CAN WEAR A RESPIRATOR.
- IF EMPLOYEE FINDS FIT OF RESPIRATOR UNACCEPTABLE, THE TEST SUBJECT SHALL BE GIVEN THE OPPORTUNITY TO SELECT A DIFFERENT RESPIRATOR AND TO BE RETESTED.

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FIT TESTING - GENERAL

- EXERCISE PROTOCOL — PRIOR TO FIT TEST.
 - TEST SUBJECT GIVEN DESCRIPTION OF THE FIT TEST AND THE TEST SUBJECT'S RESPONSIBILITIES DURING THE TEST PROCEDURE.
 - DESCRIPTION OF THE TEST EXERCISES THAT WILL BE PERFORMED.
 - RESPIRATOR TO BE FIT TESTED SHALL BE WORN FOR AT LEAST FIVE MINUTES BEFORE START OF THE TEST.

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FIT TESTING – GENERAL EXERCISES

- TEST EXERCISE PROTOCOL — MUST BE PERFORMED
- NORMAL BREATHING.
 - NORMAL STANDING POSITION.
 - WITHOUT TALKING.
 - NORMAL BREATHS FOR ONE MINUTE.
- DEEP BREATHING.
 - NORMAL STANDING POSITION.
 - SUBJECT SHALL BREATHE SLOWLY AND DEEPLY FOR ONE MINUTE.
 - AVOID HYPERVENTILATION.

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FIT TESTING – GENERAL EXERCISES

- TURNING HEAD SIDE TO SIDE.
 - STANDING IN PLACE.
 - SUBJECT SHALL SLOWLY TURN HEAD FROM SIDE TO SIDE.
 - BETWEEN THE EXTREME POSITIONS ON EACH SIDE.
 - HEAD IS HELD MOMENTARILY AT EACH EXTREME POSITION, INHALE AT EACH EXTREME POSITION.
 - PERFORM FOR ONE MINUTE.
- MOVING HEAD UP AND DOWN.
 - STANDING IN PLACE.
 - SLOWLY MOVE HEAD UP AND DOWN FOR ONE MINUTE.
 - INHALE IN THE UP POSITION (LOOKING AT THE CEILING).



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FIT TESTING – GENERAL EXERCISES

- TALKING
 - TALK OUT LOUD AND SLOWLY FOR ONE MINUTE.
 - LOUD ENOUGH TO BE HEARD CLEARLY BY TEST CONDUCTOR.
- SUBJECT CAN READ FROM PREPARED TEXT SUCH AS;
 - RAINBOW PASSAGE
 - COUNT BACKWARDS FROM 100
 - RECITE A MEMORIZED POEM OR SONG

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FIT TESTING – GENERAL EXERCISES

- RAINBOW PASSAGE (FOUND ON PG. 9 OF STD.)
- WHEN THE SUNLIGHT STRIKES RAINDROPS IN THE AIR, THEY ACT LIKE A PRISM AND FORM A RAINBOW. THE RAINBOW IS A DIVISION OF WHITE LIGHT INTO MANY BEAUTIFUL COLORS. THESE TAKE THE SHAPE OF A LONG ROUND ARCH, WITH ITS PATH HIGH ABOVE, AND ITS TWO ENDS APPARENTLY BEYOND THE HORIZON. THERE IS, ACCORDING TO LEGEND, A BOILING POT OF GOLD AT ONE END. PEOPLE LOOK, BUT NO ONE EVER FINDS IT. WHEN A MAN LOOKS FOR SOMETHING BEYOND REACH, HIS FRIENDS SAY HE IS LOOKING FOR THE POT OF GOLD AT THE END OF THE RAINBOW.



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FIT TESTING – GENERAL EXERCISES

- GRIMACE
 - TEST SUBJECT SHALL GRIMACE.
 - SMILE OR FROWN FOR 15 SECONDS.
 - APPLICABLE TO QNFT ONLY (PORTA-COUNT, ETC.)
- BENDING OVER
 - BEND AT WAIST AS IF TO TOUCH TOES FOR ONE MINUTE.
 - JOGGING IN PLACE – SUBSTITUTE FOR WHEN USING SHROUD/HOOD FOR FIT TEST. NO ROOM TO BEND OVER.
- NORMAL BREATHING
 - SAME AS EXERCISE #1.
 - REPEAT – FINAL EXERCISE.



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FIT TESTING - GENERAL

Each test exercise shall be performed for one minute.

Grimace exercises performed for 15 seconds.

Test subject shall be questioned about respirator comfort upon completion of all test protocol.

If unacceptable – another model of respirator shall be tried.

Respirator shall not be adjusted once fit test exercise has started.

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Prohibiting conditions that may result in leakage.



Preventing employees from removing respirators in hazardous environments.



Taking actions to ensure continued respirator effectiveness.



Establishing procedures for IDLH use.

USE OF RESPIRATORS

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USE OF RESPIRATORS

- FACE-PIECE SEAL PROTECTION
 - NO FACIAL HAIR
 - NO INTERFERENCE WITH SEALING SURFACE AND VALVE FUNCTION
 - NO INTERFERENCE BETWEEN PPE USE AND RESPIRATOR
 - USER SEAL (FIT) CHECK PERFORMED EACH TIME A RESPIRATOR WITH A TIGHT-FITTING FACE-PIECE IS DONNED (APPENDIX B-1)

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- CONTINUING RESPIRATOR EFFECTIVENESS
- SURVEY WORK AREA CONDITIONS FOR EMPLOYEE EXPOSURE/STRESS
- EMPLOYER SHALL ENSURE EMPLOYEES LEAVE RESPIRATOR USE AREA:
 - FOR WASHING/CLEAN-UP
 - IF DETECT VAPOR OR GAS BREAKTHROUGH
 - REPLACE RESPIRATOR/FILTER ELEMENTS
 - CHEMICAL BREAKTHROUGH, INCREASE RESISTANCE
 - LEAKS = REPAIR/REPLACE/RE-FIT

USE OF RESPIRATORS

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USE OF RESPIRATORS IDLH ATMOSPHERES

- **EMPLOYER SHALL ENSURE:**
 - ONE EMPLOYEE OR, WHEN NEEDED, MULTIPLE EMPLOYEES ARE LOCATED OUTSIDE IDLH ATMOSPHERE.
 - VISUAL, VOICE, OF SIGNAL LINE COMMUNICATION IS MAINTAINED BETWEEN EMPLOYEES, INSIDE/OUTSIDE.
 - OUTSIDE EMPLOYEES ARE TRAINED AND EQUIPPED TO PROVIDE EFFECTIVE EMERGENCY RESCUE.
 - EMPLOYER/DESIGNEE ARE NOTIFIED BEFORE OUTSIDE EMPLOYEE ENTERS FOR EMERGENCY RESCUE.
 - EMPLOYER/AUTHORIZED DESIGNEE, ONCE NOTIFIED PROVIDES NECESSARY ASSISTANCE APPROPRIATE FOR THE SITUATION.

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USE OF RESPIRATORS IDLH ATMOSPHERES

- **EMPLOYEE(S) LOCATED OUTSIDE ARE EQUIPPED WITH:**
 - PRESSURE DEMAND/POSITIVE PRESSURE SCBA
 - POSITIVE PRESSURE SUPPLIED-AIR RESPIRATOR WITH AUXILIARY SCBA
 - APPROPRIATE RETRIEVAL EQUIPMENT TO REDUCE ADDED ENTRY RISK
 - EQUIVALENT MEANS OF RESCUE WHERE RETRIEVAL EQUIPMENT IS NOT REQUIRED



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STRUCTURAL FIRE FIGHTING

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STRUCTURAL FIRE FIGHTING (2-IN-2-OUT)

- DEFINITIONS...
- ENTRANTS
 - AT LEAST TWO
 - VISUAL OR VOICE CONTACT AT ALL TIMES
- STANDBY PERSONNEL
 - AT LEAST TWO
 - ONE MAY BE ASSIGNED ANOTHER DUTY SO LONG AS CAPABLE OF PROVIDING ASSISTANCE OR RESCUE SERVICES WHEN NEEDED
- USE OF SCBA BY ALL ENTRANTS
- TWO-IN-TWO-OUT DOES NOT PREVENT PERFORMANCE OF EMERGENCY RESCUE ACTIVITIES PRIOR TO A TEAM BEING ASSEMBLED

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INCIPIENT STAGE FIRE

- PART 73 - GENERAL INDUSTRY SAFETY STANDARD FOR FIRE BRIGADES.
- "A FIRE WHICH IS IN THE INITIAL OR BEGINNING STAGE AND WHICH CAN BE CONTROLLED OR EXTINGUISHED BY PORTABLE FIRE EXTINGUISHERS, CLASS II STANDPIPE, OR SMALL HOSE SYSTEM."



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INTERIOR STRUCTURAL FIRE FIGHTING

- PART 73 - GENERAL INDUSTRY SAFETY STANDARD FOR FIRE BRIGADES.
- "THE PHYSICAL ACTIVITY OF FIRE SUPPRESSION OR RESCUE, OR BOTH, INSIDE OF BUILDINGS OR ENCLOSED STRUCTURES WHICH ARE INVOLVED IN A FIRE SITUATION BEYOND THE INCIPIENT STAGE."
- BUILDING WALLS ARE ON FIRE!

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KEY DECISIONS

- IS FIRE BEYOND THE INCIPIENT STAGE?
- IS OCCUPANT RESCUE NECESSARY PRIOR TO ASSEMBLING MANPOWER FOR TWO-IN-TWO-OUT?
- HOW HAVE WE ADDRESSED LOGISTICS FOR COMPLYING WITH TWO-IN-TWO-OUT?
- HAVE SOPs AND TRAINING BEEN ESTABLISHED/PROVIDED REGARDING TWO-IN-TWO-OUT?

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MAINTENANCE AND CARE OF RESPIRATORS

- THE EMPLOYER SHALL PROVIDE RESPIRATORS THAT ARE CLEAN, SANITARY, AND IN GOOD WORKING ORDER.
- APPENDIX B-2, OR
- EQUALLY EFFECTIVE MANUFACTURER'S PROCEDURES
- FREQUENCY
 - AS OFTEN AS NECESSARY – SANITARY CONDITION
 - PRIOR TO USE BY ANOTHER PERSON ON MULTI-USER RESPIRATORS
 - AFTER EACH USE FOR
 - EMERGENCY USE RESPIRATOR
 - THOSE USED FOR FIT TESTING AND TRAINING



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MAINTENANCE AND CARE OF RESPIRATORS - CONTINUED

- **STORAGE**
 - PROTECT FROM DAMAGE, CONTAMINATION, DEFORMATION
 - EMERGENCY RESPIRATORS (COMPARTMENTS)
- **INSPECTION**
 - ROUTINE USE - BEFORE EACH USE/DURING CLEANING
 - EMERGENCY - PERFORMED MONTHLY AND DOCUMENTED
 - EMERGENCY ESCAPE - BEFORE CARRIED INTO WORKPLACE FOR USE
- **REPAIRS**
 - PROPERLY TRAINED PERSON
 - NIOSH-APPROVED PARTS (SAME-FOR-SAME)
 - ATMOSPHERE SUPPLYING - MANUFACTURER OR TRAINED TECH



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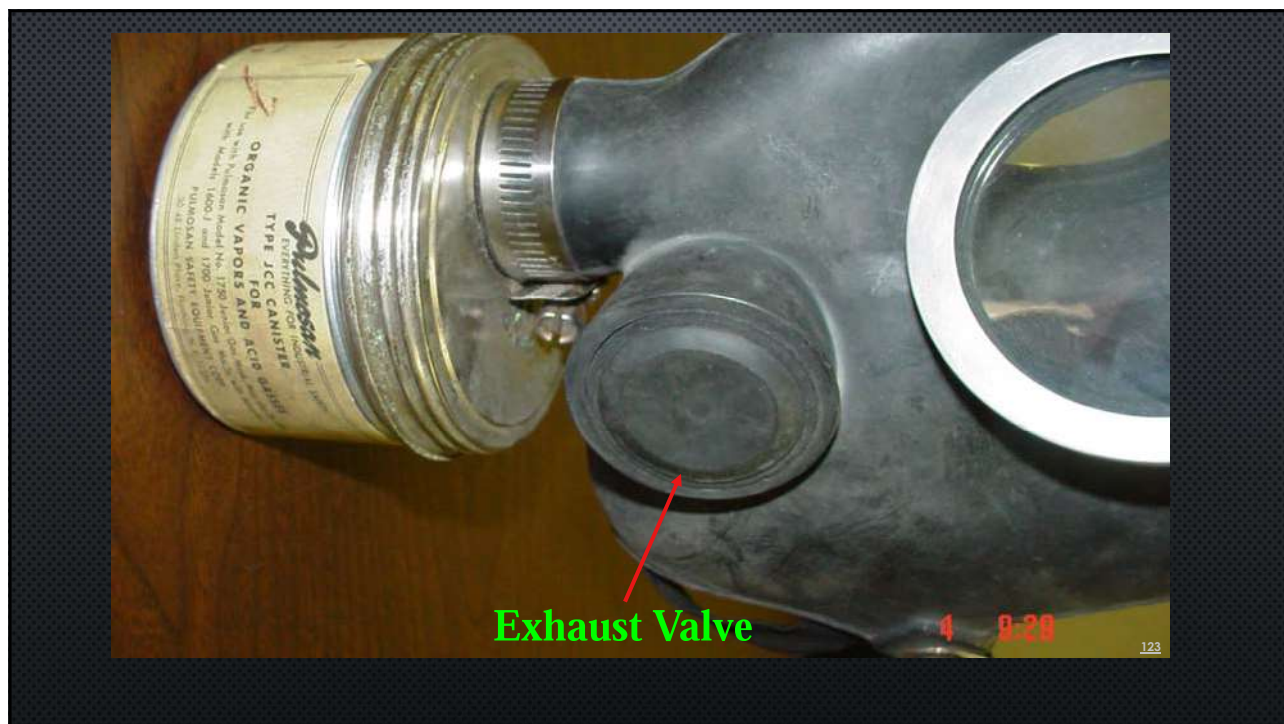
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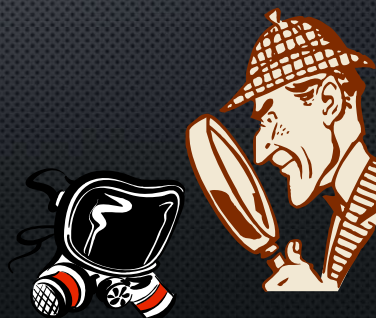
CLASS EXERCISE

INSPECT ASSIGNED RESPIRATOR FOR POTENTIAL PROBLEMS.

DISASSEMBLE THE PROVIDED RESPIRATOR FOR FINAL INSPECTION.

RE-ASSEMBLE THE RESPIRATOR.

NOTE ANY DEFICIENCIES FOUND!



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SELF-CONTAINED BREATHING APPARATUS (SCBA)

- INSPECT MONTHLY
- AIR/OXYGEN CYLINDERS AVAILABLE FOR IMMEDIATE USE
- NOT TO BE BELOW 90% OF MFG. RECOMMENDED LEVEL
- ACTIVATE REGULATOR AND LOW-PRESSURE WARNING DEVICE
- EMERGENCY USE DOCUMENTATION:
 - DATE OF INSPECTION
 - NAME OF INSPECTOR
 - INSPECTION FINDINGS, ANY ACTION REQUIRED
 - SERIAL NUMBER OR OTHER ID OF RESPIRATOR
 - RETAIN INFORMATION
 - TAGS ARE ACCEPTABLE



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WHAT'S WRONG WITH THIS PICTURE?



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WHAT'S
WRONG
WITH THIS
PICTURE?

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WHAT'S
WRONG
WITH THIS
PICTURE?



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WHAT'S
WRONG
WITH THIS
PICTURE?

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BREATHING AIR QUALITY

- REQUIREMENTS WRITTEN INTO STANDARD
- TYPE 1-GRADE D - ANSI/CGA COMMODITY SPECIFICATION FOR AIR, G-7.1-1989
- CYLINDER REQUIREMENTS
- COMPRESSOR REQUIREMENTS
 - SORBENT BEDS AND FILTERS
 - TAG (DATE OF CHANGE AND SIGNATURE)
 - NON-OIL LUBRICATED - CARBON MONOXIDE (CO) CONTENT
 - OIL-LUBRICATED -HIGH TEMPERATURE OR CO ALARM OR BOTH
- INCOMPATIBLE BREATHING AIR COUPLINGS

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GRADE D BREATHING AIR

- PERCENT O₂: 19.5 – 23.5%, BALANCE PREDOMINANTLY N₂
- OIL (CONDENSED IN MG/M³): ≤5 MG/M³
- CARBON MONOXIDE: ≤10 PPM
- CARBON DIOXIDE: ≤ 1000 PPM
- ODOR: PRESENCE OF A PRONOUNCED ODOR SHOULD RENDER THE AIR UNSATISFACTORY.

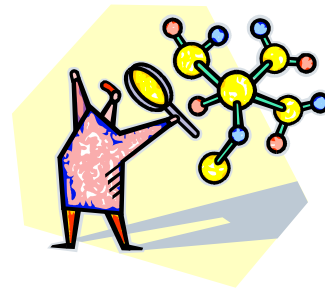


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CONFIRMING GRADE D AIR

- ANALYTICAL REPORT FROM SUPPLIER (BOTTLED GAS)
 - CERTIFICATES OF ANALYSIS
- FILTER CHANGE-OUT FOR SUPPLIED AIR SYSTEMS
- COMPRESSOR LOCATION
 - COMBUSTION EXHAUST FROM VEHICLES/COMPRESSOR
 - PLANT PROCESS EXHAUST
 - CONTAMINATED AIR FROM HAZARDOUS WORK AREAS
 - FREQUENT TESTING



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NON-OIL LUBRICATED COMPRESSORS

- LOCATING THE COMPRESSOR'S INTAKE IN AREA FREE OF CONTAMINANTS.
- CONDUCTING CONTINUOUS OR FREQUENT MONITORING OF THE AIR SUPPLY.
- MAINTAIN SORBENT BEDS AND FILTERS — NOTE CHANGE DATE ON TAG WITH PERSON'S SIGNATURE
- ENSURE CARBON MONOXIDE LEVELS DO NOT EXCEED 10 PPM.



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OIL LUBRICATED COMPRESSORS

- CARBON MONOXIDE AND/OR HIGH TEMPERATURE ALARMS PERMITTED BY PART 451.
- CARBON MONOXIDE GENERATED WHEN OIL ENTERS COMBUSTION CHAMBER AND IS PARTIALLY COMBUSTED.
 - ISSUE W/ OLDER COMPRESSORS.
 - PISTON RING/CYLINDER WEAR.
- CARBON MONOXIDE (CO) ALARMS WORK BETTER THAN HIGH-TEMP ALARMS.
 - HIGH-TEMP ALARMS DETECT ONLY IN COMBUSTION CHAMBER, NOT CO IN THE PLANT'S ATMOSPHERE (POOR INTAKE LOCATION).
 - HIGH TEMP ALARMS DESIGNED TO PROTECT COMPRESSOR.

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OIL LUBRICATED COMPRESSORS:



Non-Oil Lubricated Compressors:



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IDENTIFICATION OF FILTERS, CARTRIDGES, AND CANISTERS

- NIOSH-APPROVED FILTERS, CARTRIDGES/CANISTERS
- LABELED AND COLOR CODED WITH NIOSH-APPROVED LABEL
- LABEL
 - MUST NOT BE REMOVED
 - MUST REMAIN LEGIBLE
 - ENSURES PROPER SELECTION



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SOME EXAMPLES

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TRAINING AND INFORMATION

- MUST PROVIDE EFFECTIVE TRAINING
- REQUIRED PRIOR TO USE
- RETRAINING REQUIRED ANNUALLY (REQUIRED USE) AND WHEN
 - WORKPLACE CONDITIONS CHANGE
 - NEW TYPES OF RESPIRATORS ARE USED
 - INADEQUACIES IN EMPLOYEE'S KNOWLEDGE OR USE INDICATES NEED
- PROVIDE APPENDIX D ADVISORY INFORMATION FOR COMFORT RESPIRATOR USERS — POSTING APP D NOT CONSIDERED ADEQUATE BY OSHA/MIOSHA



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TRAINING AND INFORMATION - THE EMPLOYER SHALL ENSURE THE EMPLOYEE CAN DEMONSTRATE:

- WHY THE RESPIRATOR IS NECESSARY AND HOW IMPROPER FIT, USE, OR MAINTENANCE CAN COMPROMISE THE PROTECTIVE EFFECT OF THE RESPIRATOR
- LIMITATIONS AND CAPABILITIES
- USE IN EMERGENCY SITUATIONS
- HOW TO INSPECT, PUT ON AND REMOVE, USE AND CHECK THE SEALS
- PROCEDURES FOR MAINTENANCE AND STORAGE
- RECOGNITION OF MEDICAL SIGNS AND SYMPTOMS THAT MAY LIMIT OR PREVENT EFFECTIVE USE
- GENERAL REQUIREMENTS OF THE STANDARD

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WHAT'S WRONG WITH THESE PICTURES?

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WHAT'S
WRONG
WITH THIS
PICTURE?

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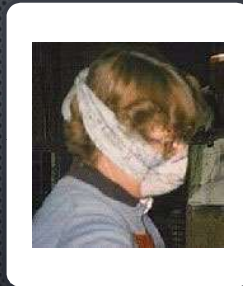
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WHAT'S
WRONG
WITH THIS
PICTURE?

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WHAT'S WRONG WITH THESE PICTURES?

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PROGRAM EVALUATION

- CONDUCTED AS NECESSARY
- REGULARLY CONSULT EMPLOYEES
- ASSESS
 - ✓ TYPE/EXTENT OF EXISTING HAZARDS
 - ✓ TYPES OF RESPIRATORS USED
 - ✓ NUMBER OF EMPLOYEES USING RESP.
 - ✓ EXPERIENCE OF RESPIRATOR WEARERS



- ✓ RESPIRATOR FIT
- ✓ APPROPRIATE SELECTION
- ✓ PROPER USE
- ✓ PROPER MAINTENANCE

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RECORDKEEPING

- MEDICAL EVALUATIONS - DURATION OF EMPLOYMENT PLUS 30 YEARS
- FIT TEST - UNTIL THE NEXT FIT TEST
- WRITTEN COPY OF CURRENT PROGRAM

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APPENDICES

- APPENDIX A
FIT TESTING PROCEDURES
- APPENDIX B - 1
USER SEAL CHECK PROCEDURES
- APPENDIX B - 2
RESPIRATOR CLEANING PROCEDURES
- APPENDIX C
OSHA RESPIRATOR MEDICAL EVALUATION QUESTIONNAIRE
- APPENDIX D
INFORMATION FOR EMPLOYEES USING RESPIRATORS WHEN NOT REQUIRED UNDER THE STANDARD

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ANY QUESTIONS?



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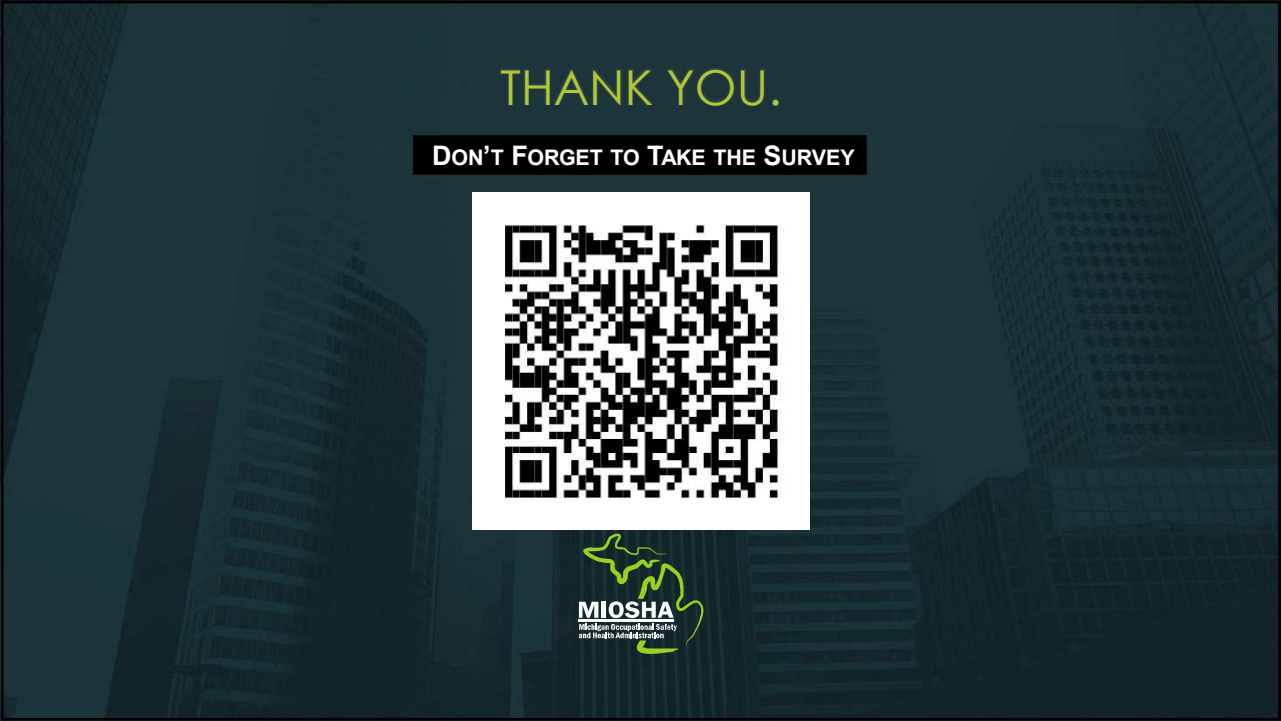
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ASSESSMENT

- THE PURPOSE OF THIS ASSESSMENT IS TO VALIDATE THE KNOWLEDGE LEARNED IN CLASS.
- PASSING SCORE OF 70% CORRECT IS REQUIRED.
- CLASS REFERENCE MATERIALS/BOOKS ARE NOT ALLOWED TO BE USED DURING THE TEST.
- COLLABORATION/DISCUSSION WITH OTHERS IS NOT ALLOWED DURING THE TEST.
- ANSWERS WILL BE REVIEWED AFTER EVERYONE COMPLETES AND SUBMITS THEIR TEST.

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Part 451. Respiratory Protection

Student Resources

MIOSHA Standards:

[Part 451. Respiratory Protection](#)

MIOSHA Publications:

[MIOSHA-Sample Written Program .pdf](#)

[Respiratory Protection \(Fire Department Sample Written Plan\)](#)

MIOSHA Instructions:

[Tuberculosis \(GISHD-COM-5-2\)](#)

"S:\Public\Agency Instructions and Memos\Agency Instructions\Respiratory Protection Standard Part 451 Enforcement Policies.docx"



Respiratory
Protection Standard

Other Resources:

<https://www.osha.gov/tuberculosis>



Michigan Department of Labor and Economic Opportunity
Michigan Occupational Safety and Health Administration
Consultation Education and Training Division
525 W. Allegan St., P.O. Box 30643
Lansing, Michigan 48909-8143

For further information or to request consultation, education and training services
call 517-284-7720

or

visit our website at www.michigan.gov/miosha

www.michigan.gov/leo

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