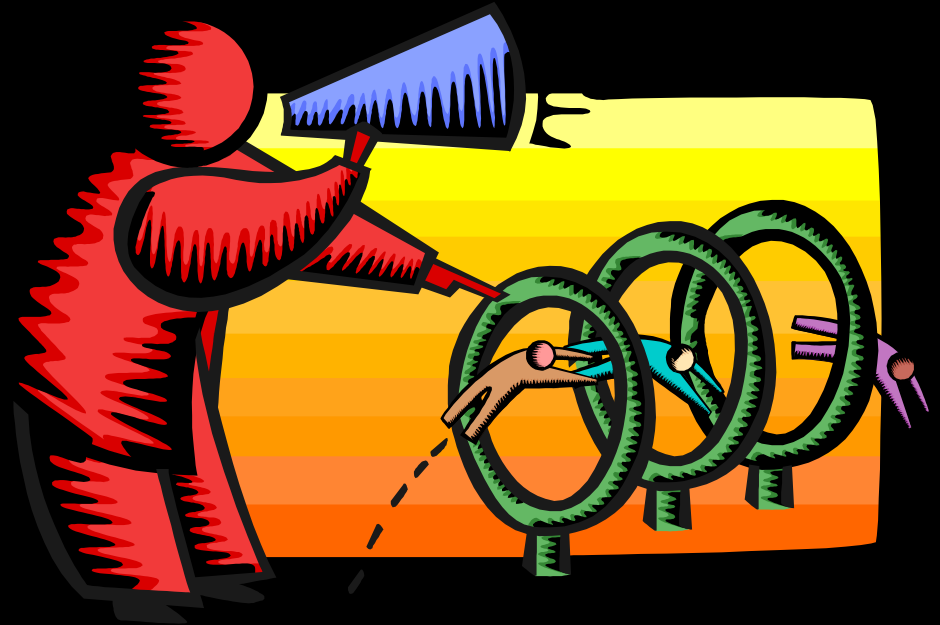


# Worker Hazards and Worker Exposure



Bruce Snead – MURC at Kansas State  
University

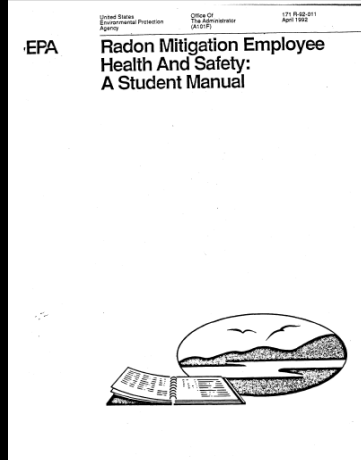
# U.S. Background

- U.S. EPA-based radon mitigation training has been designed around a set of defined competencies developed by EPA in 1989
  - Other than monitoring worker radon exposure, ***the worker health and safety competencies have been very limited***
    - U.S. EPA *Radon Mitigation Standards* and ASTM 2121 reflected these ***limited worker health and safety competencies***
    - U.S. EPA 1992 *Radon Mitigation Employee Health and Safety: Student Manual* goes into greater detail and is described on the next page
- Radon training and standards also are very limited in attention to occupant health and safety ~ mitigation

# Radon Mitigation Employee Health and Safety: Student Manual

[nepis.epa.gov/Exe/ZyNET.exe](http://nepis.epa.gov/Exe/ZyNET.exe)

- The MURC Director co-authored this manual
  - 45 pages
  - Table of Contents (major sections only)
    - I. Overview and Introduction
    - II. Respiratory Hazards and Protection in Radon Mitigation Work  
(need, selection, inspection procedures, facefit checks, fit-test, cleaning, maintenance, cartridge change, physical examination, documentation)
    - III. Monitoring Worker Radon Exposure
    - IV. Safe Mitigation Practices  
(radiation, noise and hearing conservation, asbestos, electrical safety, eye safety)
    - V. Hazard Communication and Chemical Safety



# Hazards: A lot of Critical Info Beyond U.S. Radon Mitigation Standards!

## Standards Partially Addresses:

- **Chemical** Hazards and Safety
- **Electrical** Hazards and Safety
- **Fire** Hazards and Safety
- **Respiratory** Hazards and Protection
  - Asbestos and Radon and RDPs
- **Slips, Trips, and Fall** Hazards

## Standards Do NOT Address:

- **Confined Space** Hazards and Safety
- **Driving** Hazards and Safety
- **Ergonomic** Safety
- **Eye, Face, Foot and Hand** Hazards and Protective Clothing
- **Heat and Thermal** Hazards and Safety
- **Lead** Hazards and Protection
- **Noise** Hazards and Hearing Protection
- **Tool** Safety

# EPA Radon Mitigation Standards

So what did the U.S. Radon Mitigation Standards say about worker health and safety?

- **Must (aka shall) comply with OSHA standards**<sup>1</sup>
- Unless a sole proprietor, contractor
  - **Must advise workers of hazards of exposure to radon**<sup>1</sup>
  - **Must have a worker protection plan** that is available to all workers<sup>2</sup>
  - **Must ensure ladders are safely installed and used**<sup>2</sup>
- **Electrical equipment**
  - **Must be grounded and circuits should be GFI protected**<sup>3</sup>

---

<sup>1</sup> EPA and AARST RMS as well as ASTM

<sup>2</sup> EPA and AARST RMS only

<sup>3</sup> EPA RMS only

# EPA Radon Mitigation Standards

- If combustible materials are present and work may produce a flame,
  - Must provide a suitable fire extinguisher in the work area<sup>2</sup>
- Must ventilate work areas<sup>1</sup> to reduce worker exposure to Radon decay products (more in later slides), Dust, and Other airborne pollutants

---

<sup>1</sup> EPA and AARST RMS as well as ASTM

<sup>2</sup> EPA RMS only

# EPA Radon Mitigation Standards

- In areas where it is suspected that **friable asbestos** may exist and be disturbed,
  - **Must not proceed with mitigation until a trained and certified determines the work will comply with asbestos regulations**<sup>1</sup>
- Where **sealants, adhesives, paints or other substances are used which may be hazardous, contractors**
  - **Must provide MSDS and explain the required safety procedures**<sup>1</sup>
- Also, all standards require monitoring worker radon exposure which will be described later in this unit

---

<sup>1</sup> EPA and AARST RMS as well as ASTM

# Sample Worker Health and Safety Plan

[www.elibrary.dep.state.pa.us/dsweb/View/Collection-9112](http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-9112)

- Permanent record required
- Must follow OSHA
- Training required
- Safety equipment must be available
- Worker protection plan required with annual review
- Electrical and ladder requirements
- Must vent work space
- Fire extinguisher required
- Worker exposure must be recorded

## 2.6 MITIGATION WORKER HEALTH AND SAFETY PLAN

\_\_\_\_\_  
Name of Certified Firm (if applicable)

\_\_\_\_\_  
Name of Certified Mitigation Individual

This worker protection plan will be kept on file and available at all times. Although this plan contains specific safety recommendations it cannot address all the safety concerns associated with mitigation installation. The user has responsibility for establishing appropriate safety practices.

Permanent records of exposure will be maintained. The attached *Example of Radon Exposure Tracking Record* or equivalent will be used.

All OSHA, state, and local standards or regulations relating to worker safety and occupational radon exposure will be followed.

If applicable, employees will be trained on the hazards of exposure to radon and given guidance on maintaining exposure as low as reasonably achievable. This training will be documented.

Appropriate safety equipment such as hard hats, face shields, ear plugs, and protective gloves will be available on the job site during cutting, drilling, grinding, polishing, demolishing, or other hazardous activity associated with radon mitigation projects. (If there are employees, all new employees will be informed about all relevant portions of the company worker protection plan.) All relevant portions of the worker protection plan will be reviewed with each employee at least once a year. Confirmation of employees' knowledge of relevant portions of the worker protection plan will be recorded with the employees' signature and date.

All electrical equipment used during radon mitigation projects will be properly grounded. Circuits used as a power source should be protected by Ground-Fault Circuit Interrupters (GFCI).

When work is required at elevations above the ground or floor, all ladders or scaffolding will be safely installed and operated.

Work areas will be ventilated to reduce worker exposure to radon decay products, dust, or other airborne pollutants. In work areas where premitigation levels have been greater than 0.33 WL (66 pCi/L), fan(s) should blow outside air into the basement. If a fan is not available or weather conditions do not permit use of a fan then opening appropriate windows to provide cross-ventilation should be tried. Where ventilation is impractical or where ventilation cannot reduce decay product levels to less than 0.33 WL (66 pCi/L) (based on a short-term test), respiratory protection conforming with the requirements in the NIOSH Guide to Industrial Respiratory Protection will be provided at the job site.

Where combustible materials exist in the specific area of the building where radon mitigation work is to be conducted and temperatures are high enough to induce a flame, a fire extinguisher suitable for type A, B, and C fires will be available in the immediate work area.

Radon exposure at each work site will be recorded based on: (1) the highest premitigation indoor radon or working level measurement available, and (2) the time exposed (without respirator protection) at that level. The 4 working level months (WLM) over a 12 month period exposure limit will not be exceeded. (An equilibrium radon of 50 percent shall be used to convert radon exposure to WLM.)



# Sample Worker Health and Safety Plan

[www.elibrary.dep.state.pa.us/dsweb/View/Collection-9112](http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-9112)

2900-FM-RP0010o Rev. 12/2010



COMMONWEALTH OF PENNSYLVANIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
BUREAU OF RADIATION PROTECTION

## 2.7 EXAMPLE OF RADON EXPOSURE TRACKING RECORD

Name \_\_\_\_\_ Month(s) \_\_\_\_\_

Company Name \_\_\_\_\_

Employee ID Number \_\_\_\_\_ Year \_\_\_\_\_

Date	Job Site or Number	Radon Level (pCi/L)	Working Level (WL)	Hours of Exposure (HR)	Working Level (WLM)	Cumulative Exposure <sup>(1)</sup> (WLM)	Method Used to Assess Exposure <sup>(2)</sup>	Serial Number	Supervisor Initials
_____	_____	_____	+200= _____	X _____	+170= _____	_____	_____	_____	_____
_____	_____	_____	+200= _____	X _____	+170= _____	_____	_____	_____	_____
_____	_____	_____	+200= _____	X _____	+170= _____	_____	_____	_____	_____
_____	_____	_____	+200= _____	X _____	+170= _____	_____	_____	_____	_____
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_____	_____	_____	+200= _____	X _____	+170= _____	_____	_____	_____	_____

1. Based upon an annual recommended health and safety limit of 4 working level months (WLM)  
WL =  $\frac{\text{pCi/L}}{200}$  (Assuming 50% ER)

2. Highest Premitigation Level (a)  
On-Site Measurement (b)

This documentation is not required to be submitted but must be available for review as part of the Department's inspection program.



# What's the Research? NIOSH Radon Mitigation Worker Exposure Study –



(Bloom, 1996)

- The National Institute for Occupational Health and Safety Institute (NIOSH) **studied occupational exposures of mitigation workers in 21 job sittings**
  - **Equivalent radon decay product exposures in 2 sites with 95 and 192 pCi/L exceeded NIOSH's Recommended Exposure Limit (REL) of 1 Working Level Month if experienced 40 hours per week over a year**
  - **These findings reinforce the need for adequate ventilation of the mitigation work area**

# NIOSH Radon Mitigation Worker Exposure Study

(Bloom, 1996)



- Mitigation workers may be exposed to elevated noise during drilling, hammer drilling, chiseling, and vacuuming
- The standards for noise for 8 hours of continuous exposure are:
  - NIOSH Recommended Exposure Limit (REL) for exposure to noise is 85 decibels (dBA)
    - One hour NIOSH REL is 100 dBA
  - OSHA Permissible Exposure Level (PEL) limits exposure to 90 dBA
    - One hour OSHA PEL is 105 dBA
- In the NIOSH study of 21 mitigation jobs, short-term exposure to noise ranged from 99 to 112 dBA
  - Ear (hearing) protection would preclude hearing loss

# Typical Decibel (dBA) Levels

[www.sengpielaudio.com/TableOfSoundPressureLevels.htm](http://www.sengpielaudio.com/TableOfSoundPressureLevels.htm) and

[www.brandontoolhire.co.uk/safety/vibration/downloads/eav/media/pdf/Brandon EAV Power Tools V1 03 11b.pdf](http://www.brandontoolhire.co.uk/safety/vibration/downloads/eav/media/pdf/Brandon_EAV_Power_Tools_V1_03_11b.pdf)



<b>Tools</b>	<b>dBa</b>
Drills, Cordless	70 - 89
Drills, Percussion	<b>99</b>
Drills, Hammer	89- <b>108</b>
Drills, Dry Diamond	<b>94</b>
Saws, Circular Wood	80- <b>108</b>
Saws, Jig	73-85
Saws, Reciprocating	83-88
<b>Reference Levels</b>	
Threshold of pain	130
<b>OSHA 1 Hour Permissible Exposure Level</b>	<b>105</b>
<b>NIOSH 8 Hour Recommended Exposure Level</b>	<b>85</b>

# NIOSH Radon Mitigation Worker Exposure Study

(Bloom, 1996)



- Organic solvents from glues and sealants used in mitigation observed during the NIOSH study contained:
  - Acetone ..... Narcosis (unconsciousness), eye irritation
  - Methyl Ethyl Ketone ..... Sensory irritation
  - Tetrahydrofuran ..... Narcosis, systemic (whole body) effects
- Maximum organic vapor concentrations, sampled from ½ to 4 hours:

Chemical	Maximum Measured	NIOSH REL		OSHA PEL
		TWA	STEL	TWA
Methyl Ethyl Ketone	67 ppm	200 ppm	300 ppm	200 ppm
Acetone	23 ppm	250 ppm	- - -	1,000 ppm
Tetrahydrofuran	32 ppm	200 ppm	250 ppm	200 ppm

- TWA = time weighted average as measured over an 8 hour day
- STEL = short-term exposure limit as measured over a 15 minute sampling period
- ppm = parts per million

# Chemical Hazards and Safety

(29 CFR 1910 Subpart Z – Toxic and Hazardous Substances)



## ■ Objective

- Prevent toxic exposure to workers

## ■ Specification

- The least toxic suitable material will be chosen
- Hazards associated with

- |                        |  |
|------------------------|--|
| ○ Contaminated drywall | ○ Defective or improperly used respirators and Personal Protective Equipment (PPE) |
| ○ Fibers               |  |
| ○ Insulation           |  |
| ○ Foams                | ○ Sealants   |
| ○ Lead                 | ○ VOCs   |

... will be eliminated

# Chemical Safety: What's a Contractor

## Required to Do? (U.S. EPA 1992 *Radon Mitigation Employee Health and Safety: Student Manual*)

- All employees who may be exposed to hazardous chemicals need to be trained in the dangers of the chemicals and the precautions they are to take
- There are **four major elements of compliance required** by the Hazardous Communication Standard
  1. **Material Safety Data Sheets (MSDSs)**
    - You must have an MSDS for each hazardous substance you use
    - The MSDSs must be available at to each employee at each jobsite
  2. **Labels** (e.g., portable containers)
    - All hazardous substance containers must be clearly labeled
  3. **Employee training**
  4. **Written Hazard Communication Plan**
    - A description of all activities in the previous three steps including a list of all hazardous substances used on the job as well as MSDSs

For more information, see: [www.osha.gov/dsg/hazcom/index.html](http://www.osha.gov/dsg/hazcom/index.html)

# Chemical Safety: SDS Example for a Brand of Polyurethane Caulk (page 1 of 3) – FYI

- Options?
  - Substitute product?
  - Ventilate workspace
  - Use NIOSH approved respirator
  - Wear safety glasses
  - Minimize skin contact
  - Do not ingest
  - Wash hands after handling



### 1. PRODUCT AND COMPANY IDENTIFICATION

**PRODUCT NAME:** 3300 Colors

**DISTRIBUTOR**

Geocel, LLC  
PO Box 398  
Elkhart, IN 46515-0398  
Product Stewardship: 574-264-0645

**24 HR. EMERGENCY TELEPHONE NUMBERS**

ChemTel - 800-255-3924

### 2. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW**

**IMMEDIATE CONCERNS:** CAUTION! May cause eye and skin irritation. May be harmful if swallowed.

**POTENTIAL HEALTH EFFECTS**

**EYES:** Contact may cause eye irritation.

**SKIN:** May cause moderate irritation. Repeated skin contact may cause sensitization or allergic skin reaction

**INGESTION:** Substance may be harmful if swallowed.

**INHALATION:** Possible respiratory irritant and potential respiratory sensitizer.

**SIGNS AND SYMPTOMS OF OVEREXPOSURE**

**EYES:** Causes eye irritation.

**SKIN:** Irritation of the skin.

**INGESTION:** Ingestion of this material can cause mouth, throat, esophageal, and gastrointestinal tract irritation.

**INHALATION:** This product may be a respiratory irritant and potential respiratory sensitizer.

**TARGET ORGAN STATEMENT:** The eyes, lungs and skin may be targeted and damaged by components of the product.

**HEALTH HAZARDS:** This product contains Methylene Diphenyl Isocyanate (MDI) which is a potential skin sensitizer. Risk to your health depends on duration and concentration of exposure.

**COMMENTS:** Signs and symptoms of overexposure to this product include headache, irritation of upper respiratory tract, asthmatic symptoms, chest tightness, breathing difficulty, coughing, dizziness, weakness, fatigue, eye irritation, skin irritation, diarrhea.

### 3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS	EINECS
Methylene Diphenyl Isocyanate	101-68-8	202-966-0
Polymeric Isocyanates	9016-87-9	- -
1,2-Benzenedicarboxylic Acid DIC9-11 Branched Alkylesters, C10 Rich	68515-49-1	

### 4. FIRST AID MEASURES

**EYES:** Immediately flush with plenty of water for at least 15 minutes. Get medical attention or advice.

**SKIN:** Remove contaminated clothing to prevent further skin exposure and dispose of properly. In situations involving considerable skin contact, place the contaminated person in a deluge shower for at least 15 minutes. For minor exposures, wash thoroughly with soap and clean water. Get medical attention if irritation persists.

**INGESTION:** If ingested, get immediate medical attention. Do not induce vomiting unless instructed to do so by medical personnel. Never give anything by mouth to a victim who is unconscious or is having convulsions.

**INHALATION:** Remove to fresh air. Get medical attention immediately for a large dose exposure or if cough or other symptoms develop. Administer oxygen or artificial respiration as needed.

**NOTES TO PHYSICIAN:** Symptomatic and supportive therapy as needed.

### 5. FIRE FIGHTING MEASURES

**FLASHPOINT AND METHOD:** Not Established

**EXTINGUISHING MEDIA:** Dry chemical, foam, carbon dioxide (CO2), sand.



# Respiratory Hazards



- Asbestos
- Blastomycosis (from a fungus in acidic soils with rotten organic material)
- Hantavirus (from infected rodents or their urine or droppings)
- Histoplasmosis (from a fungus in bat, bird, and other animal droppings)
- Radon
  - Particulate filtering respirators offer no protection against radon
    - However, majority of health risk is from radon decay products
- **Radon Decay Products (RDPs)**
  - **High Efficiency Particulate Air Filters (HEPA)**
    - **Purple or magenta filters** (same as for asbestos)

# Respiratory Hazard Assessment: Radon and RDP

## Opportunities for Exposure

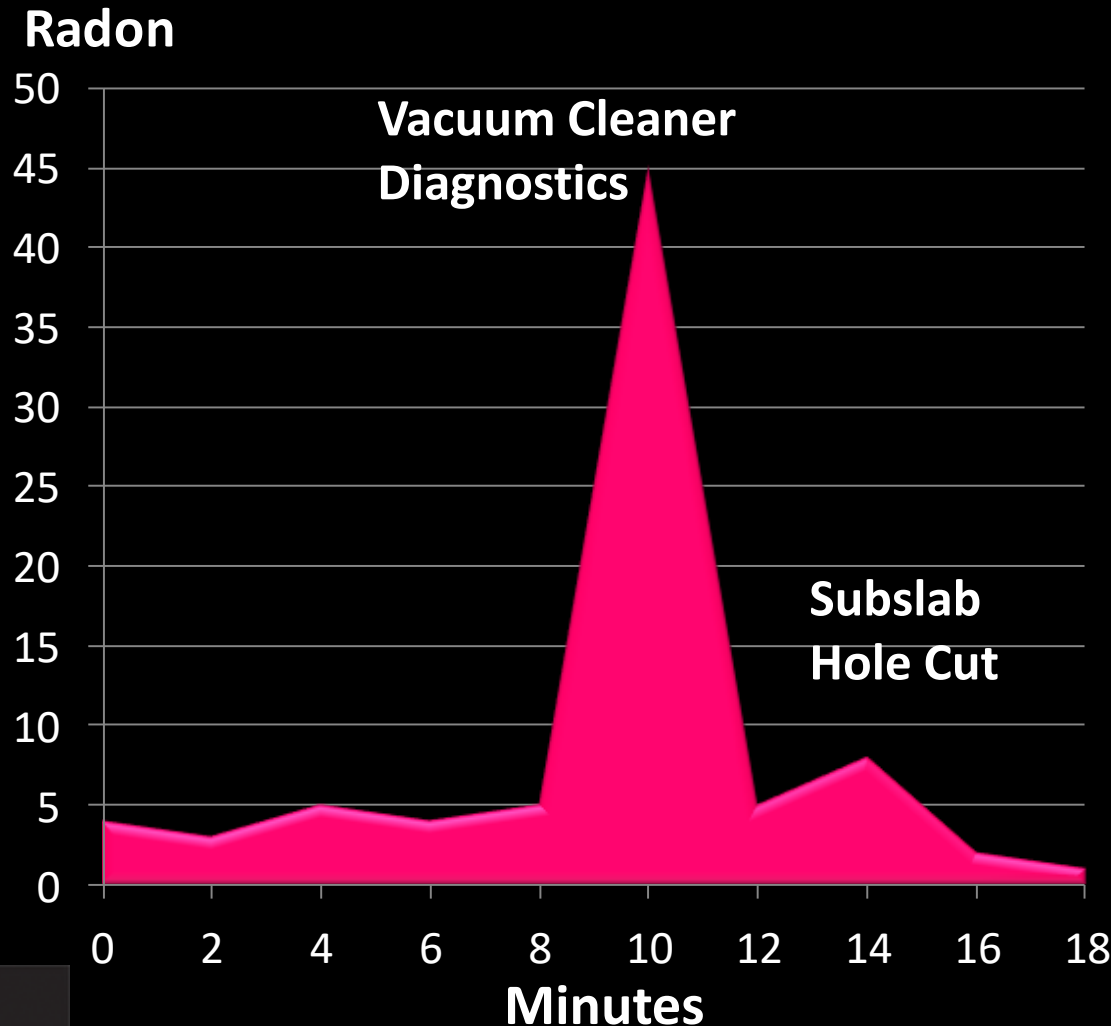
- Entering a home with a “potential” radon problem
- Investigating a “known” radon concern - - - *Ignorance of radon levels is not an excuse*
- Installing radon systems
- Repairing radon systems

## What does the U.S. standards say?

1. Must record worker radon exposure at each jobsite (e.g., CRM or ATD) or using highest previous radon measurement
2. Must ensure workers are not exposed to more than 4 WLM/year
3. Recommend health and safety records, including WLM exposure logs, are kept for 20 years

**Important**

# Respiratory Hazard Assessment: Short-term Radon Exposure During Diagnostics



- House was passively ventilated with vacuum cleaner outside
- Diagnostic activities can create large exposures

# Measuring Worker Exposure to Radon and RDPs

Working Level (WL)	Hours	WL Hours (WLH)	Working Level Month = WLH/170
1.10	2	2.20	<b>0.0129</b>
0.5	8	4.00	<b>0.0235</b>
0.65	4	2.60	<b>0.0153</b>
0.04	3	0.12	<b>0.0007</b>
<b>Total</b>			<b>0.0524</b>

# Converting from pCi/L to WL for Calculating Employee Exposures

- Reminder - - - converting pCi/L to WL
  - $R_n = \frac{100 \times WL}{ER}$
  - Where ER = 0.50 or 50%

# Calculating Exposure Based on Highest Radon Measurements

House	Hours Worked	Highest Radon (pCi/L)	Working Level (Rn x 0.5)/100	Working Level Hours (WL x Hours)	Working Level Month (WLH/170)
A	6	25	0.125	0.75	<b>0.0044</b>
B	10	4	0.02	0.2	<b>0.00012</b>
C	10	4	0.02	0.2	<b>0.00012</b>
<b>Total</b>					<b>0.00464</b>

# What Standards Apply?

- Accumulative time-dose exposure shall not exceed:
  - 4 WLM per consecutive 12 month period ~ OSHA
- Respiratory protection shall be worn when levels are above:
  - 30 pCi/L ~ EPA RMS and ASTM only

# Respiratory Protection: Common Interpretations and Actions for Radon

- According to the EPA RMS and ASTM, if pre-mitigation radon measurements are > 30 pCi/L
  - Usually the first action that is taken in mitigation is to ventilate the workspace by using a fan to bring outdoor air into the workspace
  - If it is not possible to ventilate the workspace with outdoor air, workers must be supplied
    - An appropriate respirator
    - The workspace is monitored with a continuous radon monitor
- Employee personnel monitoring equipment should also be used and it is required by ASTM E 2121
  - However, 2121 does NOT describe how this should be done



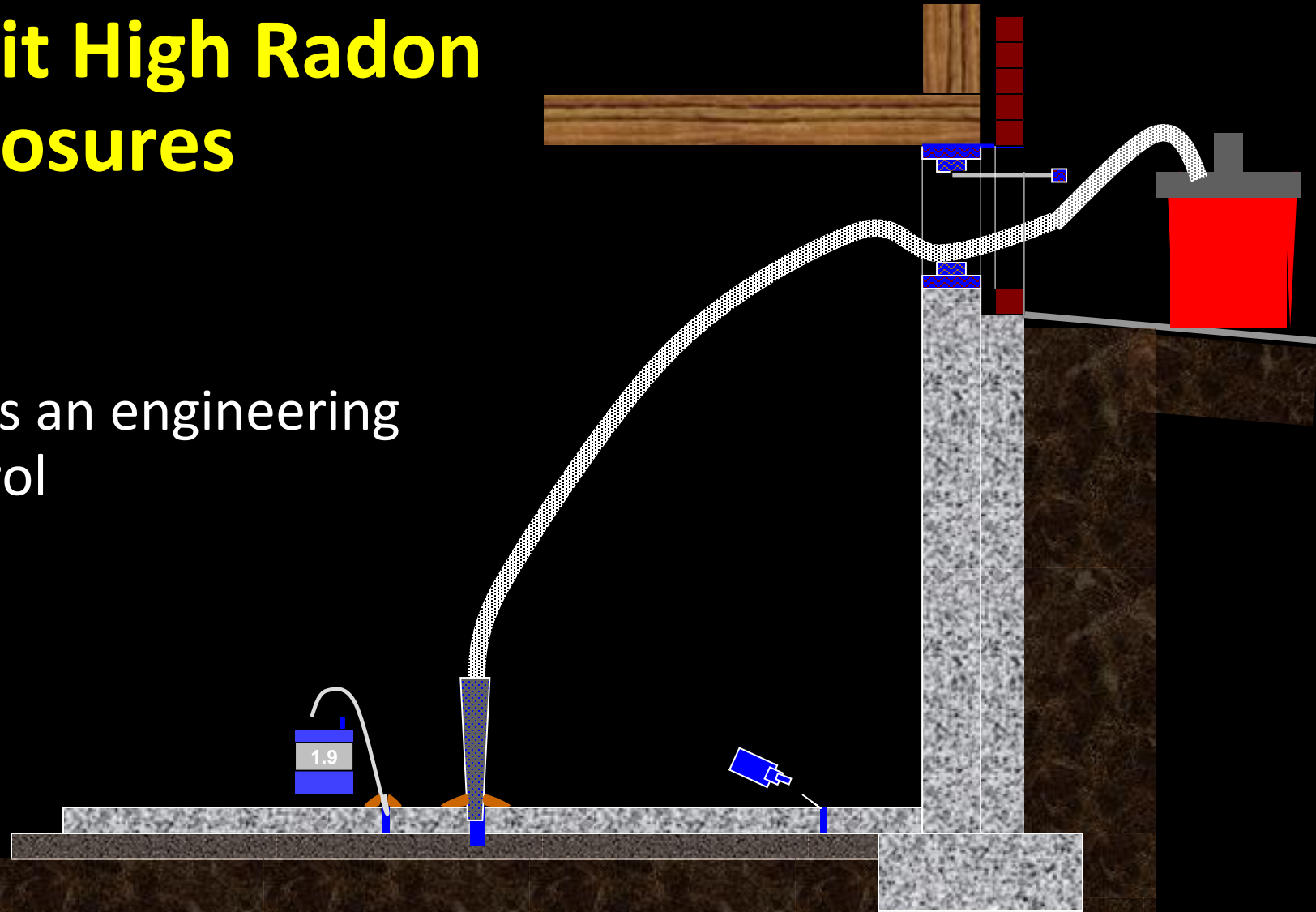


# Installing Radon Mitigation Systems

- First, implement engineering controls, e.g.,
  - Ventilate work area to less than 0.3 WL
    - ... or 30 pCi/L assuming 100% (1.0) ER
- If engineering control is insufficient,
  - Ensure available respiratory protection equipment in areas greater than 0.3 WL
    - ... or 30 pCi/L assuming 100% (1.0) ER

# When Performing ASD Diagnostics, Limit High Radon Exposures

This is an engineering control



# Respiratory Protection



## ■ Objective

- Minimize exposure to airborne contaminants,
  - e.g., insulation material, mold spores, feces, bacteria, chemicals
- Protect workers from toxic exposure

## ■ Specification

- Respirators appropriate for the contaminants present will be worn
  - e.g., N-95 or equivalent
  - OSHA Technical Manual Section VII: Chapter 2, part IV
- If friable asbestos (e.g., vermiculite), OSHA asbestos abatement protocol 1926.1101 will be followed



# Respiratory Protection

[www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=12716](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716)

- OSHA specified **permissible practices**
  - Those 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**
    - o **This shall be accomplished as far as feasible by accepted engineering control measures** (e.g., enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials)
      - **When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section**

# Respiratory Protection

[www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=12716](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716)

- OSHA specified permissible practices (continued)
  - A respirator shall be provided to each employee when such equipment is necessary to protect the health of such 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 (OSHA 1910, I, 1910.134)
  - The program shall cover each employee required by this section to use a respirator

# Respiratory Protection

[www.osha.gov/Publications/3280-10N-05-english-06-27-2007.html](http://www.osha.gov/Publications/3280-10N-05-english-06-27-2007.html)

- Respiratory protection must be worn whenever you are working in a hazardous atmosphere
- The appropriate respirator will depend on the
  - Contaminant(s) to which you are exposed and
  - Protection factor (PF) required
- Required respirators must be
  - NIOSH-approved and
  - Before use
    - Medical evaluation and
    - Training must be provided



# Respiratory Protection

[www.osha.gov/Publications/3280-10N-05-english-06-27-2007.html](http://www.osha.gov/Publications/3280-10N-05-english-06-27-2007.html)



- **Single-strap dust masks** are usually not NIOSH-approved
  - They must not be used to protect from hazardous atmospheres



- **Approved filtering facepieces** (dust masks) can be used for dust, mists, welding fumes, etc.
  - They do not provide protection from gases or vapors. DO NOT USE FOR ASBESTOS OR LEAD; instead, select from the respirators below



- **Half-face respirators** can be used for protection against most vapors, acid gases, dust or welding fumes
  - Cartridges/filters must match contaminant(s) and be changed periodically

# Respiratory Protection

[www.osha.gov/Publications/3280-10N-05-english-06-27-2007.html](http://www.osha.gov/Publications/3280-10N-05-english-06-27-2007.html)



- **Full-face respirators** are more protective than half-face respirators
  - They can also be used for protection against most vapors, acid gases, dust or welding fumes
  - The face-shield protects face and eyes from irritants and contaminants
  - Cartridges/filters must match contaminant(s) and be changed periodically



- **Loose-fitting powered-air-purifying respirators (PAPR)** offer breathing comfort from a battery-powered fan which pulls air through filters and circulates air throughout helmet/hood
  - They can be worn by most workers who have beards
  - Cartridges/filters must match contaminant(s) and be changed periodically



- **A Self-Contained Breathing Apparatus (SCBA)** is used for entry and escape from atmospheres that are considered immediately dangerous to life and health (IDLH) or oxygen deficient



# Slips, Trips and Falls: Working on Roofs (NAHB-

OSHA 1999 *Jobsite Safety Handbook*)

- Before getting onto roof surfaces,
  - Inspect for and remove frost and other slipping hazards
- **When the roof pitch is**
  - Over 4:12 and up to 6:12,
    - Install slide guards along the roof eave after the first 3 rows of roofing material
  - Exceeds 6:12,
    - Install slide guards along the roof eave after the first 3 rows of roofing material are installed and again every 8 feet up the roof
  - Greater than 8:12 or if the ground-to-eave height exceeds 25 feet,
    - Use a safety harness system with a solid anchor point
- Wear shoes with slip-resistant soles
- . . . OR use Kozy Kollars

# Beyond U.S. Radon Mitigation Standards

- **Confined Space** Hazards and Safety
- **Driving** Hazards and Safety
- **Ergonomic** Safety
- **Eye, Face, Foot and Hand** Hazards and Protective Clothing
- **Heat and Thermal** Hazards and Safety
- **Lead** Hazards and Protection
- **Noise** Hazards and Hearing Protection
- **Tool** Safety

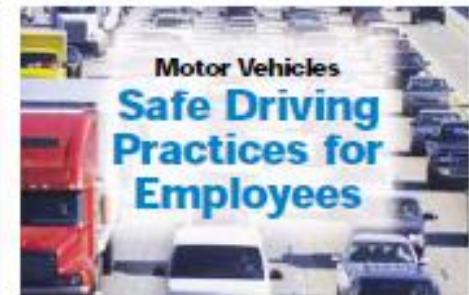
# Crawl Space/Confined Space Protection

[www.osha.gov/Publications/osha3138.html](http://www.osha.gov/Publications/osha3138.html)

- Crawl Spaces
  - Durable, wrist protecting gloves will be worn
  - Respirators appropriate for contaminants present will be worn
  - Electrical safety assessment will be conducted
    - Special precautions if knob and tube wiring is present
  - Eye protection will always be worn, e.g.,
    - Safety glasses, goggles or full face respirator
- Confined space (in addition to the above)
  - Access and egress points will be identified before entry
  - Adequate ventilation will be provided
  - Use of toxic materials will be avoided

# Driving Hazards

- According to the Bureau of Labor Statistics, more than 2,400 deaths a year result from occupational motor vehicle incidents
  - That number is more than 42 percent of the annual number of fatalities from occupational injuries
  - The average crash costs an employer \$16,500
    - When a worker has an on-the-job crash that results in an injury, the cost to their employer is \$74,000
    - Costs can exceed \$500,000 when a fatality is involved
  - Some of the issues are:
    - Distracted driving
    - Failure to wear seat belts
    - Fatigue



You are your employer's most valuable asset! The way that you drive says everything about you and your company. Make a positive statement by following these work-related safe driving practices.

#### Stay Safe

- Use a seat belt at all times – driver and passenger(s).
- Be well-rested before driving.
- Avoid taking medications that make you drowsy.
- Set a realistic goal for the number of miles that you can drive safely each day.
- If you are impaired by alcohol or any drug, do not drive.

#### Stay Focused

- Driving requires your full attention. Avoid distractions, such as adjusting the radio or other controls, eating or drinking, and talking on the phone.
- Continuously search the roadway to be alert to situations requiring quick action.
- Stop about every two hours for a break. Get out of the vehicle to stretch, take a walk, and get refreshed.

#### Avoid Aggressive Driving

- Keep your cool in traffic!
- Be patient and courteous to other drivers.
- Do not take other drivers' actions personally.
- Reduce your stress by planning your route ahead of time (bring the maps and directions), allowing plenty of travel time, and avoiding crowded roadways and busy driving times.

For more information on safe driving for work, refer to "Guidelines for Employers to Reduce Motor Vehicle Crashes" at <http://www.osha.gov/SLTC/motorvehicle/safety/index.html>.

For more complete information:

**OSHA**  
Occupational  
Safety and Health  
Administration  
U.S. Department of Labor  
[www.osha.gov](http://www.osha.gov) (800) 321-OSHA

10-10-10

# Noise Hazards



- Noise is a common occupational hazard
  - Operation of drills, grinders, and saws as well as other power tools create noise hazards
    - The extent of damage from high levels of noise depends primarily on the intensity of the noise and the duration of the exposure
    - Noise induced hearing loss can be temporary or permanent
      - Temporary hearing loss is a result of short-term exposure to noise and normal hearing returns after a time of rest
      - Long-term exposure to high noise levels causes permanent damage

# Hearing Protection

- Use hearing protection during high noise activities such as hammer drilling

- Disposable earplugs
- Reusable earplugs
- Reusable earmuffs
- Radio Earmuffs



- To monitor workplace noise, you may buy a

- Noise indicator is available for \$39 or
- iPhone sound meter app for \$20



# Protective Clothing

(Appendix D – OSHA Personal Protective Equipment Standards)



## ■ Objective

- Protective worker from skin contact with contaminants
  - Some skin contact hazards will be discussed in the respiratory hazards section
- Minimize spread of contaminants

## ■ Specification

- If contaminants are present, removable protective clothing will be worn
- Eye protection will be worn at all times, e.g.,
  - Safety glasses
  - Goggles
    - If not using full face respirator



# Ear Muffs, Knee Pads, Drill Braced, Vacuum for Dust

- Where is eye protection?





# Caution!

- Every precaution that is suitable for you or your employees should be considered for the occupant as well
- Remember your workplace is another person's home

# Working Level Months

$$\text{WLM} = \text{WL} \times \text{Hours} / 170 \text{ Hours}$$

For example, if a worker was exposed to

- 2.2 WL for 8 hours and
- 6.4 WL for 6 hours

His or her WLM accumulative exposure would be 0.3294 based upon the following calculation:

- $\text{WLM for first 8 hours} = 2.2 \times 8 / 170 = 0.1035$
- $\text{WLM for second 6 hours} = 6.4 \times 6 / 170 = 0.2259$
- $\text{WLM total} = 0.1035 + 0.2259 = 0.3294$

# Working Level Month

- If radon levels are used to monitor exposure, pCi/L must be converted to WL using an ER of 0.5 and the following formula (based upon  $ER = WL \times 100/pCi/L$ )
- For example, if a worker was exposed to 50 pCi/L for 8 hours and 90 pCi/L for 6 hours, his or her WLM accumulative exposure would be 0.0287 based upon the following calculation:
  - $WLM \text{ for first 8 hours} = (0.5 \times 50/100) \times 8/170 = 0.0128$
  - $WLM \text{ for second 6 hours} = (0.5 \times 90/100) \times 6/170 = 0.0159$
  - $WLM \text{ total} = 0.0128 + 0.0159 = 0.0287$

# : Working Level Month

Remember, the OSHA standard is:

- 4 WLM during any 12 month consecutive period  
and
- All U.S. radon mitigation standards require that workers wear respiratory protection when radon concentrations are greater than 30 pCi/L

# Questions?

Remember the best safety tool you have is the head on your shoulders and your work partner

***If possible, do not work alone!***

# Worker Health and Safety References

- Bloom, Thomas F, 1996, Occupational exposures among radon mitigation workers, *Proceedings of the International Radon Symposium*, Haines City, FL, American Association of Radon Scientists and Technologists
- NAHB-OSHA, 1999, *Jobsite Safety Handbook*, Second Edition
- NIOSH, 2004, *Respirator Selection Logic*
- Torraco, Richard, Angell, William J, Drake, Dyanne 1992 *Radon Mitigation Employee Health and Safety: Student Manual (171 R-92-011)* Office of the Administrator, Washington, DC: U.S. Environmental Protection Agency