

UNIT 7

PERSONAL PROTECTIVE EQUIPMENT



AG HEALTH 101

CHAPTER

DISCUSSION QUESTIONS

CHAPTER 1. INTRODUCTION TO PPE & CONTROL OPTIONS

In your personal life, you have probably worn some type of PPE, either at work or doing hobbies/chores at home. Describe the task you did and what PPE you selected to use. Do you think the PPE was well selected for the hazard? Describe the comfort level & what improvements you wish could be made.

CHAPTER 2. PPE CATEGORIES & HAZARDS TO CONSIDER

Search the internet using the phrase "PPE Hazard Assessment Form." Examine two or three of the forms used to conduct PPE hazard assessment. Share the links with others and discuss which forms you like best and why. Select your "favorite" form for **conducting** and then for **documenting** a PPE Hazard Assessment.

CHAPTER 3. CHEMICAL PROTECTIVE CLOTHING

What chemicals do you know about on the farm that may need to have chemical protective gloves properly selected? Use information you have learned from other units in this series and discuss whether you think we can "group" chemicals together to select one glove type or whether we need to consider different materials for different chemicals being used.

CHAPTER 4. CHEMICAL PROTECTIVE CLOTHING SELECTION

Look at a chemical that you contact at home (hobby, cleaning, workshop, etc.) or work and walk through the same process that was presented in this chapter.

CHAPTER 5. RESPIRATORY PROTECTION

Reflect on how comfortable you are wearing an N95. How do you think it affected your ability to communicate? What barriers do you think workers would have if required to wear other respiratory protection options? Does this fit with the concerns mentioned about the Hierarchy of Controls and why PPE is the "last line of defense?"

CHAPTER 6. RESPIRATORS ON THE FARM

Having PPE available and accessible when you need it out on the farm is often an afterthought. If they are stored in a clean environment in the shop, they might not be with you when you are in a different area of the farm when you need it. Discuss your thoughts on how to plan work for respirator use.

CHAPTER 7. RESPIRATORY PROTECTION PROGRAM

How would you begin the conversation with a farm worker to understand if they wear a respirator (or are required to) and whether they have had a medical exam and fit testing?

CHAPTER 8.

Complete the process of a PPE hazard assessment for two tasks: (1) Connecting a drive shaft to the tractor power take-off (PTO); (2) Completing a corn transfer (from a bin to a cart).

CHAPTER 1

INTRODUCTION

TO PPE & CONTROL OPTIONS

Effectiveness

Control Type

Business Value

MOST



LEAST

Eliminate or Substitute

Engineering Controls

Administrative (training and work scheduling)

Personal Protective Equipment

MOST



LEAST

Hierarchy of Controls

MOST EFFECTIVE



LEAST EFFECTIVE

ELIMINATION

Physically Remove the Hazard

SUBSTITUTION

Replace the Hazard

ENGINEERING CONTROLS

Isolate People from the Hazard

ADMINISTRATIVE CONTROLS

Change the Way People Work

PPE

Protect the Worker with Personal Protective Equipment (PPE)

At the Top: The probability of an incident (illness, injury) is significantly reduced
Training only informs of the risk - may not do anything to reduce the probability
PPE reduces the probability ONLY if the worker properly uses the PPE and if it is not damaged - last line of defense

CHAPTER 2

PPE CATEGORIES & HAZARDS TO CONSIDER



HEAD PROTECTION

Hard Hats and Safety Helmets
ANSI Z89.1

Type 1: Impacts anticipated from above

Type 2: Impacts anticipated from above or the side

Class G: Electrical hazards; protects from up to 2,000 volts

Class E: Electrical hazards for utility workers

Bump Cap: Do not provide impact protection but can help protect the head from incidental contact when in tight spaces

EYE PROTECTION

ANSI/ISEA Z87.1

Safety Glasses: Protect the eyes from flying objects

Safety Goggles: Provide improved protection for smaller fragments (like when grinding) because they seal the eye.

- **Vented:** For non-chemical hazards
- **Non-Vented:** For chemical hazards



FACE PROTECTION

ANSI Z87.1

Should cover below the chin to the forehead & extending from cheekbone to cheekbone.

Protects the face against flying debris, chemical splash, explosive power tools, etc.

***Use in combination with safety glasses**

HAND & ARM PROTECTION

Leather, Canvas, or Metal Mesh Work Gloves: Used for heat or cut resistance



Fabric & Coated Fabric Gloves: Used for dirt & slip resistant protection

Chemical- & Liquid-Resistant Gloves: For chemical protection



Insulating Rubber Gloves: For electrical hazards

HEARING PROTECTION

CFR 1910.95 (OSHA), ANSI s12.6

Recommended when working in loud areas, even for short durations. Hearing protection should be required when noise exposure is 85 dBA or higher.

- **Earmuffs**
- **Ear Plugs**



BODY PROTECTION

Paper Type Fiber: For single-use protection against dust & possible splashes



Treated Wool & Cotton: Fire-resistant; Protects against abrasions & rough irritating surfaces

Duck Cloth: Heavier; Protects against cuts & bruises when handling heavy or sharp/rough materials



Leather: Protects against dry heat, flames, & sparking

Rubber (e.g., Neoprene): Protects against chemical hazards



FOOT & LEG PROTECTION

ASTM F-2412/2413 or ANSI Z41

Snap-On Leggings: Protects from heat hazards



Metatarsal Guards: Protects the instep from impact & compression hazards

Foot & Shin Guards: Protects the lower legs



Puncture Resistant Insoles, Electrically Conductive Soles (never wear if exposed to electrical hazards), & Oil Resistant Soles



Electrical Hazard Shoes: Prevent the wearer from completing an electrical circuit to the ground

CHAPTER 3 CHEMICAL PROTECTIVE CLOTHING

GLOVE MATERIAL SELECTION CHECKLIST:

- ✓ Chemical being handled
- ✓ Grip Requirements
- ✓ Nature of Contact
- ✓ Thermal Protection Needed?
- ✓ Duration of Contact
- ✓ Size and Comfort
- ✓ Area Requiring Protection
- ✓ Abrasion?

GENERAL GLOVE PERFORMANCE INFORMATION

GLOVE MATERIAL	CHEMICAL CATEGORIES FOR GOOD PERFORMANCE	KNOWN PROBLEMS	PERFORMANCE NOTES
 <p>Butyl Rubber</p>	Peroxide, highly corrosive acids, strong bases, alcohols, aldehydes, ketones, esters, nitro-compounds	Not good with aliphatic & aromatic hydrocarbons; halogenated solvents	Resist oxidation, ozone corrosion, & abrasion; Flexible at low temperatures
 <p>Natural (latex) Rubber</p>	Protect against water solutions of acids, alkalis, salts, & ketones. Useful for resisting abrasions during polishing & grinding	May not be appropriate for all because latex allergies; Those lined with powder may be irritating	Comfortable to wear; general purpose
 <p>Neoprene Rubber</p>	Hydraulic fluids, gasoline, alcohols, organic acids, alkalis		Often superior chemical & wear resistance compared to natural rubber
 <p>Nitrile</p>	Chlorinated solvents; good for oils, greases, acids, caustics and alcohols	Not recommended for strong oxidizing agents, aromatic solvents, ketones & acetates	Great for jobs requiring dexterity & sensitivity

CHAPTER 4

CHEMICAL PROTECTIVE CLOTHING

SELECTION EXAMPLE: PERMETHRIN

Step 1. Identify the Use & Hazard

How will the chemical be used? Permethrin SFR insecticide (36.8%) is a liquid & needs to be diluted before application because it is a concentrate.

Is it hazardous to the skin? The label states, "harmful if absorbed through the skin; avoid contact with the skin, eyes, and clothing." Therefore, the skin needs to be protected.

Look at both the safety data sheet and label to determine the hazards of this chemical product (*included in the resources page for this chapter*).

Step 3. Select, Record, & Provide

Select, record, & provide the specific pieces of equipment (**make, model, size**) that the worker should use.

Glove Selection Sizing: Wrap a soft measuring tape around dominant hand's palm, excluding the thumb. The number of inches corresponds to the size of glove needed.

See the resources page for this chapter to view the link to a safety glove size chart.



Step 2. Glove Materials Needed

Personal Protective Equipment (PPE): Some materials that are chemical-resistant to this product are barrier laminate, butyl rubber, & nitrile rubber.

Applicators using ULV cold foggers or fog/mist generators in indoor spaces must wear:

- **Coveralls over long-sleeved shirt & long pants;**
- **Chemical-resistant gloves;**
- **Chemical-resistant footwear, plus socks; and**
- **Chemical-resistant headgear, if overhead exposure.**

Applicators using ULV cold foggers and/or fog/mist generators in outdoor spaces must wear:

- **Long-sleeve shirt & pants;**
- **Shoes, plus socks; and**
- **Chemical-resistant gloves.**

All other mixers, loaders, applicators, & other handlers must wear:

- **Long-sleeve shirt & pants;**
- **Shoes, plus socks; and**
- **Chemical-resistant gloves for all handlers except for applicators using motorized ground equipment;**
- **Chemical-resistant apron for mixers/loaders, persons cleaning equipment, & person exposed to the concentrate.**

CHEMICAL RESISTANCE CHART & SELECTION GUIDE

Chemicals	PVC			CPVC					PP					PVDF						ABS					
	Temp. °C		°F	20	40	60	20	40	60	80	100	20	40	60	80	100	20	40	60	80	100	120	20	40	60
	68	104	140	68	104	140	176	212	68	104	140	176	212	68	104	140	176	212	248	68	104	140	68	104	140
Furfuryl Alcohol									1	2				1	1	2									
Gasoline	1	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Gelatin	1	1	1	1		3			1	1	1			1	1	1									

- 1 High Resistance - All materials belonging to this class are completely or almost completely inert when used with the specified chemical at the specified concentration/temperature levels.
- 2 Limited Resistance - All materials belonging in this class are partially attacked by the specified chemicals at the specified concentration/temperature levels. Life expectancy is thus shortened and it is recommended to use a higher safety factor than that adopted for Class 1 materials.
- 3 No Resistance - All materials in this class are severely attacked by the specified chemicals at the specified concentration/temperature levels. They should, therefore, not be used.

CHEMICALS	LATEX	NITRILE
Acetaldehyde	FAIR	NOT RECOMMENDED
Acetamide	NOT RECOMMENDED	GOOD
Acetic acid (50% concentration)	GOOD	GOOD
Acetone	NOT RECOMMENDED	NOT RECOMMENDED
Acetonitrile	GOOD	NOT RECOMMENDED

EXCELLENT

GOOD

FAIR

NOT RECOMMENDED

RESPIRATORY PROTECTION

INFORMATION NEEDED TO PERFORM SELECTION

1. What is the hazard that we need to protect the worker from?
2. What is the concentration of the hazard in the environment?
3. What is the "safe level" of that contaminant (Occupational Exposure Limit or OEL)?

AIR-PURIFYING RESPIRATOR

Air-purifying respirators (APRs) work by removing gases, vapors, aerosols (airborne droplets & solid particles), or a combination of contaminants from the air through the use of filters, cartridges, or canisters.

SUPPLIED AIR RESPIRATOR

Supplied Air Respirators (SARs) are devices that provide breathable air from an outside source. They are used in environments where the air is contaminated, harmful, low in oxygen (below 19.5% concentration), or unknown.

Respirator Selection

Calculating the Ratio: Exposure Concentration/OEL

This ratio determines the MINIMUM Assigned Protection Factor that the respirator needs to have. Each style of respirator has an assigned protection factor as well:

- Half Mask & Face-Filtering = 10
- Powered Air-Purifying Respirator (PAPR) = 25
- Full Face Air Purifying Respirator = 50
- Supplied Air Respirator = 1000+

RESPIRATOR CARTRIDGE COLOR CODING

WHITE



Hydrogen Chloride, Sulfur Dioxide, Hydrogen Sulfide

BLACK



Organic Vapors (OV)

MAGENTA



Radioactive (Except Nobel Gases & Tritium), Particulates (Dusts, Fumes, Fogs Smoke)

GREEN



Ammonia, or Ammonia & Methylamine

YELLOW



Organic Vapors with Hydrogen Chloride, Sulfur Dioxide, Hydrogen Sulfide or Hydrogen Fluoride

BLUE



Carbon Monoxide

CHAPTER 6

RESPIRATORS ON THE FARM



DUST/PARTICLE PROTECTION	N95, Half-Mask, PAPR
GRAIN HANDLING	N95 FFR
ANIMAL HANDLING	N95 FFR if ammonia concentrations are reasonably low (<10 ppm). Cartridge respirator is needed if both ammonia & dust are present & need to be controlled for.
WELDING	Donning particle filtration respirator in combination with working in well-ventilated areas (including outdoors).
MANURE HANDLING	An air supplied respirator must be worn if there is no air quality monitor to confirm concentration when entering a confined space.
PESTICIDE HANDLING	2,4,D, Pyraclastrobin (fungicide): Half-Mask with Organic Vapor & N100 Dust Filtration Acetochlor, Pyrethroids: Half-Mask with Organic Vapor Glyphosate: Air-Purifying N100 Dust Filtration Dicamba, Chlorpyrifos: Full-Face with N100 Dust Filtration

CHAPTER 7

RESPIRATORY PROTECTION PROGRAM

CRITICAL ELEMENTS OF THE PROGRAM

Procedures for Selecting Respirators on the Farm: This section needs to document the steps taken (provided in Chapter 5) to select the respirator type (air-supplied, air-filtering), style (half-face, full-face, PAPR), and filter needed.

Medical Evaluations of Employees: When respirators are required, a physician or licensed health care practitioner has to evaluate any medical conditions (questionnaire), and, in some cases, a follow-up exam may be needed to determine whether the employee has any medical conditions that would prevent them from being able to wear a respirator safely. The medical examiner needs to have information on:

- type of respirators to be worn,
- expected physical work effort,
- any additional PPE or equipment that needs to be worn, and
- any temperature or humidity extremes that would be present when wearing the respirator.

Fit Testing Procedures: To assess the fit of the selected respirator, workers need to be fit tested for any tight-fitting respirator to make sure there is a proper seal between the respirator and the face. Workers need to pass the fit test on the make, model, and size of respirator. The written program should document this process, including who conducts this initial and annual test.

Proper Use of Respirators for Routine & Reasonably Foreseeable Emergency Situations: Details on how workers need to properly use the respirator need to be in the program. This includes communicating prohibitions when wearing a tight-fitting respirator (e.g., no facial hair), the requirement for seal checks every time the respirator is worn, and practices to maintain the respirator's effectiveness (how to detect breakthrough; when to change the filter/cartridge).

Maintaining Respirators: Detailed procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.

Training: The program should include training for respirator wearers that covers:

- what the respiratory hazards are for which they are wearing the respirators,
- proper use of respirators (how to put on, remove, and maintain), and
- limitations of respirator use (when not to wear them).

The program should also include key personnel and roles and should be annually reviewed to assess its effectiveness.

CHAPTER 8

PPE ASSESSMENT PROGRAM

WITH ON FARM EXAMPLE



MUCKING THE STABLE

Link: https://youtu.be/IXhtZV9P_Mg

Identify Selected PPE & Reason for Selecting:

- Hands:
- Head:
- Eyes & Face:
- Ears:
- Respiratory System:
- Feet:
- Body:
- Notes:

CONNECTING PTO SHAFT

Link: <https://youtu.be/3sbk6ONJvMI>

Identify Selected PPE & Reason for Selecting:

- Hands:
- Head:
- Eyes & Face:
- Ears:
- Respiratory System:
- Feet:
- Body:
- Notes:

CORN TRANSFER

Link: <https://youtu.be/kU5yP9ow3TU>

Identify Selected PPE & Reason for Selecting:

- Hands:
- Head:
- Eyes & Face:
- Ears:
- Respiratory System:
- Feet:
- Body:
- Notes:

VIEW THESE LINKS FOR
MORE INFORMATION &
ADDITIONAL RESOURCES ON
THE CONTENT PRESENTED IN
THIS UNIT.

PPE RESOURCES

CHAPTER 1. INTRODUCTION TO PPE

- Pesticides identified by the EPA as suitable alternatives for conventional pesticides: <https://www.epa.gov/pesticide-registration/reduced-risk-and-organophosphate-alternative-decisions-conventional>

CHAPTER 2. PPE CATEGORIES & HAZARDS

- <https://www.osha.gov/training/library/personal-protective-equipment/assessment>
- <https://www.osha.gov/sites/default/files/publications/osha3151.pdf>

CHAPTER 3. CHEMICAL PROTECTIVE CLOTHING

- ANSELL: <https://cdn.msdirect.com/global/media/pdf/search/ansell/ansell-chemical-glove-resistance-guide.pdf>
- Cole Palmer: <https://www.colepalmer.com/chemical-resistance>
- Gilson: <https://www.gilsoneng.com/reference/ChemRes.pdf>
- 3M Clothing Selection Guide: <https://multimedia.3m.com/mws/media/1347630O/product-selection-guide-coveralls.pdf>
- 3M Glove Selection Guide: <https://multimedia.3m.mws/media/1602262O/us-3m-safety-gloves-selection-guide-2018-en-fr-sp-pdf.pdf>
- Showa: <https://www.showagroup.com/us-en/hazard/chemical>
(select a glove then look at performance)

CHAPTER 4. CHEMICAL PROTECTIVE CLOTHING SELECTION: PERMETHRIN

- Permethrin Safety Data Sheet: https://www.domyown.com/msds/Permethrin_SFR1_MSDS.pdf
- Permethrin Safety Label: https://www.domyown.com/msds/Permethrin_SFR_Label.pdf
- Safety Glove Size Chart: <https://www.grainger.com/know-how/safety/ppe-in-the-workplace/ppe-management/kh-safety-glove-size-chart-qt-306>

CHAPTER 5. RESPIRATORY PROTECTION

- <https://aghealthandsafety.com/wp-content/uploads/2021/10/respiratory-quick-guide-WEB.pdf>

CHAPTER 6. RESPIRATORS ON THE FARM

- Comprehensive Selection Guide for Respirator Selection: <https://aghealthandsafety.com/wp-content/uploads/2023/10/respiratory-quick-guide.pdf>

CHAPTER 7. RESPIRATORY PROTECTION PROGRAM

- 3M: https://www.3m.com/3M/en_US/respiratory-protection-us/support/center-for-respiratory-protection/written-program/
- Components of an Agricultural Respiratory Protection Program: <https://gpcah.public-health.uiowa.edu/ppe-resources/> (this page includes the link to a fit testing train-the-trainer guide)

CHAPTER 8. PPE ASSESSMENT PROCESS

"Croplife" Form: <https://croplife.org/wp-content/uploads/2019/04/PPE-risk-assessment-document.pdf>

"Connecting a Drive Shaft to the Tractor PTO":

- Connecting a Spreader to a PTO: <https://youtu.be/3sbk6ONJvMI>
- Another Demo: <https://youtu.be/FoPe9NcAxuw>
- How the Two Parts Connect: <https://youtu.be/8nub8HrTPBo>

Corn Transfer: <https://youtu.be/kUsyP9ow3TU>

0-3 min: Working at Elevation; Setting Up Auger

3:30-4:33: Filling Grain Cart

4:40: Transfer from Cart to Bin Via Auger



BONUS CHAPTER

ADDITIONAL PPE TOOLS

Directions for Bonus Chapter Content:

The purpose of this bonus chapter is to provide an interactive tool to help illustrate what PPE is worn by agricultural workers and to discuss additional suggestions for PPE while performing different tasks on the farm.

The link below provides a toolkit and instructions for how to use the *Flat Farmers* educational tool to facilitate PPE discussions. This toolkit includes an array of clothing and PPE options that can be printed on cardstock.

Use these illustrations when discussing PPE for different work tasks by overlaying the specific type of PPE that should be worn onto the farmworker image. These graphics can help demonstrate recommendations for current and additional layers of PPE for workers.

Additionally, you can lead the worker through the PPE Hazard Assessment checklist (like we did in Chapter 8) to discuss hazards to the head, eye, face, etc. Then identify PPE to reduce risk of injury or illness for tasks that are relevant to your patient.

Link to Flat Farmers: <https://gpcah.public-health.uiowa.edu/flat-farmers/>