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Aircraft Armament Systems Journeyman

Volume 2. Safety and Security

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THIS SECOND VOLUME of CDC 2W151A, *Aircraft Armament Systems Journeyman*, covers safety and security. In unit 1, we will discuss ground safety and hazards that you, as armament personnel, will encounter. In unit 2, we look at explosive safety and the explosive handling safety factors. In unit 3, we discuss nuclear surety; lastly, in unit 4, we look at security. This volume presents issues applying most frequently to the 2W151 AFSC. The information in this volume will give you the background you need to perform your duties as an aircraft armament systems specialist.

A glossary is included for your use.

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This volume is valued at 9 hours and 3 points. A glossary is included for your use.

NOTE:

In this volume, the subject matter is divided into self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

Page

Please read the menu for Unit 1 and begin ➔

Unit 1. Ground Safety

THE AIR FORCE SAFETY CENTER recently released statistics which showed a 10-year average of on-duty and off-duty fatalities; these statistics revealed an average of 5.9 on-duty fatalities compared to an average of 50.6 off-duty fatalities. Now when you consider the dangers of working with explosives, heavy industrial equipment, and aircraft that Airmen are surrounded by every day, you may ask yourself how is that possible? It is because the Air Force conducts a comprehensive and aggressive program to protect all personnel from work-related deaths and injuries and occupational illnesses. While you are in the Air Force, you are continually alerted to the dangers involved in the performance of your duties as an aircraft armament systems specialist. Your safety instructions include lectures given by people from your local safety office, your supervisor, and your coworkers. Make yourself aware of all posted safety signs, bulletins, and safety notes which are spread throughout the manuals and technical orders (TO) you will be using on a daily basis.

In this unit, we discuss safety and you. We point out some general safety fundamentals you should be aware of. We also cover fire and electrical safety. When it comes to accidents, it is less painful to learn from the mistakes of others. Don't become part of the next accident statistic—*THINK SAFETY!*

1–1. General Safety Fundamentals

Instructions and literature on safety alone cannot and will not prevent you from being involved in an accident. Only by training yourself to think *SAFETY FIRST* can you hope to prevent accidents. To do this, you MUST think and practice safety at all times. You must think safety to the point it becomes an automatic reaction or a muscle memory. This process helps you become safety conscious. For example, when people visit a steel foundry and are permitted to view the hot molten cauldrons of steel from a walkway, most of them stand well back. This is being "safety conscious." Since the dangers are apparent, viewers take positive safety steps to keep away from the edge of the walkway. Flight-line safety sometimes is not so apparent, so we must use various means to identify the inherent dangers. Just do not fall into the trap of becoming complacent in your work center and pushing safety aside to get the job done faster. It is up to everyone to be aware of the inherent dangers within our career field.

201. Accident controls

What is accident control? This is a device, program, instruction, or procedure intended to mitigate the effects or causes of accidents. In other words, accident control is anything that prevents accidents or lessens the damage of them.

Safety publications

Ground, explosive, nuclear, and missile safety and health publications list most of the causes of mishaps as well as the means to prevent them. Knowing the correct way to do a job includes knowing what *not* to do so you can eliminate hazards or protect against them. Your job involves handling, transporting, and loading weapons. So you will, at one time or another, be exposed to many types of hazards. You can learn to recognize these hazards by studying the following basic safety standards and regulations:

- Air Force Consolidated Occupational Safety Instruction 91 series, Safety.
- Air Force Instruction (AFI) 91 series, Safety (in particular, nuclear surety).
- Air Force Manual (AFMAN) 91–201, *Explosives Safety Standards.*

There are numerous other publications dealing with safety. Your safety office can provide you with comprehensive lists of safety references. We will look at the safety issues common to our career field.

Personal protective equipment

In general, safety equipment protects the worker from possible injuries due to known hazards. The use of protective equipment greatly decreases accidents and protects lives. Safety helmets and protective goggles, when worn, can prevent otherwise serious or fatal injuries. ~~AFI 91–203, *Air Force Consolidated Occupational Safety Instruction,* part I,~~ chapter 14, gives supervisors and workers the standards for personal protective equipment (PPE) and the work center requirements for implementing the standard.

Flight-line safety

Most safety issues that you encounter on the flight line differ depending on which specific aircraft you are supporting and what duties you are assigned to perform. Covering each aircraft's specific safety issues is not in the scope of this volume; however, AFIs and Air Force Occupational Safety and Health Standards (AFOSHSTD) regulations cover safety issues that occur on the flight line worldwide, no matter what duties you may perform. The following table describes some of those safety issues and gives you the reference where you can find further information:

Safety Issue	Reference
Fixed and portable ladders usage	~~AFI 91–203~~, chapter 7
Adverse weather	~~AFI 91–203, chapter 11~~
Hand tools and portable power tools	~~AFI 91–203, chapter 12~~
Manually propelled and self-powered work platforms	~~AFI 91–203,~~ chapter 16
Respiratory Protection Program	AFI 48–137

Safety enforcement

Even when safety equipment has been safety engineered, and technicians have acquired safety knowledge, there are still problems. Some people are a hazard to themselves and others because they do not follow the accepted safety rules. The time squeeze caused by heavy workloads and emergency war plans may cause people who are normally careful to become careless. The answer to such dangers is supervisors must insist on safety, regardless of the rush. Commanders and operations officers must also insist on safety at all times. If they don't insist on safety, they are, in effect, approving of unsafe practices leading to an accident.

Applying safety information

The importance of placing proper technical instructions and detailed guidance in the hands of the "user" cannot be overemphasized. Air Force-wide standardized procedures are preferable, but often they do not cover the variations in local circumstances or operating conditions. Checklists are the most common forms of directives you will use, but when they do not cover local variations, you may use maintenance operating instructions (MOI) or other locally approved directives. An accurate and complete TO checklist goes a long way toward providing a safe task sequence. As an aircraft armament systems specialist, you must use loading and maintenance checklists faithfully. The checklist reminds you of the steps you might overlook in a time squeeze. If you are a supervisor or a load crew chief, you must insist that you or your subordinates use a checklist at all times. Get into the habit early and when the time crunch comes, using tech data will be second nature.

202. Maintaining safe work areas

Safety in any work area is enhanced by the way your equipment and accessories are arranged. Within the limitations imposed by the size of your work area or design of your shop, you should try to arrange things to make inspection and maintenance simple. You should have ready access to tools, test equipment, and handling equipment to the point where hazards will not be created and endanger other personnel.

General housekeeping

General housekeeping is the term for maintaining a work area in a general state of good order that will facilitate completion of work. ~~AFI 91–203,~~ chapter 5 provides the general guidance needed for maintaining a minimum level of order in a work area.

The floors and walkways in all areas should be of particular concern to you. Floors and walkways should always be clear of obstacles because they could cause people to slip, trip, or fall. Keeping the floors as dry as possible and cleaning up all spills immediately will prevent a possible mishap. In some areas, such as gun shops where vats are used to clean guns, the floors become extremely slippery at times. A nonskid paint used on the floor will greatly reduce the hazard of personnel slipping and falling.

Another focus of concern in housekeeping is the placement of materials and supplies so that they do not cause an unacceptable hazard for no other reason than their location. For example guidance is given for how close to sprinkler systems boxes may be stacked. You can have an adequate fire suppression system but if the agent is shielded from the fire, it is useless.

All shops have walkways, and AFI 91–203, chapter 7 lays out the requirements for them. These walkways should be at least 36 inches wide to permit free movement of workers, equipment, and supplies. In the open bay areas like armament shops, permanent aisles should be marked with lines on the floors. These lines should be yellow or yellow and black and be at least 2 to 3 inches wide.

Poor-quality lighting or insufficient lighting can have a detrimental effect on your vision. Not only can it cause damage to your eyes, but it can also reduce your ability to see the obstacles to good housekeeping.

You should be aware of the placement of all safety equipment and protective devices whether working on the flight line or in-shop. Knowing the location and type of equipment available will allow you to react quickly in the case of an accident. The serviceability of this equipment is very important, and periodic checks should be made to ensure its serviceability. First-aid kits are not normally permitted in shop areas. However, they may be kept in a shop when authorized by the base surgeon, who must also determine the contents of the kit. The reason for this limitation is that people with injuries should be treated by medical personnel; they should not treat themselves. Supervisors should discuss shop hazards with medical personnel to determine what, if any, first-aid items they should have on hand.

A typical maintenance operation calls for cleaning, inspecting, and using safety devices. The safety devices needed are a good ventilation system, rubber gloves, and face shields to protect the skin and eyes from cleaning agents, eye protectors, and containers for clean and dirty rags. When an operation is over, there remains the important job of returning tools and test equipment to the respective storage points; cleaning the area; cleaning protective equipment; and storing the cleaning agents, solvents, and paint properly. Maintenance equipment may also need repair.

Other good housekeeping practices, equipment, and facilities you should be aware of are as follows:

- The floors need sweeping to keep them clean of dirt and small debris.
- Each shop or work area must have plainly marked separate metal cans for dirty and oily rags and trash.
- An area for storing brooms, mops, buckets, brushes, etc., should be set aside.
- Boiler or similar utility rooms must not be used for storage.

Tool discipline

Tool discipline goes hand-in-hand with the composite tool kit (CTK) program. It isn't the only purpose of the program, but it is an area of high importance. Hand tools are precision instruments capable of performing many jobs when you use them properly and safely. You should have racks, shelves, toolboxes, or tool shadow boards for storing tools when you aren't working with them. When you don't put tools in their proper storage places, they can scatter and disappear like a handful of dropped marbles.

Our purpose at this time is to discuss some general rules for control of tools in maintenance areas. The variety of your tasks require you to use a large number of hand, power, and special tools. For a particular task, select the proper tools and lay them out on some type of stand or tool board or place them in a tool bag. Return them to the stand or bag when you are not using them. When the job is complete, return each tool to its proper storage place. Don't lay tools on or in a piece of equipment or on its storage dolly. The dangers of leaving a tool in a piece of equipment, where it can fall on or in equipment or on you, are obvious. Keep tools out of your pockets; they are dangerous to you, the people working with you, and the equipment. Keep tools off the floor. They can be kicked out of sight or become dirty or damaged. All of these possibilities are obvious when you take the time to think about them; yet, they remain a problem in almost all organizations. Supervisory attention is necessary to eliminate these problems.

Your section can do a lot to control hand tools. The most effective common tool control method is building shadow boards or putting together shadowed toolboxes to match its range of tools. The time spent in construction of shadow boards and boxes will be repaid many times over to the unit in the speed and accuracy with which they will allow tool inventories to be completed. The shadow boards can be of the large, permanently mounted wall type, and toolboxes may be a smaller type that can be mounted on casters and rolled to the job. The needs of your section and the materials it has at its disposal govern the size, style, and design of the shadow boards and toolboxes. Other benefits of the shadow boards or boxes are you will save time by not having to look all over the work area for particular tools, and you will have a quicker, easier way to control your tools.

Accident prevention signs

Accident prevention and safety signs are widely used throughout the Air Force and industry. Figure 1–1 shows some typical signs. The recognized standards for these types of signs are as follows:

- **DANGER**: Grave and immediate danger signs should have DANGER in white within a red oval outlined in white on a black rectangular background.
- **CAUTION**: Use the caution sign for lesser hazards. This sign has yellow lettering on a black background.
- Radiation hazards: These signs have lettering in black on magenta background.

- General safety: This type of safety sign has white lettering on a green background.
- Directional signs: These signs generally have black letters on a white background on the lower panel.

Figure 1–1. Industrial accident prevention signs.

Compressed-gas cylinders

Metal cylinders containing compressed gases, such as oxygen, nitrogen, and air are color coded for identification (fig. 1–2). They are often about the same size and shape; consequently, confusing one type of gas for another could have disastrous results. Therefore, you should always verify the type of gas upon receipt of the cylinder in the work area before you use it. **NOTE**: The type of gas is also stenciled lengthwise on the bottle.

Class	Standard Color	Class of Material
a	Yellow, No. 13655	FLAMMABLE MATERIALS. All materials known ordinarily as flammables or combustibles. Of the chromatic colors, it has the highest coefficient of reflection under white light and can be recognized under the poorest conditions of illumination.
b	Brown, No. 10080	TOXIC AND POISONOUS MATERIALS. All materials extremely hazardous to life or health under normal conditions as toxics or poisons.
c	Blue, No. 15102	ANESTHETICS AND HARMFUL MATERIALS. All materials productive of anesthetic vapors and all liquid chemicals and compounds hazardous to life and property but not normally productive of dangerous quantities of fumes or vapors.
d	Green, No. 14260	OXIDIZING MATERIALS. All materials which readily furnish oxygen for combustion and fire producers which react explosively or with the evolution of heat in contact with many other materials.
e	Gray, No. 16187	PHYSICALLY DANGEROUS MATERIALS. All materials, not dangerous in themselves, which are asphyxiating in confined areas or which are generally handled in a dangerous physical state of pressure or temperature.
f	Red, No. 11105	FIRE PROTECTION MATERIALS. All materials provided in piping systems or in compressed-gas cylinders exclusively for use in fire protection.

TITLE	LOCATION ON CYLINDER			
	TOP A	BAND B	BAND C	BODY
ACETYLENE	YELLOW	YELLOW	YELLOW	YELLOW
ARGON, OIL-FREE	GRAY	WHITE	GRAY	GRAY
CARBON DIOXIDE	GRAY	GRAY	GRAY	GRAY
CARBON DIOXIDE *(Fire only)*	RED	RED	RED	RED
HELIUM, OIL-TOLERANT	GRAY	ORANGE	GRAY	GRAY
METHYLE ACETYLENE PROPADIENE (MAPP) MIXTURE	YELLOW	ORANGE	YELLOW	YELLOW
OXYGEN	GREEN	GREEN	GREEN	GREEN

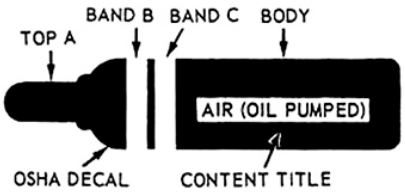

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Figure 1–2. Gas cylinder color codes.

203. Hazardous communication basics

You'll encounter countless hazardous materials in your work. Everything from common cleaners to office supplies can have detrimental consequences for your health if used without the proper level of knowledge. How do you, as the user, gain the knowledge necessary to use these materials safely? This lesson will introduce the various resources available to gain the knowledge you will need to protect yourself and those you work with from the chemical hazards you will be exposed to in the 2W1 career field.

Federal Hazard Communication Training Program

As a 2W1, you will be working with or around many hazardous chemicals. The Federal Hazard Communication Training Program is intended to reduce the incidence of chemically induced occupational illness and injuries by informing employees of the hazards associated with handling hazardous materials in the work place. This program also gives information on the proper preventive

measures to take when using or handling hazardous materials in the work place. It is your responsibility to know how to safely handle and use these chemicals. Chemical containers must be marked with a Warning Label and have a Safety Data Sheet (SDS) describing all hazards involved with handling the material and safety measures to follow while handling the material (figs. 1–3 and 1–4). The SDS and Warning Label are placed in different locations.

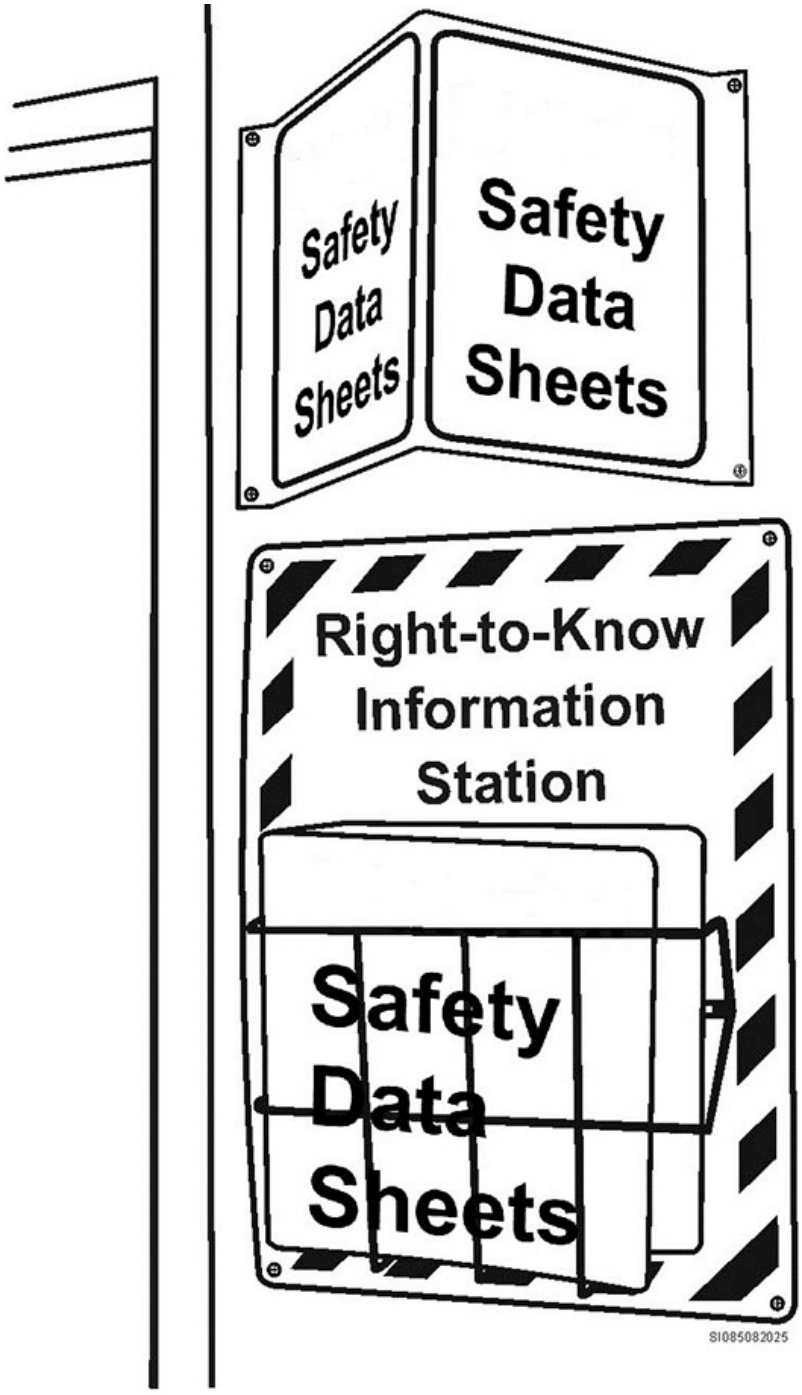

Figure 1–3. Typical Safety Data Sheet, front.

INSTANT HAND SANITIZER

5. FIRE FIGHTING MEASURES:

NFPA: Health 0 Fire 3 Reactivity 0
Flashpoint °F/°C (PMCC method): 86.36°F/30.2°C
Unusual Fire and Explosion Hazards: Product is flammable due to alcohol content.
Special Fire Fighting Procedures: None known.
Extinguishing Media: X Water Fog X Alcohol Foam X CO_2 X Dry Chemical ____ Other

6. ACCIDENTAL RELEASE MEASURES:

Avoid contact with ignition sources since product is flammable. Absorb onto inert material and dispose in appropriate manner. Water clean up and rinse. CAUTION – WILL CAUSE SLIPPERY SURFACES.

7. HANDLING AND STORAGE:

Keep away from fire or flame. Store at normal room temperature away from reach of small children. Keep containers sealed. Use older containers first. Avoid freezing conditions.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

Eye Protection:	None required under normal conditions.
Skin Protection:	None required under normal conditions.
Respiratory Protection:	None required under normal conditions.
Ventilation:	None required under normal conditions.
Protective Equipment or Clothing:	None required under normal conditions.

9. PHYSICAL AND CHEMICAL PROPERTIES:

Appearance and Odor	Clear liquid, citrus fragrance
pH (undiluted):	4.5 – 9.5
VOC , %:	65

10. STABILITY AND REACTIVITY:

Stable/Non reactive product. Avoid ignition sources.

11. TOXICOLOGICAL INFORMATION:

No acute or chronic toxic effects expected when used according to directions.

12. ECOLOGICAL CONSIDERATIONS:

No ecological or special considerations when used according to directions. Not considered environmentally harmful from normal dilution, expected usage and typical drainage to sewers, septic systems and treatment plants.

13. DISPOSAL CONSIDERATIONS:

Characteristic hazardous waste-flammable liquid. Dispose according to local, state and Federal regulations.

14. TRANSPORT INFORMATION:

Hazardous by transport regulations. When transported by Ground and Rail, this product typically is shipped as Consumer Commodity ORM-D. When transported by air, this product is typically shipped as Consumer Commodity or Alcohols N.O.S. depending on package size. When transported by ocean, this product is typically shipped as Limited Quantities. Refer to current regulations for exact requirements.

15. REGULATORY AND OTHER INFORMATION:

TSCA: All ingredients are listed or exempt per reference 15 USC 2602 (2)(B)(iv).

Complies with current FDA regulations for cosmetic and/or over-the-counter drug products.

Notice: The information herein is based on data considered to be accurate as of the date of preparation of this material safety data sheet. However, no warranty or representation, expressed or implied, is made as to the accuracy or completeness of the foregoing data and safety information. The user assumes all liability for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

Figure 1–4. Typical Safety Data Sheet, back.

Occupational Safety and Health Administration's hazard communication standard

The Hazard Communication Standard was issued in 1983 and revised in 1987 by the Occupational Safety and Health Administration (OSHA). This standard strives to achieve the following goals:

- Reduce the incidence of injury and illness caused by hazardous chemicals in the workplace.
- Identify and evaluate chemical hazards.
- Establish uniform requirements for communicating information about chemical hazards to both management and workers.

To achieve these goals, the standard requires certain actions (as described in the table below) by the chemical manufacturers, importers, and employers:

HAZARD COMMUNICATION STANDARD ACTIONS	
Chemical Manufacturers and Importers	**Employers**
1. Conduct hazard determinations to identify the hazards of, and appropriate control measures for, the chemicals they produce or import. 2. Label all containers of hazardous chemicals leaving the workplace to communicate the identity of the material, all appropriate hazard warnings, and the name and address of the responsible party. 3. Obtain or prepare an accurate and up-to-date SDS for each hazardous chemical material sold and provide a copy to every employer that purchases the chemical. 4. Add new information to the SDS on the hazards of a chemical, and/or the appropriate control measures within three months after becoming aware of such information.	1. Maintain an SDS for every hazardous chemical used, and make these SDSs readily available to workers on every shift. 2. Make sure that containers of hazardous chemicals are labeled, tagged, or otherwise marked to identify the chemical and warn workers of the hazards it presents. 3. Maintain an up-to-date list of all hazardous chemical materials known to be present in the workplace and make this list readily available to workers at all times. 4. Inform and train workers. 5. Maintain a written local Hazard Communication Program that describes how the organization complies with the above actions and make this written program available to employees upon request.

Safety Data Sheet

The SDS is the information that you need to know to protect yourself. Every SDS must contain the following general information:

1. The name, address, and telephone number of the party responsible for preparing and or distributing the SDS. Also, it should list the name of someone who can provide additional information on the hazardous chemical and appropriate emergency procedures.
2. Name of the chemical material as it appears on the warning label and Hazardous Chemical Inventory in your workplace.
3. Health hazards of the chemical, including signs and symptoms of exposure.
4. Precautions for safe handling and use.
5. Any applicable control measures.

Many chemical materials are mixtures. Mixtures contain more than one ingredient. The SDS must identify *ALL* hazardous ingredients in a mixture.

Warning labels must be affixed to bags, barrels, bottles, boxes, cans, cylinders, drums, reaction vessels, storage tanks, and other chemical containers. Placards or bin labels can be used for stationary containers as long as the placard clearly identifies the containers to which it applies and provides the same information required for any other type of hazard warning label.

Pipes carrying chemicals do not have to be labeled, but you must be informed about the hazards of any chemicals carried through your work area in unlabeled pipes. A transfer container does not have to be labeled if only one person handles the container and the container is filled and emptied in the same shift.

The following types of chemicals are exempt from the OSHA labeling requirement because other federal laws require labeling.

- Pesticides covered by the Federal Insecticide, Fungicide, and Rodenticide Act (SDSs must be available for pesticides).
- Food, food additives, color additives, drugs, cosmetics, and ingredients in these products covered by the Federal Food, Drug, and Cosmetic Act.

- Distilled spirits, wine, or malt beverages not intended for industrial use covered by the Federal Alcohol Administration Act. SDSs must be available if the use of these products results in worker exposures significantly greater than those of consumers.
- Consumer products and hazardous substances covered by the Consumer Product Safety and Federal Hazardous Substances Acts. SDSs must be available if the use of these products results in worker exposures significantly greater than those of consumers.

The hazardous chemical inventory must name all hazardous chemical materials currently found in your workplace. Containers of materials on the Hazardous Chemical Inventory must be labeled, tagged, or placarded, and SDSs must be available for every material on the Inventory. You can use the Inventory to find out whether a hazardous chemical material is used in your workplace. You can also use the Inventory to see if a material you work with is considered hazardous. If it is hazardous, it must be on the Hazardous Chemical Inventory.

SAFETY DATA SHEET

IN CASE OF EMERGENCY CALL

1. **PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION:**

Product Name: **INSTANT HAND SANITIZER**

Company Name & Address: Kenneth Burke & Company
24 Griffey-Buhner St. Suite 1119
Martinez, Wa. 99626

Emergency Phone: 123-456-7890
Non-Emergency Phone: 956-542-9834
MSDS Request Phone: 658-682-4698

2. **INFORMATION ON INGREDIENTS:**

HAZARDOUS INGREDIENTS	CAS NUMBER	OSHA PEL	ACGIH TLV	% RANGE
Ethyl Alcohol	64-17-5	1000 ppm	1000 ppm	62
Isopropanol	67-63-0	400 ppm	400 ppm	<5

Other ingredient(s) with notification requirements:	CAS NUMBER	List
Ethyl Alcohol	64-17-5	MA 1; NJ 1S; PA 1; CN 2
Isopropanol	67-63-0	MA 1; NJ 1S; CN 1

3. **HAZARDS IDENTIFICATION:**

EMERGENCY OVERVIEW
When used according to instructions, the product applicable to this MSDS is safe and presents no immediate or long-term health hazard. However, abnormal entry routes, such as gross ingestion, may require immediate medical attention.

Potential Health Effects:

HMIS: Health 1 Flammability 3 Reactivity 0 Personal Protection None

Eye Contact: May cause eye irritation.
Skin Contact: No irritation or reaction expected.
Inhalation: Not applicable.
Ingestion: May cause upset stomach, nausea (Abnormal entry route).
Carcinogenicity: Not listed as a carcinogen by NTP, IARC, OSHA or ACGIH.

4. **FIRST AID MEASURES:**

Eye Contact: Do not rub eyes. Flush eyes thoroughly with water for 15 minutes. If condition worsens or irritation persists, contact physician.
Skin Contact: Not applicable.
Inhalation: Not applicable.
Ingestion: Do not induce vomiting. Contact a physician or Poison Control Center.

Figure 1–5. Typical SDS information station.

OSHA-required SDS information should be organized in one convenient, central location (fig. 1–5). Access to SDSs in the work area and shops is provided as follows:

1. All workers on all shifts must know how to obtain an SDS and must have unrestricted direct access to SDSs for their work area/shop during all shifts.
2. SDSs may be maintained in the work area/shops in paper or electronic version. OSHA does not specifically prohibit any form of access as long as "no barriers to immediate employee access" are created.
3. The location of SDSs and/or means of access for any work area/shop is determined locally. The supervisor should consider how long it would take a worker to obtain an SDS if it were needed to respond to a spill or if a worker was accidentally splashed with a hazardous chemical.
4. If the primary means for SDS access is electronic, a back-up system for SDS access must be established in case primary computer access is disrupted. The back-up system may include, but is not limited to, paper copies, local computer files, or CDs at another nonimpacted location, telephone, or FAX. Local judgment must be used to determine an adequate back-up system on a case-by-case basis.
5. Where personnel must travel between work area/shops during a work shift (e.g., their work is carried out at more than one geographical location such as flight line operations), the SDS may be kept at the primary work area/shop facility. In this situation, the supervisor must make sure that personnel can immediately obtain the required information in an emergency.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

201. Accident controls

1. What AFI gives supervisors and workers the standards for personal protective equipment?

2. What will prevent accidents when time constraints and emergencies cause people who are normally careful to become careless?

3. What is the *most* common form of directives you will use?

202. Maintaining safe work areas

1. What term refers to maintaining a work area in a general state of good order that will facilitate completion of work?

2. What tasks are required when a maintenance operation is completed?

3. What is the *most* effective common tool control method that a section can take?

4. How are directional signs *normally* color coded?

5. Besides color coding, how can you determine the contents of a compressed gas cylinder?

203. Hazardous communication basics

1. What is the purpose of the Federal Hazard Communication Training Program?

2. What contact information is required on SDS labels so that the user can obtain more information on the chemical?

3. What must be established if the primary means of SDS access is by electronic methods?

1–2. Health Hazards and Protective Equipment

In the normal range of work within the 2W1X1 career field, you will encounter a number of health hazards at one time or another. These hazards are classified as follows:

- Atmospheric contaminants.
- Skin contaminants.
- Physical hazards.

Each of these particular hazards requires you to use the appropriate protective equipment when you are working around them. Electrical hazards are discussed in a later unit.

204. Physical hazards, contaminants, and influencing factors

Our career field will expose the average worker to many different hazardous conditions and locations to complete the mission. Every situation will expose you to a unique mix of hazards and situations that you are going to have to protect yourself and others from.

Physical hazards

A typical armament shop is a prime source of physical hazards. Power tools and heavy objects cause most of these conditions. Power tools can throw off metal shards, wood splinters, and plastic chips with enough force to penetrate an eye or the skin. You may drop a heavy object or an object may fall on your toes or fingers. Objects with rough or sharp edges can cause splinters and cuts when handled. Eye accidents make up the largest percentage of all accidents resulting from physical hazards.

Lighting

Insufficient light can cause long-term eye problems. General lighting may be sufficient, but some work areas may need more. If you suspect your lighting is inadequate, contact bioenvironmental engineering. These personnel use light meters to determine the correct lighting.

Handling heavy objects

One particular hazard affecting many people is the handling of heavy objects. According to the National Safety Council (NSC), the majority of injuries on the job results from handling materials or heavy lifting. This, of course, causes injuries to the back. The bones in your spinal column are arranged like a stack of coins. The straighter they are, the stronger they are. Hence, the main point to remember when lifting is to lift with your legs, *not* with your back. Keep your back as straight as possible.

When the load or material is too much for one person to handle safely, and mechanical equipment is not practical to use, always get help from your coworkers. You should choose, if possible, a coworker approximately the same size as yourself. If one of you lifts too soon, shifts the load, or lowers improperly, either you or your coworker may be overloaded or strained. Supervisors should periodically monitor, evaluate, and advise their employees on proper lifting techniques.

Atmospheric contaminants

Dust, gas, vapor, fumes, and mist are examples of atmospheric contaminants. Dust is not a particular problem unless you do extensive sanding or you handle certain packaging materials. Dust is the most injurious and is made up of small particles you can't see. Gas and vapor are hazardous because they are asphyxiates, irritants, anesthetics, or poisons. Asphyxiates prevent oxygen absorption into the blood. Irritants inflame the respiratory system. Anesthetics cause a narcotic or drug-like effect. Poisons injure or destroy organs.

Gases and vapors

A gas and a vapor are not the same. A gas is a substance existing as a gas in its natural state at ordinary temperature and pressure. Examples are oxygen, nitrogen, tritium, and carbon monoxide. A vapor is the gas given off from a substance normally existing as a liquid or, in some cases, a solid. Common vapors found in your work area are those given off from acetone, toluene, water, trichloroethylene, and alcohol.

Fumes

Fumes, sometimes confused with gases and vapors, are of about 0.3-micron size, usually resulting from the condensation of substances heated or burned. Fumes are produced from decomposition, chemical or metallurgical processes, or molten metal. Such things as overhead rectifiers, hot solder, and burnt electrical insulation produce fumes.

Mists

Mists or fogs are suspended droplets of liquid caused by the condensation of materials from a gaseous to a liquid state or by the breaking up of a liquid into minute drops. Sulfuric acid, resulting from charging a lead-acid battery, may produce a mist during certain operations. Steam, fog, and spray paint are other examples of mists.

Degree of hazard

The degree of hazard is associated with exposure to health hazards and depends on various criteria. The following is a short list of common criteria that further defines the methods that chemicals can cause injury:

1. Toxicity.
2. Dosage.
3. Individual differences.

Toxicity

Toxicity of the chemical is a measure of how severe symptoms a given chemical produces or how long these symptoms persist.

Toxicity	Effects of Exposure
Low	Minor symptoms that go away when exposure stops.
Medium	Require medical attention, may be permanent.
High	Can cause death or severely disabling conditions.

Some chemicals are more toxic by one exposure route than by another. For example, onion juice vapor irritates the eyes, but skin contact with onion juice produces little or no effect.

Dosage

Dosage is simply a measure of how much exposure someone has had to a particular chemical. Things to consider regarding the exposure of the chemical include the following:

1. How *much* you are exposed to each time.
2. How *long* each exposure lasts.
3. How *often* you are exposed.

Individual differences

Different people are affected in different ways when subjected to chemicals. Many factors are going to contribute to the effects on personnel such as the following:

1. Work practices.
2. Age and size.
3. General physical and emotional health.
4. Allergies and sensitivities.
5. Level of exertion.

Skin contaminants

Skin contaminants are substances that cause irritation to the skin. They fall into chemical, mechanical, and physical categories. The solvents previously mentioned represent the class of materials you will be concerned with the most. In addition to cleaning solvents (such as trichloroethylene and methyl ethyl keytone), there are acids (mostly battery acids), paints, paint removers and thinners, petroleum fuels, strong soaps, and epoxies. When used on support equipment, they may remove skin oils or splash in your eyes or on your clothing. You must use protective equipment each time you handle one of these agents. If you want to know the specific dangers of any chemical agent, read the SDS or contact the bioenvironmental engineering section at the base medical facility.

Tiny particles of wood, metal, steel wool, and emery dust may enter the skin through scratches, or they may enter in by force. These particles are classified as mechanical agents. Primary hazards are steel wool and various types of abrasive papers used in cleaning and painting. Other hazards to the skin are sunburn, frostbite, and chapping. These are classified as physical hazards.

205. Common protective equipment

The purpose of protective equipment is to protect you and the people working with you—not the equipment. If protective equipment is not used, left in a drawer, left on the wall, or left on a bench—it is useless.

Purpose

You should take steps to protect your own health, and supervisors should look out for careless workers who do not use the proper equipment. You must overcome the natural aversion most people have to wearing protective equipment. Unfortunately, the equipment is a burden to put on; it requires time and interferes with your movements in many cases. You probably dislike wearing items worn by others. You should realize the important need to use this equipment and get over your natural reluctance to wearing it.

How will you know what kind of protective equipment to use while performing a task if specific guidance is not provided from a technical manual? The responsibility for determining this rests with the bioenvironmental engineering personnel at your local medical facility. Contact them for advice, and remember to present them a complete picture of your situation.

Equipment types

The following paragraphs discuss the methods of providing protection for the health hazards we just discussed. The appropriate equipment authorization tables or documents list specific types of protective equipment for your organization. These fall into the following general categories:

- Respiratory equipment.
- Goggles.
- Head protection.
- Foot protection.
- Arm and hand protection.
- Body protection.

Respiratory equipment

One of the best protections, and the most basic, you can have against atmospheric contaminants is *good ventilation*. Some chemical agents "swell up" very rapidly in the maintenance area; others can make a light-headed, but not objectionable, atmosphere before you are aware of them. In cases where the exhaust system will not satisfactorily remove atmospheric contaminants from a working area, it may be necessary to move the job to the outdoors, use smaller amounts of materials, or open doors to circulate air.

If you recall from a previous discussion atmospheric contaminants are those affecting the respiratory system—the lungs. Listed below are a few types of protective breathing equipment:

- The filtering type uses a filter pad, canister, or cartridge to reduce contaminated air to a safe level for breathing over a short period.
- A safe-air type provides uncontaminated air from a distant point.
- A self-contained or self-generating oxygen breathing apparatus.

You must be careful to use the right type of equipment for each job. For example, a dust filter mask used to filter out particles when you are sanding would be of no use when you are cleaning a surface with a volatile liquid cleaning agent. The toxic vapor from the cleaning agent (where the concentration was high enough) would require a safe air breathing apparatus.

Goggles

Goggles are for eye protection. Types normally available are as follows:

- Spectacle goggles.
- Nonconductor and nonflammable spectacles.
- Chipper's goggles.
- Wire-screen goggles.
- Chemical goggles.
- Welding goggles.
- Combustion (foundry) goggles.
- Gastight goggles.
- Miscellaneous goggles (heated lens, prescription lens, and for wearing over regular glasses).

You should take care to select the right type of goggles for the job to protect your eyes from particles flying from any direction.

Wear goggles for those jobs where there is a probability of flying particles. Typical examples of jobs requiring the use of goggles are those requiring the use of electrically powered tools to remove threaded inserts, drill holes, buffing corroded or painted surfaces, or grinding. Observers, as well as the person doing the work, should wear goggles. Clean the goggles after they are used.

When visibility is critical, the use of a face shield can be used in the place of goggles. Grinding operations are a good example of needing greater visibility. The face shield provides protection in all directions for the entire face and allows for greater visibility with less chance of fogging. Face shields, however, do not work well when you have to move in and out of tight spots.

Head protection

Of the many types of head protection devices in use, we are interested in the hard hat. The hardhats are usually fracture-resistant composition shells supported on adjustable cradles or hammocks that act as shock absorbers. They protect the wearer from injury by falling or flying objects. You should wear head protection when working around items above your head, such as equipment or boxes on shelves, and where there is the possibility of these items falling on you. You should refer to AFI 91–203, chapter 14, for safety items to be worn in your work area.

Foot protection

There are three types of safety shoes: safety-toe shoes, conductive shoes, and non-sparking shoes. Safety-toe shoes protect a worker's feet from injuries caused by heavy, rolling, or falling objects. A steel box built into the toe of the shoe provides this protection. Conductive shoes ground static charges generated on people when working in locations where explosives or flammable atmospheres exist or where explosives or flammable materials are used. Non-sparking shoes contain very little ferrous metal. As an aircraft armament systems specialist, you will most likely be issued safety-toe shoes.

Arm and hand protection

Special sleeves and gloves provide arm and hand protection. You will normally use these items when using toxic cleaning agents and when moving boxes or similar rough-edged materials. The jobs you do will determine the type of glove or sleeve you use.

You should wear rubber or plastic gloves and sleeves wherever acids, alkalis, organic solvents, and other harmful chemicals are used. Leather or cloth gloves are all-purpose gloves worn to protect the hands from jagged objects, rough wood, or similar hazards. Sleeves and gloves are also used to protect the wearer in certain situations where the worker is expected to handle hot items or where high heat may be encountered. They will shield the worker from incidental contact with items that are extremely hot or where prolonged contact with hot items may result in burns to unprotected skin.

The protective quality of a rubber or plastic glove is nullified if it has small holes in it or if it was put away with harmful chemicals on the outside. Inspect the gloves before and after use. Cleaning the gloves after use is necessary.

Body protection

An apron, usually the bib type, helps to protect the body. The apron, face shield, sleeves, and rubber gloves together are usually sufficient protection against solvents and cleaning agents that might get on a person's skin or clothing while cleaning parts or machinery. You may also be instructed to use an apron in situations where you may be exposed to hydraulic fluid such as while connecting or disconnecting hydraulic lines. Clean the equipment of corrosive chemicals or fluids following use. An apron is also used in applications where the worker is using bench or hand-held grinders or similar tools. The apron shields the worker from flying particles and hot sparks that may cause injury.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

204. Physical hazards, contaminants, and influencing factors

1. What causes most of the physical hazards found in a typical armament shop?

2. What is the main point to remember when lifting heavy objects?

3. How do gases and vapors (asphyxiates, irritants, anesthetics, and poisons) differ in the danger they pose to us?

4. What is the difference between a gas and a vapor?

5. What is the difference between fumes and mist?

6. List the three categories of skin contaminants.

205. Common protective equipment

1. Why is it necessary to use protective equipment?

2. Why do people have a natural reluctance to wear safety equipment?

3. Who should you contact to determine the safety equipment to use in a particular situation?

4. What is the *best* basic protection against atmospheric contaminants?

5. On what type of jobs are goggles to be worn?

6. What conditions determine whether goggles or a face shield should be worn?

7. In addition to goggles or a face shield, what other head protection will you normally use?

8. What type of protective footwear is required when working around heavy, rolling, or falling objects?

9. What type of protection would you use for your hands when doing the following?

   (a) Working with hazardous chemicals?

   (b) Working with wooden crates?

1–3. Fire Prevention

You should direct your “practice of safety” toward prevention rather than cure. In this section, we discuss fire classifications, firefighting equipment, and health hazards associated with fire. We intend to provide you with information on fire prevention and your responsibilities regarding fire prevention.

206. Fire and its common causes

Fire and its causes obviously need to be a primary focus of attention for any personnel working with/or around explosives. As a weapons troop your close proximity and interaction with explosives on a daily basis make this topic of discussion very important.

Fire

Fire is the rapid oxidation of a combustible material, producing light and heat. To produce fire, three things must be present at the same time—fuel, heat, and oxygen. If any one of the three is missing, a fire cannot be started. With the removal of any one of them, the fire will be extinguished.

Common causes

Generally, when a work area is not properly kept, many types of fire hazards can be present. Wastepaper baskets or rags left on workbenches can be fire hazards. Good housekeeping is necessary in all areas where work takes place.

Flammable vapor concentrations

All flammable liquids have an upper and lower explosive limit. Flammable liquids give off vapors and, when mixed with a certain amount of oxygen, support combustion. In other words, the concentration of vapors in a working area below the lower explosive limits is too lean to burn. This means there is too little fuel to allow combustion. The concentration of vapors could also be above the upper explosive limit or too rich to allow combustion. This means there is not enough oxygen to burn. When the concentration of vapors is between the explosive limits, combustion or explosion is possible. This same situation occurs in an automobile. If the carburetor settings are too rich or too lean, the engine will not start. Within a certain range, an engine will run, although it will run best at one point within the range.

Flash point

A flammable liquid is any liquid with a flash point below 100 °F. A *flash point* is the temperature at which a flammable liquid produces a sufficient amount of vapor to produce a flame if a source of ignition is supplied close to the surface. The flame will flash over the liquid and go out. The point at which the flame will persist is called the *fire point*. Toluene, as an example, has a flash point of 40 °F (4.4 °C). A flame is less likely to happen out of doors because the normal air movement would dilute and remove the vapor concentration. Based on these considerations, the flash point can be avoided by good ventilation to lean out the mixture or by eliminating spark-producing sources. Ventilation is far more practical than temperature control.

207. Fire classes and extinguishers

The maintenance and operation of portable fire extinguishers and fire suppression systems may involve exposure to toxic fire extinguishing agents and by-products of combustion. Health hazards include breathing toxic gases, absorption of toxic liquids through skin contact, and ingestion of toxic liquids. The severity of the hazard depends upon the type of chemical, concentration, and duration of exposure. Additionally, fires produce toxic by-products of combustion, some of which are toxic gases and fumes. Fires also consume oxygen and produce high temperatures, which create areas that are immediately dangerous to life and health. It is important that personnel receive training in the proper use of available portable fire extinguishers and fixed fire suppression systems.

Fire classifications

Fire extinguishers are divided into four categories (fig. 1–6), which are based on different types of fires. Each fire extinguisher also has a numerical rating that serves as a guide for the amount of fire the extinguisher can extinguish. The higher the number rating on the extinguisher, the more fire-fighting power contained in the extinguisher.

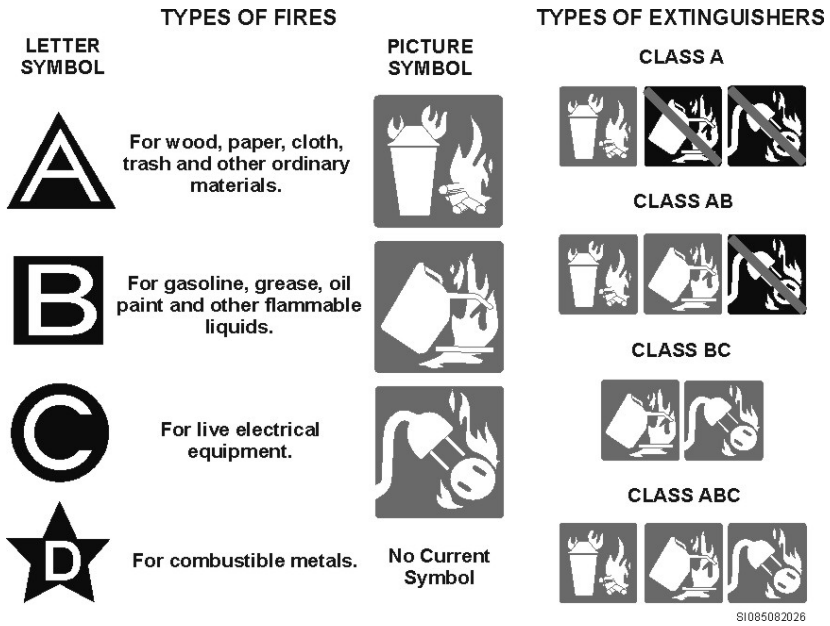

Figure 1–6. Fire extinguisher classes.

It is critical that you use the correct type of extinguisher on each class of fire. Some agents are ineffective on certain classes of fires; some may cause the fire to grow in size; or some will cause the burning material to explode. For example, if you were to use water on an electrical fire, it can act as a conductor and permit your electrocution. The four classes of fires and their extinguishing agents are discussed in the following table.

CLASSES OF FIRES	
Class	**Explanation**
A	Fires involving wood, paper, cardboard, and most plastics are typical class A fires. Fires in this classification can be extinguished by water effectively and safely. The agents used on this fire generally work by cooling the fuel to quench the fire. The numerical rating on these types of extinguishers indicates the amount of water it holds and the amount of fire it can extinguish.
B	Fires in flammable liquids such as gasoline or other fuels, solvents, natural gases, or similar substances are termed class B fires. The agents used to extinguish this type of fire dilute or eliminate oxygen by exclusion or blanketing to smother the fire. The numerical rating for class B extinguishers indicates the approximate number of square feet of fire it can extinguish.
C	Fires in electrical equipment are class C fires. The extinguishing agents used on this class of fire *must* be nonconductors of electricity and work principally to smother the fire eliminating its access to oxygen. Class C extinguishers do not have a numerical rating.
D	Fires in combustible metals such as magnesium, potassium, powered aluminum, zinc, sodium, titanium, zirconium, and lithium are class D fires. Use dry-powder extinguishers on all class D fires. These types of extinguishers also have no numerical rating, nor are they given a multipurpose rating—they are designed for class D fires only.

Your base fire chief is responsible for training your people on the proper use of fire equipment and performing fire inspections.

Common fire extinguishing agents

AFI 91–203, chapter 6 lists the common fire extinguishing agents that you may encounter in an operational setting and the hazards associated with them. While not a comprehensive listing, the following list does provide a good cross-section of commonly used agents:

1. Bromotrifluoromethane (Halon 1301) agent vapors are relatively nontoxic except at high vapor concentrations. However, they are toxic when exposed to heat and produce toxic by-products during combustion that can be hazardous, especially in small areas.
2. Bromchlorodifluoromethane (Halon 1211) and other halon agents are used in engine nacelle and other compartment fire suppression systems. All halons should be considered toxic and not approved for use in flooding applications in occupied locations. These agents should be handled with care, and inhalation of halon vapors should be avoided.
3. Carbon dioxide used in concentrations sufficient to extinguish a fire, while not toxic itself, will displace oxygen and make the area incapable of supporting life. A vapor cloud may reduce visibility.
4. Water presents shock and electrocution hazards if used on fires involving energized electric equipment.
5. Dry chemical agents can reduce visibility when used in small, unventilated areas. It is a fine powder and is composed of sodium bicarbonate, potassium bicarbonate, urea-based potassium bicarbonate, chloride, or monoammonium phosphate. It may clog filters in air-handling systems and leave a residue. Dry chemical agents are considered nontoxic from a physiological point of view. However, they may produce mild irritation to the eyes and, in heavy concentrations, can also cause breathing difficulty.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

206. Fire and its common causes

1. What three things must be present at the same time to produce fire?

2. What is a flammable liquid?

3. Define flash point.

207. Fire classes and extinguishers

1. List the four general classes of fires.

2. Where do class C fires occur?

3. Fires in which class can be extinguished by water effectively and safely or some other agent used to cool or quench the fire?

4. Which fire classification consists of combustible metals such as magnesium, potassium, powered aluminum, zinc, sodium, titanium, zirconium, and lithium?

1–4. Electrical Safety

One of the most treacherous features of electricity, particularly in high-voltage circuits, is you cannot see, hear, taste, or smell it. You will certainly be able to feel it if something goes wrong. In your work, you will be exposed daily to the dangers of electrical shock and burns resulting from contact with “hot” circuits. Our purpose in this section is to give you a basic knowledge of electrical safety and its hazards and to discuss how electrical safety applies to you in your job.

208. Factors influencing the effects electricity has on an individual

Everyone has felt the physical effects of electricity—from the bright spark of a static discharge to the tingle of a 9-volt battery. These are generally harmless manifestations of electricity. What makes them harmless as opposed to dangerous? This lesson will enlighten you on the important factors that can transform harmless experiences to life threatening hazard.

Effects of current (amperage)

Current flow or amperage is the primary factor to consider when dealing with electricity. There are a number of associated factors used to determine the shock severity you may receive, such as rate of flow, duration, frequency, path of current flow, your physical condition, and the phase of the heart cycle at the time the shock occurs.

These are largely intangible factors that are virtually impossible to predict even if it would be of value to do so. The following considerations should reinforce the fact that amperage, not necessarily voltage, is the killer. A current of about 1 milliampere (.001 of an ampere) causes a shock strong enough to be felt but is *normally* harmless. Current between 25 and 50 milliamperes (.025 and .050 of an ampere) is very painful and may produce exhaustion, asphyxiation, collapse, or unconsciousness followed by death. Death may result when breathing becomes impossible due to paralysis of the muscles controlling respiration.

Currents from 100 to 300 milliamperes (.100 to .300 of an ampere) lasting for a quarter of a second or longer may produce an immediate fatal electrical shock. These currents will usually cause *ventricular fibrillation*. This means the normal heart rhythm is disturbed and the individual muscle fibers of the heart chambers (ventricles) twitch, or fibrillate, instead of contracting in unison. The heart fails in its function, and circulation of the blood ceases. This stoppage of blood flow results in *cerebral anoxia* (lack of oxygen to the brain cells). This, in turn, affects the respiratory center and nerves so respiration stops after a few minutes. The human heart *cannot* normally recover by itself from ventricular fibrillation. It requires a medical procedure using a counter-electrical shock to stop fibrillation and to reestablish normal heart rhythm. Large currents of 2.5 to 6 or more amperes, lasting for short periods usually stop (clamp) the heart as long as the current is flowing. The blood pressure may fall to a very low level. When current flow is stopped, the heart generally resumes normal beating and reestablishes the circulation of the blood. However, loss of consciousness generally takes place. High-current shocks frequently stops breathing because of paralysis, but the body may respond to resuscitation if it is applied immediately.

Alternating currents of 2.5 or more amperes may cause serious burns, particularly in the area of contact. Burns break down the resistance of the skin, permitting a much greater current flow with a more severe shock than would occur through intact skin. The intensity and effect of the shock also depends on the circumstances and what parts of the body the current flows through. Current passing from one leg to another can be relatively large without causing more than contact burns. A similar current passing from arm to arm or from arm to leg (fig. 1–7) may cause stoppage of the heart or paralysis of the muscles of respiration.

Figure 1–7. Current flow across the heart.

High/low voltage

There are many factors affecting the way the human body will react to an electrical charge. In addition, there is a strong tendency for people to be voltage-oriented—meaning, if it is not high voltage, it is harmless. This viewpoint is wrong and must be corrected. High voltage is considered

600 volts (V) or 50 milliamperes, and lesser amounts are regarded as low voltage. All voltages are potentially dangerous under certain conditions. These conditions are, but are not limited to, excessive humidity, wet or damp areas, and exposed electrical contacts.

First aid for electrical shock

If the victim of an electrical shock shows any of the following symptoms, emergency medical assistance must be obtained:

- Cardiac arrest (stoppage of the heart).
- Respiratory failure.
- Erratic heartbeat.
- Seizures.
- Unconsciousness.
- Muscle pain, contractions, erratic twitches or jumps.
- Tingling, numbness, burning sensations, or shooting pains.

Assistance may be obtained by telephone, radio, or any other methods that will immediately summon help for the victim. The method is irrelevant as long as the victim gets the help he or she needs. The health of the victim of an electrical shock is directly dependent on the speed at which the person receives the appropriate treatment for his or her injuries.

As the first responder awaiting emergency help, you need to take the appropriate actions to ensure the health of the person you are trying to assist. Initially, you must first make sure that the person is no longer in contact with the source of the electricity and therefore a hazard to you. If you touch a person who is still connected to the source, he or she may end up becoming a conductor of electricity to you. You need to inspect the scene visually *before* you touch anything to ensure that you do not become a victim yourself.

You must turn off any source of electricity or remove it from the victim using nonconductive materials. This can be as simple as turning off a switch or throwing a circuit breaker. You might need to remove the victim or the source (i.e., a downed wire) with a nonconductive object. This can be anything from a wooden broom handle to a piece of plastic pipe, anything that will not transfer the charge to you.

The next step is to use your training in cardiopulmonary resuscitation (CPR) and rescue breathing to evaluate the victim’s needs and offer assistance. Normally, all personnel who work with electricity or on electronic equipment are required to have heart-lung resuscitation training. This training is better known in the field as closed-chest heart massage and mouth-to-mouth resuscitation. Qualified medical technicians provide this training.

Finally, you must treat the victim for shock. All aircraft armament systems specialists are trained in self-aid/buddy care. This specialized training gives you the proper tools to evaluate and treat for shock. Specially trained instructors need to provide this training.

209. Purpose of electrical safety and common electrical hazards

Electricity poses hazards unlike other items that you will work with in the career field. This lesson will cover the two main hazards involved with electricity—shock and fire.

Purpose of electrical safety

There are two very practical purposes behind electrical safety. The first one is to protect you from electrocution. The second is to prevent electrical voltage, either static or normal, from producing a spark that will possibly ignite a combustible or explosive material.

Examples of electrical safety to achieve the first purpose are grounding metal frames of tools and test equipment and using established work procedures to keep you from inadvertently touching a “hot” point. Examples of electrical safety to achieve the second purpose are grounding nonelectrical powered assemblies near combustible gases to bleed off static electricity and shielding squibs to isolate them from static electricity and electromagnetic radiation.

Electrical shock

Electrical shock is probably the most common hazard associated with electricity. Death or serious injury can be the result of receiving an electrical shock. Shock normally causes the heart muscle to spasm or paralysis of the body’s respiratory center.

The injurious effect suffered during electrical shock depends upon the path the electrical current takes through your body. The current takes the most direct route through the body. For this reason, any current path involving the heart or brain is particularly dangerous. Keeping one hand in your pocket greatly reduces the chances of an electrical current getting to either of these two areas. In turn, it greatly increases your chances of living through an electrical shock.

Electrical fires

Do you remember the class C fires we discussed in a previous section? Shorted circuits, overheating equipment, and failure of current limiters or other safety devices frequently cause electrical fires. These types of fire can cause catastrophic property damage, not to mention the ever-present possibility of burns to the human body.

210. Safe electrical work habits

By this point in your studies, you are familiar with the hazards of electricity. We will now cover the ways that we can mitigate the danger involved with electricity.

Electrical repairs

Only competent, qualified personnel should complete electrical repairs. As an aircraft armament systems specialist, you need to learn how to handle electrical circuits properly and how to work on aircraft and suspension equipment safely. AFI 91–203, chapter 8, states the general guidelines on safety while working with electrical equipment. Refer to it often.

Generally, it’s advisable to disconnect electrical items from the power source when you are performing maintenance on the item. In some cases, electrical power may need to be applied for testing, troubleshooting, and adjusting electrical items. In cases where electrical power is to remain on, take precautions to prevent accidental shock. When the repair or troubleshooting of energized circuits with applied voltage in excess of 300 V is authorized, the work will not be started until a qualified safety observer is present. The safety observer must be prepared to disconnect the power immediately if a mishap occurs. All safety observers should be thoroughly trained in the techniques of first aid for electrical shock and CPR and should know the locations of power switches. Anytime equipment is in repair, it should be locked and tagged to prevent inadvertent use.

Do *not* use lead pencils, screwdrivers, or other unapproved tools to test any piece of electrical equipment. Use only items that are authorized for use by technical data or manufacturer’s guidelines for adjustment or repair of electrical items. Do not hold meters in your hands while performing measurements on energized circuits or equipment. When it is necessary to hand hold meters or meter cables, wear gloves or use effective personnel protective equipment. When performing tests, keep the workbenches clean at all times. When voltage is applied to equipment being repaired or tested, personnel must remove all tools and equipment that are not essential to the test from the bench. Ground any metal workbench when you use it for repairing and testing electronic equipment. Workbench stools should be made of wood, fiberglass, or other nonconductive materials.

Electrical cleaning

Use only approved cleaning solvents to clean electrical equipment, components, or devices. Remove electrical power and install proper lockout devices to prevent energizing the item prior to the completion of cleaning. Vacuuming is considered the first choice as an effective method for cleaning dust and debris from circuit devices. Consider the use of compressed air for cleaning *only* as a last resort. Do not allow the maximum pressure to exceed 30 pounds per square inch (psi).

Electrical inspection

Visually inspect all electronic equipment following any repair action, prior to testing. The intent of this inspection is to detect obvious defects that could cause additional damage to equipment if power is applied. The visual inspection consists of, but is not limited to, checking for the following:

- Overheating of electronic components.
- Loose or missing mechanical hardware.
- Proper mechanical operation of controls.
- Frayed, burnt, pinched, or broken wires.
- Securely mounted chassis-mounted components and printed circuit cards.
- Secure and serviceable mechanical, crimped, and soldered connections.
- Missing, damaged, recessed, or bent connector contacts and serviceable insulation.
- Mechanical integrity of case.

Jewelry and loose clothing

AFI 91–203, specifically forbids the wearing of loose (baggy) clothing while working on moving machinery. AFI 91–203, chapter 9, also forbids wearing of finger rings anytime there is the potential for the ring to catch on a part of the equipment. It also forbids rings or watches when working around electrical circuits. The rule itself states people cannot wear rings, watches, or other metal conductive jewelry when working on *electrical* equipment. Metal jewelry makes an excellent low-resistance contact because of its large skin contact area.

Supervisory responsibilities

Supervisors make sure the work areas are inspected for possible electrical hazards. The following are some of the items they check:

- Potential electrocution hazards are found and eliminated.
- Explosion-proof equipment is installed where required.
- Flammable materials are not stored or used near ignition sources.
- Nonessential equipment is deenergized when not in use.

Ultimately it’s everyone’s responsibility to work safely. It takes a conscious effort on everyone’s part to create a safe work environment.

211. Electrical control measures

Electricity is critical in modern systems. However, the presence of voltage in unexpected areas can have dangerous consequences. Whether from a shorted component or static electricity, an unexpected spark can become a source of ignition for flammable gasses, vapors, or explosives. This lesson will enlighten you on the methods and procedures for controlling static electricity and shorted test equipment.

Bonding and grounding

Bonding and grounding of electrical systems, metal structures, containers, power tools, mechanized equipment, and even aircraft are effective means of controlling static and dynamic electrical energy.

The use of bonding and grounding is so common that you will find these techniques to have functional value in virtually all work areas. TO 00–25–172, *Ground Servicing of Aircraft and Static Grounding/Bonding,* and the *National Electrical Code (NEC),* provides the guidelines for proper electrical grounding and bonding.

Bonding

Bonding is simply the placement of a low-resistance (1–3 ohms) wire between two metal objects. This wire allows for equalization of any static electrical charge(s) generated. The wire is usually temporarily affixed to both objects by using metal clamps (preferably copper). Make sure the clamps are placed on *bare metal.* Never place the clamps on painted, rusted, or soiled surfaces as coating or dirt can cause excessive resistance in the connection. Bonding two objects only *equalizes* any static charge present and *does not* drain off or dissipate the charge. This is the reason bonding is invariably used with a grounding system. Figure 1–8 presents an example of bonding used in conjunction with a ground. *By connecting a grounding system, the static charge is safely drained off to a low-resistance point of dissipation.*

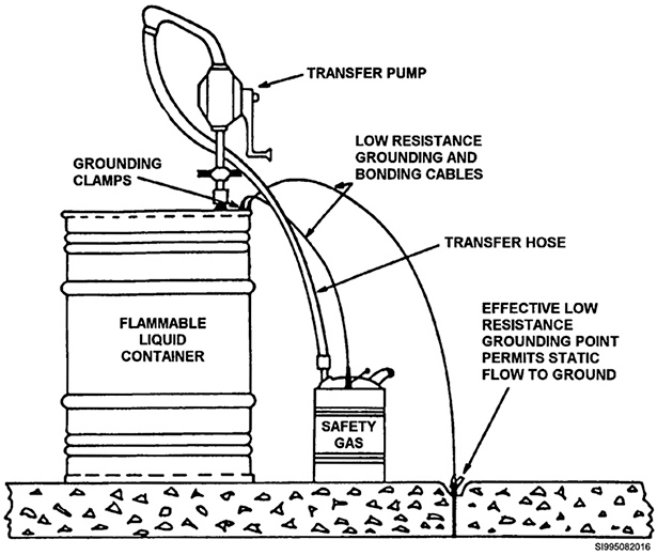

Figure 1–8. Grounding and bonding for flammable materials.

Grounding

Grounding is used to control both static and dynamic electrical charges. Grounding is required as a safety measure in all maintenance operations involving flammable liquids, flammable gasses, and explosives. The two common types of grounds, system and equipment, serve similar yet different purposes.

System ground

A system ground is a current-carrying conductor. An example is in a home wiring system. The so-called return wire in a two-wire 110 V circuit, or the neutral wire in a three-wire 220 V circuit, is attached to a ground in the earth. One of the leads back to the power station is also attached to ground. Thus, the earth also acts as part of the conductor.

The actual ground in this instance is normally a cold water pipe, with the ground wire being affixed to the pipe at a point between the earth and pipe connections, such as joints, elbows, water faucets, or water meters. The NEC sets forth guidelines for grounding and bonding.

Equipment ground

An equipment ground is a wire attached to the frame of a power saw, the case of an electric drill, or an aircraft frame (fig. 1–9). The other end of the wire is attached to ground or earth. Its purpose is to drain off any voltage built up in these units due to poor insulation or bare wires in them. This ground wire prevents the operator from becoming the grounding conductor. The most important point is that the grounding paths *must* be continuous—there must be no breaks in the grounding paths.

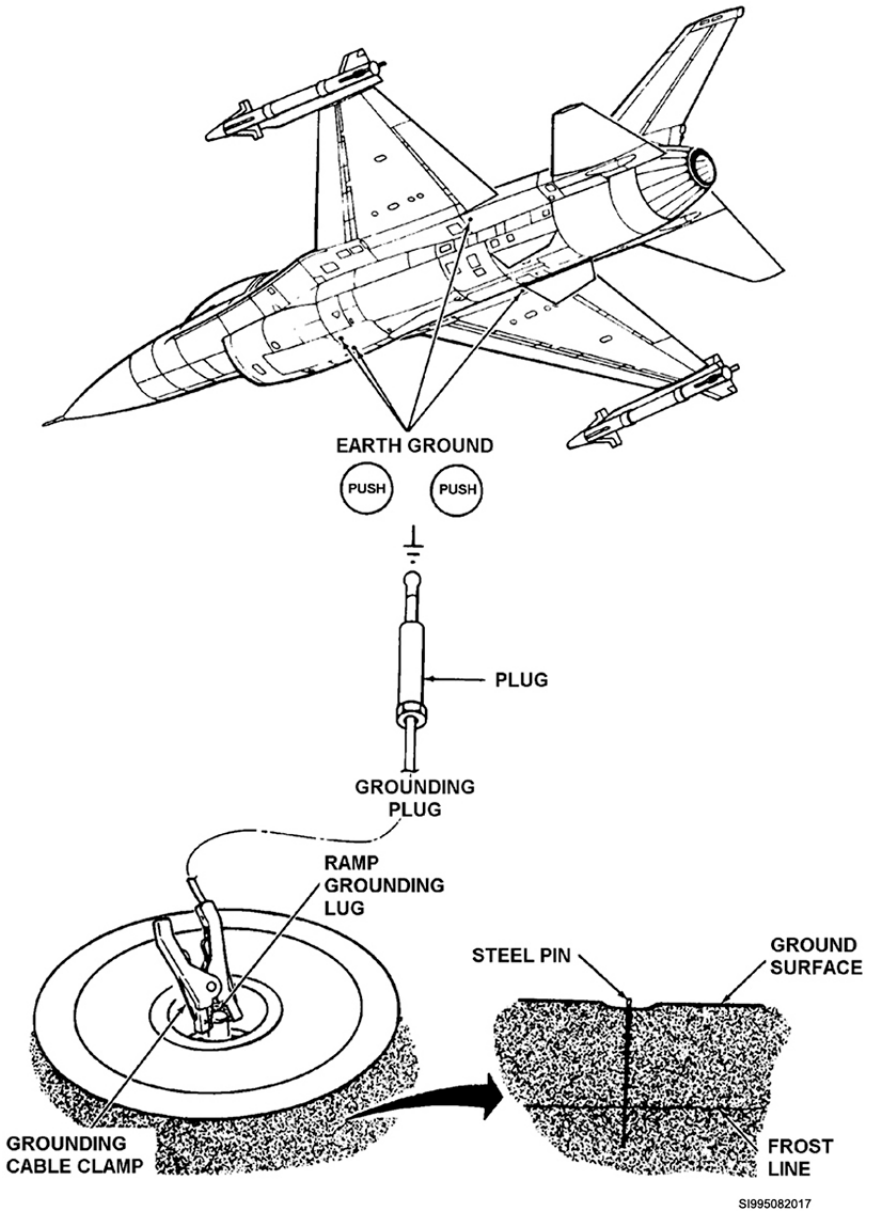

Figure 1–9. Aircraft grounding.

Portable electric equipment grounding

Portable electric equipment is a primary source of problems regarding maintenance of effective grounds. Usually, this is because the equipment is moved about so much and is, thereby, subject to general abuse and use in less than ideal working conditions. Modern equipment design has considered this factor and provided double-insulated casings for gear such as electric handheld drills, sanders, soldering guns, and so forth. This simply means the outer casing is not in contact with the inner casing.

Should an electrical problem develop, the current will be confined to the inner casing and the electrical circuit until the fuse or circuit breaker capacity is exceeded and the fuse burns out or the circuit breaker trips. Equipment designed in this fashion will not be provided a third wire/grounding wire.

For grounding portable tools or appliances, a three-wire extension cord with a three-pronged plug is generally used. Two wires and prongs provide the connections for normal use. The third wire is connected to a prong slightly longer than the other two. When the plug is mated to a suitable receptacle, the longer prong makes contact first; this grounds the tool or appliance before a connection is made to the energized lines. Because a person's body resistance is a lot higher than the resistance in the ground line, the larger current will flow through the ground line until the fuse overloads and blows, thereby opening the voltage source to the drill.

Ground test equipment

Most test equipment uses only a two-wire power cord but has a ground lug on the case of the equipment. Connect a ground wire (unless exempted by specific directives) from the grounding lug to the building ground conductor. Some internally powered (battery) test equipment may have a ground wire. You should not hold a meter in your hand while taking measurements on energized circuits or equipment. When it is necessary to hold meters in your hand, gloves or other PPE should be used. Technical orders requiring the use of the test set tells you if you must use a ground. An added safety feature required for the use of high-voltage test equipment (over 600 V) is the use of nonconductive rubber mats to insulate the operator from the floor.

NOTE: Always clamp the spring-loaded alligator clip or battery-type clamp at the end of the ground wire to bare metal. Paint on the surface could insulate the clamp.

212. Safety concerns for fiber optic systems

Fiber optic systems are increasingly used next to conventional electrical systems. They present hazards that are completely alien to other electrical information systems. Aircraft armament systems specialists do not generally come into direct contact with fiber optic systems. You will, however, encounter them with increasing regularity in the future when dealing with other specialties systems. It is important for you to be aware of the unique hazards presented by these systems.

The primary hazard involved with fiber optics is damage to unprotected eyes. The light beam generated by a laser diode can be potentially hazardous to a maintainer's eyes. Avoid looking directly into light beams. Some light beams are not visible to the naked eye; however, they are still hazardous to the eyes. Be cautious around unconnected or uncovered connectors that may contain fiber optic connectors as even casual contact with these light sources can cause severe eye damage.

A secondary hazard is formed by the particles formed from broken pieces of fiber. When broken, the fibers form needle-like structures that can easily be embedded into the skin or eyes. If repair of fiber optic systems is required, it is recommended that damaged or broken fiber material is placed on adhesive tape to facilitate its disposal.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

208. Factors influencing the effects electricity has on an individual

1. What is the primary factor to consider when evaluating potential severity of electrical shock?

2. What amount of current causes a shock to be harmless and still be felt?

3. What amount of current is usually very painful and could cause unconsciousness followed by death?

4. List three conditions where all voltages are potentially dangerous.

5. What method(s) should be used to summon help for an electrical shock victim?

6. If you cannot shut off power when rendering assistance to an electrical shock victim, what action must you take?

209. Purpose of electrical safety and common electrical hazards

1. State the purpose of electrical safety.

2. What is a way to greatly reduce the chances of current reaching your heart or brain when working around live circuits?

210. Safe electrical work habits

1. Who can complete electrical repairs?

2. What precautions must you take when power that exceeds 300 V is to remain on during testing?

3. What items can you use for repair and adjustment of electrical items?

4. What should workbench stools be made of?

5. What type of cleaning solvent is authorized for cleaning electrical equipment?

6. When cleaning an electrical item, what do you install to prevent energizing the item?

7. What is an effective method of cleaning debris from circuit devices?

8. When air cleaning, what is the maximum pressure you can use?

9. What must you do prior to performing electrical testing?

10. What is the intent of performing an electrical inspection?

11. What does performing an electrical inspection consist of?

211. Electrical control measures

1. Bonding is different from grounding in what specific respect?

2. Name the two types of grounding systems.

3. What is the purpose of an equipment ground?

212. Safety concerns for fiber optic systems

1. What is the primary hazard involved with fiber optics systems?

2. What is a secondary hazard associated with fiber optic systems.

Answers to Self-Test Questions

201

1. AFI 91–203.
2. On-the-job supervisors insisting on safety, regardless of the rush.
3. Checklists.

202

1. General housekeeping.
2. Return tools and equipment to their proper storage places, clean the area, clean protective equipment, clean painting equipment, and cleanings agents, solvents, and store paints. You may need to repair equipment.
3. The building of shadow boards or putting together shadowed toolboxes to match its range of tools.
4. Black letters on white background.
5. The type of gas is also stenciled lengthwise on the bottle.

203

1. This program is intended to reduce the incidence of chemically induced occupational illness and injuries by informing employees of the hazards associated with handling hazardous materials in the work place. This program also gives information on the proper preventive measures to be taken when using or handling hazardous materials in the work place.
2. The name, address, and telephone number of the party responsible for preparing and or distributing the SDS. Also, it should list the name of someone who can provide additional information on the hazardous chemical and appropriate emergency procedures.
3. A back-up system for SDS access must be established in case primary computer access is disrupted. The back-up system may include, but is not limited to, paper copies, local computer files, or CDs at another nonimpacted location, telephone, or fax.

204

1. Power tools and heavy objects.
2. Lift with your legs, *not* your back.
3. An asphyxiate prevents oxygen absorption into the blood; an irritant inflames the respiratory system; an anesthetic has a drug-like effect; and a poison destroys or injuries body organs.
4. A gas is a substance that exists as a gas in its normal state at ordinary temperature and pressure. A vapor is a gas given off from a substance, normally a liquid or, in some cases, a solid.
5. Fumes usually result from a condensation of substances that have been heated or burned. Mists are suspended droplets of liquids caused by the condensation of materials from a gas to a liquid state.
6. (1) Chemical.
   (2) Mechanical.
   (3) Physical.

205

1. To protect you and the people working with or for you.
2. In many cases the equipment is a problem to put on. It requires time and interferes with body movement. People also dislike wearing items that have been worn by others.
3. Bioenvironmental engineering personnel at the local medical facility.
4. Good ventilation.
5. On jobs where there is a probability of flying particles.
6. A face shield is usually used in the place of goggles when a wider range of vision is needed, when goggles might fog, or when the entire face needs protection.
7. A hard hat.
8. Safety-toe shoes.
9. (a) Rubber or plastic gloves.
   (b) Leather gloves or cloth gloves.

206

1. Fuel, heat, and oxygen.
2. A liquid having a flashpoint below 100°F.
3. A temperature at which a flammable liquid produces a sufficient amount of vapor to produce a flame if a source of ignition is supplied close to the surface.

207

1. (1) Class A.
   (2) Class B.
   (3) Class C.
   (4) Class D.
2. Electrical equipment.
3. Class A.
4. Class D.

208

1. Current flow or amperage.
2. 1 milliampere (.001 of an ampere).
3. Current between 25 and 50 milliamperes (.025 to .050 of an ampere).
4. Excessive humidity, wet or damp areas, and electrical contacts.
5. Assistance may be obtained by telephone, radio, or any other methods that will immediately summon help for the victim.
6. You need to separate the victim from the source of current with a nonconductive object.

209

1. To protect yourself from electrocution and to prevent electrical voltage, either static or normal, from producing a spark that might ignite a combustible explosive material.
2. Keeping one hand in your pocket.

210

1. Only competent, qualified personnel.
2. A safety observer is required.
3. Only items authorized for use by technical data or manufacturer’s guidelines.
4. Wood, fiberglass, or nonconducting materials.
5. Only approved cleaning solvents.
6. Lockout device.
7. Vacuuming.
8. 30 psi.
9. A visual inspection.
10. To detect obvious defects that may go unnoticed.
11. The inspection consists of, but is not limited to, checking for the following:
    (1) Overheating of electronic components.
    (2) Loose or missing mechanical hardware.
    (3) Proper mechanical operation of controls.
    (4) Frayed, burnt, pinched, or broken wires.
    (5) Securely mounted chassis-mounted components and printed circuit cards.
    (6) Secure and serviceable mechanical, crimped, and soldered connections.
    (7) Missing, damaged, recessed, or bent connector contacts and serviceable insulation.
    (8) Mechanical integrity of case.

211

1. Bonding only equalizes any static discharge present and does not drain off or dissipate the charge.
2. System and equipment.
3. To drain off any voltage built up in these units due to poor insulation or bare wires in them. This ground wire prevents the operator from becoming the grounding conductor.

212

1. Damage to unprotected eyes.
2. The particles formed from broken pieces of fiber.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

1. (201) When considering safety, personal protective equipment *greatly*
   a. increases accidents.
   b. decreases accidents.
   c. increases the cost of protection.
   d. decreases the cost of protection.

2. (201) ~~AFI 91-203, *Air Force Consolidated Occupational Safety Instruction*~~, chapter 7, provides guidance for
   a. respiratory protection program.
   b. fixed and portable ladder usage.
   c. aircraft towing, jacking, and back shop machinery.
   d. color coding, walk surfaces, and movable surfaces.

3. (201) What should you refer to when checklists *do not* cover local variations?
   a. Safety engineering.
   b. Operations engineering.
   c. Career development courses.
   d. Maintenance operating instructions.

4. (202) First-aid kits may be kept in a maintenance shop when
   a. authorized by the base surgeon.
   b. the shop contains flammable material.
   c. the shop contains electrical equipment.
   d. authorized by the squadron commander.

5. (202) Which accident prevention sign has white lettering on a green background?
   a. Danger.
   b. Caution.
   c. Directional.
   d. General safety.

6. (202) What type of accident prevention sign generally has black letters on a white background on the lower panel?
   a. Caution.
   b. Danger.
   c. Directional.
   d. General safety.

7. (203) Which is *not* a goal of the Hazard Communication Standard?
   a. Identifying and evaluating chemical hazards.
   b. Reducing the incidence of injury and illness caused by hazardous chemicals in the workplace.
   c. Ensuring Environmental Protection Agency (EPA) approved methods of disposal for hazardous materials.
   d. Establishing uniform requirements for communicating information about chemical hazards to both management and workers.

8. (203) Who is responsible for adding new information to the safety data sheet (SDS) on the hazards of a chemical and the appropriate control measures within three months after becoming aware of such information?
   a. Air Force office of safety and health.
   b. The chemicals manufacturer and importer.
   c. Occupational safety and health administration.
   d. Federal bureau of mines, chemical, and hazard abatement.

9. (203) According to Occupational Safety and Health Administration (OSHA) labeling requirements, how are pipes transporting hazardous chemicals labeled?
   a. They have placards at the location where they enter the facility.
   b. They have placards where they enter a room larger than 10 by 10 feet.
   c. They are stenciled with their contents on the outward side within 10 feet of where they emerge into an occupied room.
   d. They do not have to be labeled, but personnel must be informed about the hazards of any chemicals carried through their work area in unlabeled pipes.

10. (203) Which document lists *all* hazardous chemicals currently located in your shop?
    a. Common use registry.
    b. Materials inventory listing.
    c. Hazardous chemical inventory.
    d. Combined material safety registry.

11. (204) What agency should you contact if you suspect your lighting is inadequate in a work area?
    a. Wing safety office.
    b. Air Force office of safety and health.
    c. Base bioenvironmental engineering office.
    d. Occupational safety and health administration.

12. (204) Which type of hazard causes the *majority* of injuries on the job?
    a. Wet floors.
    b. Power tools.
    c. Heavy lifting.
    d. Insufficient lighting.

13. (204) In which document can you find information on the hazards of chemicals?
    a. Safety Data Sheet.
    b. AFMAN 91–201, *Explosives Safety Standards.*
    c. AFI 91–101, *Air Force Nuclear Weapons Surety Program.*
    d. AFI 91–202, *The US Air Force Mishap Prevention Program.*

14. (204) Particles of wood and metal are classified as what type of skin contaminant?
    a. Material.
    b. Physical.
    c. Chemical.
    d. Mechanical.

15. (205) A face shield *usually* replaces goggles when
    a. drilling holes.
    b. vision is critical.
    c. a hard hat is worn.
    d. there is a danger of falling objects.

16. (205) What type of protective footwear is required when working around heavy, rolling, or falling objects?
    a. Safety-toe shoes.
    b. Engineer's boots.
    c. Conductive shoes.
    d. Reinforced structure shoes.

17. (205) What type of gloves for arm and hand protection is needed when working around jagged objects, rough wood, or similar hazards?
    a. Vinyl.
    b. Plastic.
    c. Kevlar.
    d. Leather.

18. (206) The definition of fire is the rapid oxidation of a combustible material producing
    a. light and heat.
    b. heat and gases.
    c. heat and vapors.
    d. light and vapors.

19. (206) The temperature where a flammable liquid produces enough vapors to produce a flame if a source of ignition is supplied close to the surface is the
    a. spark point.
    b. fire point.
    c. flash point.
    d. hot point.

20. (206) The *flash point* of a liquid can be *most easily* avoided by
    a. less ventilation and elimination of spark devices.
    b. good ventilation or elimination of spark devices.
    c. controlling the liquid temperature above the flash point.
    d. diluting the liquid and controlling the liquid temperature above the flash point.

21. (207) Which fire classification can be effectively extinguished by water?
    a. Class A.
    b. Class B.
    c. Class C.
    d. Class D.

22. (207) Which fire classification covers flammable liquids?
    a. Class A.
    b. Class B.
    c. Class C.
    d. Class D.

23. (207) The fire extinguishers for which class of fires are *never* assigned numerical ratings nor given multipurpose ratings?
    a. Class A.
    b. Class B.
    c. Class C.
    d. Class D.

24. (207) What hazard does carbon dioxide present to the user when used as a fire-fighting agent in concentrations sufficient to extinguish a fire?
    a. Clogs filters in air-handling systems and leaves a residue.
    b. Displaces oxygen and makes the area incapable of supporting life.
    c. Presents a shock and electrocution hazards if used on fires involving energized electric equipment.
    d. Is toxic when exposed to heat and produces toxic by-products of combustion that can be hazardous.

25. (208) What is the *primary factor* to consider when dealing with the potential harm caused by an electrical shock?
    a. Resistance or ohms.
    b. Current flow or amperage.
    c. Electrical pressure or volts.
    d. Potential difference or electro-motive force.

26. (208) What amount of current flow causes a shock strong enough to be felt, but is *normally* harmless?
    a. .0001 amp.
    b. .001 amp.
    c. .01 amp.
    d. .1 amp.

27. (208) What effect, if any, do burns have on current flow through the skin?
    a. Greatly reduces the skin's resistance to current flow.
    b. Greatly increases the skin's resistance to current flow.
    c. Has no effect on the skin's resistance to current flow.
    d. Marginally increase the skin's resistance to current flow.

28. (208) The intensity and effects of electrical shock are dependent on the circumstances and
    a. the blood pressure of the person.
    b. are stopped by the amount of oxygen in the body.
    c. what parts of the body the current flows through.
    d. are regulated by the lack of contact with the electrical source.

29. (209) One of the purposes of electrical safety is to prevent
    a. static electricity.
    b. wasted resources.
    c. you from electrocution.
    d. normal voltage from shorting out equipment.

30. (210) When performing measurements on energized circuits, meters should
    a. *not* be used.
    b. be held by a helper.
    c. *not* be held in your hand.
    d. be placed on the equipment under test.

31. (210) When do you use compressed air for cleaning electrical equipment?
    a. Only as a last resort.
    b. After using dry cleaners.
    c. Only when oil is applied.
    d. After using chemical cleaners.

32. (210) What do you do before testing and following repair actions of electrical equipment?
    a. Visually check equipment.
    b. Electrically check equipment.
    c. Mechanically check equipment.
    d. Operationally check equipment.

33. (210) Why do you visually inspect equipment before testing and following repair actions?
    a. Document actions taken.
    b. Check for obvious defects.
    c. Establish a maintenance record.
    d. Ensure the job was completed on time.

34. (210) Wearing jewelry is prohibited around electrical equipment because metal jewelry can
    a. heat up through induction causing burns.
    b. heat up through capacitance causing burns.
    c. store static charges that can damage electronics.
    d. be an excellent low-resistance contact because of its large skin contact area.

35. (211) In electrical systems, bonding is simply the placement of a
    a. low-resistance wire between two metal objects.
    b. high-resistance wire between two metal objects.
    c. low-resistance wire between a metal object and the ground.
    d. high-resistance wire between a metal object and the ground.

36. (211) What are the *preferred* metal clamps used for grounding and bonding in electrical systems?
    a. Zinc.
    b. Gold.
    c. Copper.
    d. Aluminum.

37. (211) What effect does bonding have on static electrical charges?
    a. Dissipates them.
    b. Equalizes them.
    c. Increases them.
    d. Rounds them.

38. (211) What electrical safety measure is *required* in maintenance operations involving flammable liquids, flammable gasses, and explosives?
    a. Bonding.
    b. Rounding.
    c. Grounding.
    d. Static testing.

39. (211) What procedure should be used when grounding test equipment?
    a. Route a ground wire from the test set’s ground lug to a two-prong plug.
    b. Route a ground wire from the two-prong plug to the test set’s ground conductor.
    c. Connect a ground wire from the building ground lug to the test set’s electrical connector.
    d. Connect a ground wire from the test set’s ground lug to the building grounding conductor.

40. (211) When handholding a meter while checking electrical circuits, you must always
    a. use gloves or some other type of protective equipment.
    b. ensure the meter leads are set to low resistance to prevent shock.
    c. ensure a ground wire is connected from the meter to a ground point.
    d. ensure a ground wire is connected from the circuit to a ground point.

41. (212) What is the *primary* hazard involved with working around fiber optics?
    a. Thermal burns.
    b. Damage to unprotected eyes.
    c. Inhalation from damaged insulation.
    d. Fire hazard from energized laser diodes.

42. (212) What is considered the *secondary* hazard involved with working around fiber optics?
    a. Thermal burns.
    b. Inhalation from damaged insulation.
    c. Fire hazard from energized laser diodes.
    d. Needle-like structures that can easily be embedded into the skin or eyes.

43. (212) When repairing fiber optic systems, what is the *recommended* method to control broken fiber optic particles?
    a. Sweeping.
    b. Vacuuming.
    c. Cleaning with compressed air at 15 psi.
    d. Placing broken pieces on adhesive tape.

Please read the unit menu for unit 2 and continue ➔

Student Notes

Unit 2. Explosive Safety

THE MENTION OF explosives usually instills a feeling of apprehension in most people. Though explosives are traditionally considered hazardous and there is a history of accidents involving the manufacture and use of these devices, they can be handled, transported, and stored safely when proper precautions are observed. There is no margin for error or carelessness in the handling of explosive items. Those who work continually with explosives must fight the tendency to become too relaxed in observance of safety precautions.

The term “explosive” refers to the fillers in explosive items and includes all ammunition, demolition material, solid rocket motors, liquid propellants, cartridges, pyrotechnics, mines, bombs, and grenades. It also includes warheads of all types (including nuclear warheads), explosive elements of ejection and aircrew egress systems, and explosive components of missile and space systems, as well as assembled kits and devices containing explosive material.

2–1. Explosive Hazards

Explosives are dangerous. As stated in the preceding paragraph, there is a long history of accidents involving their manufacture and use, but they can be handled, transported, and stored safely.

213. Primary hazards of explosives

In addition to the obvious explosive hazards, there are other hazards to consider when working around explosives like toxicity, sensitivity, fragmentation, forward-firing munitions, fire, electricity, and the ever-present human factor.

Toxicity

Inhaling toxic vapors is a hazard to consider when dealing with munitions. This can cause mild headaches in some people and violent headaches in others. Toxic substances in incendiaries and smoke-generating munitions (e.g., spotting charges in practice bombs) are primarily a fire hazard, but these munitions also generate toxic fumes that when inhaled may cause respiratory problems. Looking at burning munitions that contain magnesium or thermite may impair your vision.

Sensitivity

Sensitivity means initiation by a form of energy. This may be friction, compression, or static electricity. All explosives are sensitive to a degree. Each type must be handled according to its specific sensitivity. For this reason alone, you *must* find out the sensitivity of a new or unknown explosive before you try to do *anything* with it. The more sensitive the explosive, the smaller the quantity you should handle at any one time.

Fragmentation

All of the ordnance items used in the military today are encased in some type of container. Generally, they are constructed of thin- or heavy-cased metal. Once the explosive is initiated, the metal case will

rupture and become highly lethal fragments. The velocity and distance these fragments travel depends on a wide variety of factors such as the type of explosive, type of container, or velocity of detonation. As an aircraft armament systems technician involved in handling, loading, and unloading munitions, you must recognize the hazard of fragmentation as an important factor in your operations.

Forward-firing munitions

Munitions items such as guns, rockets, missiles, and flare dispensers pose a forward-firing hazard because of their directional response and potentially long-range impact if activated inadvertently. Aircraft carrying these types of munitions should be positioned to present the minimum hazard to personnel and resources in the event of a mishap. You should never stand unnecessarily in front of or behind these munitions when they are loaded on an aircraft.

Electrical

Guarding against an electrical impulse is of particular concern to us because it might initiate an explosive train. An explosive train can be started by electrical power from an ohmmeter, static electricity, electromagnetic radiation from a radio or radar transmitter or receiver, lightning, or any condition where an electrical voltage could be developed. Using proper grounding and/or bonding techniques can eliminate these ignition sources.

Fire

Fire is one of the greatest single hazards where munitions are concerned. Some explosives ignite at temperatures substantially lower than those required to ignite wood, paper, or fabrics; such ignition may result in an explosion. Therefore, every effort should be made to prevent excessive temperatures surrounding explosives.

Humans

High-strung, nervous, or “jumpy” individuals are not compatible with sensitive explosives, nor are those people who are always in a hurry with everything they do. Explosives handlers should have or acquire close observance of safety. During most of your jobs involving explosives, you have the help of one or more coworkers. They may be qualified craftsmen or other munitions personnel. A good working relation with your coworkers is important. You should always know what they are doing and how they are doing it. From your training, you know that the human factor dictates most of your actions. This human factor is especially important in practicing good explosive safety.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

213. Primary hazards of explosives

1. What are the primary hazards that you must consider when handling explosives?

2. Name three factors that influence the velocity and distance of explosive fragments.

3. Why do forward-firing munitions present a hazard?

4. What technique can be used to prevent an explosive train?

2–2. Explosive Handling

Handling is the main factor, other than quantity-distance (QD) and compatibility that requires special consideration for explosive safety. Examples of common handling situations for a 2W1X1 are fuzing bombs, arming, de-arming, and loading or unloading munitions from aircraft or trailers. Each of these handling situations is governed by rules that help to prevent an unintended explosion by reducing the possibility of fire, severe concussion or impact, and an impulse from an initiating agent.

To guard against a detonation from severe concussion or impact, you must make sure that a munitions item is not dropped, tipped over, or rammed. Remember that cartridges, delay elements, and bomb fuzes also require very gentle treatment.

214. Safe handling of explosives

Since aircraft armament systems specialists cannot avoid explosives, the safe handling of explosives needs to be a priority for members of our career field.

You must observe the following precautions when handling explosive items:

- Handle explosives and components containing explosives with appropriate care at all times. The explosive elements in primers and fuzes are particularly sensitive to shock and high temperatures.
- Be certain containers packed with explosives are not dropped, dragged, or rolled.
- Be careful to keep packing boxes and containers from being broken, cracked, or dented.
- *Never* store explosives in damp places; always use dunnage to keep stored items off the ground or floor. Always store explosive items in the original containers and in a dry, well-ventilated place protected from the direct rays of the sun and other sources of excessive heat.
- *Never* store sensitive initiators, such as bomb fuzes and primers, with other types of explosives.
- *Never* disassemble explosive components.
- Do *not* unnecessarily open sealed containers (i.e., for inspection), and do not remove protective safety devices until just before use.
- Protect explosive items from contamination with mud, sand, dirt, and water.
- Do *not* permit open containers of explosives in a storage magazine.
- *Never* smoke near explosives.
- Avoid using rags and wearing clothing made of materials that have high static generating characteristics.
    a) Normally, clothing materials acceptable for flight-line use are acceptable for handling munitions. Cotton or cotton-synthetic blend materials are preferred. Materials of 100 percent polyester, nylon, rayon, silk, or wool are highly static producing. Wool socks, glove inserts, and caps as well as undergarments of synthetic fabrics or silk are less of a hazard. Nylon field jacket liners should not be worn as an outer garment.
    b) Regardless of the type of clothing worn, a charge of static electricity can collect by being in contact with moving nonconductive substances or coming in contact with a mass previously charged. Therefore, you must be particularly careful to discharge the static potential by grounding yourself prior to handling explosives.
- Do not put on or remove garments while engaged in explosives operations. This reduces the generation of static charges caused by physical separation of materials. If outer garments need to be removed, personnel must step out of the immediate area of operation, remove the garment, ground themselves, and then reenter.

All individuals must thoroughly acquaint themselves with the contents of safety regulations, manuals, and operating instructions before starting an operation. You must fully understand the procedural and safety requirements before you proceed with an explosive operation. AFMAN 91–201, *Explosive Safety Standards*, is the official Air Force regulation on explosive safety. Study the more applicable portions and refer to them frequently.

215. Personnel and explosive limits

One of the best ways to limit the damage caused by an explosive accident is to simply limit the amount of people exposed to explosives.

Personnel limits

All operations must be reviewed to devise ways of reducing the number of people and the quantity of explosives subject to a mishap. The cardinal principle of explosive safety is to expose the minimum number of people to the minimum amount of explosives for the minimum amount of time. Examples of this rule are as follows:

- Tasks not necessary to the operation will be prohibited within the immediate hazard area.
- Personnel not required for the operation in progress will be prohibited from visiting the work area. This does *not* prohibit official visits by safety, quality assurance, management, or inspection personnel up to the established limits.
- You should be aware of the personnel and visitors limits involved in each operation, and you should ensure the limits are not exceeded. You can normally find these limits in your maintenance operational instruction (MOI).

Explosive limits

Determination of an explosives limit requires a careful analysis of all facts. This analysis must cover the operations timing, transportation methods, size of the items, and the chemical and physical characteristics of the materials.

- When needed for a clear understanding, limits will be set up for each area of operation.
- Each worker is responsible for staying within the limits set for his or her location. Limits are normally expressed in net explosive weight (NEW). NEW refers to the total amount of explosives contained in the munitions. This differs from the actual weight of munitions involved. For example an Mk 82 500-pound bomb has a NEW weight of 192 pounds; the weight of the explosive filler *only*. Explosive limits may also be expressed in trays, boxes, pallets, or other units that may be more easily observed and controlled.
- Explosive limits are based on the quantity of explosives sufficient for the operation and QD separation criteria.
- If you require more information in this area, you should consult AFMAN 91–201.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

214. Safe handling of explosives

1. Why must you store explosive items on a dunnage?

2. How should explosive items be stored?

3. What clothing materials are especially high static electricity producers?

4. What is the rule for putting on or removing clothing while you are engaged in explosive operations?

215. Personnel and explosive limits

1. What is the first rule you must follow when planning an explosive operation?

2. What must the analysis of determining explosive limits include?

2–3. Explosive Fire Safety

As we have already discussed, fire is one of the greatest hazards to consider when dealing with explosives. Therefore, it's important for us to look at the hazard classes and divisions of munitions fires so we'll know what to expect if a fire does occur. We should always be familiar with the symbols used to designate the different types of explosive hazards, as we may be required to direct firefighting personnel or fight the fire. Then we'll look at some of the safety precautions we should take during any operation involving explosives. These can't be all-inclusive because of the scope of this course.

216. Explosive fire hazard classes and divisions

How munitions items react to fire and/or explosive detonations is critical information to anyone who interacts with them. It lets handlers and emergency responders know exactly how to react to a given munition/explosive in emergency situations.

General

The Department of Defense (DOD) hazard classification system is applied to the development, manufacture, test, maintenance, storage, handling, loading and unloading of aircraft, and disposal of ammunition and explosives. This system is based on the system recommended for international use by the United Nations organization. The classes and divisions give levels of protection for personnel and property from the effects of fires or explosions, inside and outside military installations. It consists of nine classes for dangerous goods. Ammunition and explosives are all included in class 1.

The ammunition and explosives hazard classes are subdivided into divisions based on the nature of the hazard and its potential for injury or damage. The divisions are not based on compatibility groupings or intended use. The list of items for each division contains examples of the type of product in the division, but does not include all articles in the division.

The separation of the hazard classes into divisions does not always mean the different items in a division may be stored together. In addition, some items may appear in more than one division. This depends on the degree of confinement or separation, type of packaging, storage configuration, or state of assembly. TO 11A–1–46, *Fire Fighting Guidance, Transportation and Storage Management Data and Ammunition Complete Round Chart,* provides you with all information pertaining to hazard class/divisions.

Hazard class 1

The maximum amount of explosives allowed in any location is limited by the QD criteria. These limits are set at amounts no greater than those consistent with safe and efficient operations. Class 1 is divided into six divisions by the types of hazards expected. We concentrate on the four divisions described in the following table that are most applicable to the 2W1 career field.

Explosive Hazard Class 1		
Division	**Title**	**Description**
1	Mass Detonating	Items in this division are principally a blast hazard and may be expected to mass detonate when a small portion is initiated. These explosions generally cause structural damage to adjacent objects. Items included in class/division 1.1 include bulk explosives, some propellants, mines, bombs, demolition charges, missile warheads, rockets, palletized projectiles loaded with trinitrotoluene (TNT) or Comp B (plastic explosives), and ammunition components having mass detonating characteristics. Nuclear weapons are included in this division.
2	Fragment Producing	These are items whose principal hazards are fragment and blast. The hazards may either be individual or in combination, depending on the item's storage configuration, type of packing, and quantity. Minimum separation distances are based on the range of fragments. Most of the fragments will fall within one of the four minimum distances (400, 800, 1,200, or 1,800 feet). These items may explode or detonate progressively when initiated. They burn with intense heat. Examples are rocket motors, igniters, arm/safe devices, and incendiary grenades.
3	Mass Fire	These items burn vigorously, and the fires are difficult to put out. Explosions are usually pressure ruptures of containers. A severe hazard of the spread of fire may result from the tossing about of burning container materials, propellants, or other debris. Toxic effects usually do not exist beyond inhabited building distances. Examples are ammunition with explosive bullets, white phosphorous (WP), and smoke hand grenades.
4	Moderate Fire, No Blast	These items present a fire hazard but no blast hazard. There is virtually no fragmentation or toxic hazard beyond the fire hazard clearance required for high-risk materials. Poisonous fumes may also be expected from this division. Pistol and rifle ammunition, impulse cartridges, safety fuse, and fuze lighters are examples of explosives in this division.

217. Fire division and chemical hazard symbols

The fire division and chemical hazard symbols are used to give guidance to firefighters, security forces, and other personnel as to what type of hazard exists in a fire involving explosives.

General

Fire symbols are normally posted on a storage facility and must be visible from *all* approach routes. You may be tasked with storing munitions at some time or the other, and you will be responsible for seeing that the correct symbols are posted. TO 11A–1–46 helps you to determine the correct symbol to post.

Fire division symbols

Fire division symbols represent the four explosive divisions we discussed previously. The four explosive divisions, 1 through 4, are set up according to the hazard they present. The hazard associated with each decreases as the fire symbol number increases. The hazard is based on the burning or explosive characteristics of the material involved and the danger in fighting the fire. A distinctively shaped symbol (fig. 2–1) depicts each of the four fire divisions. Figure 2–2 summarizes the hazard each symbol represents, as well as the firefighting precautions for each symbol. The background colors for these symbols are orange and the numbers are black.

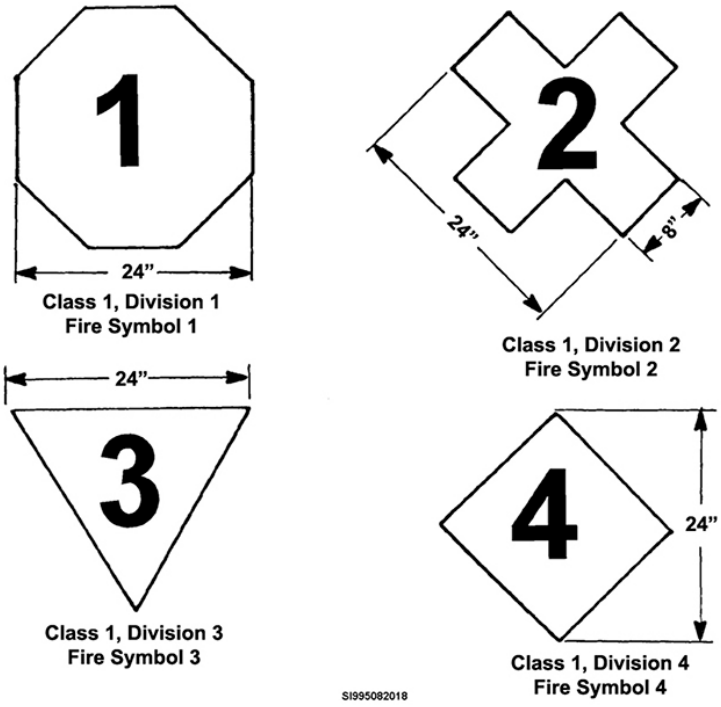

Figure 2–1. Fire symbols.

Fire Symbol	Materials	Hazard	Action/Remarks
1	1.1 Explosives and certain liquid propellants	Mass detonation	1. Will not be fought unless a rescue attempt is being made. 2. If there is a suitable separation between nonexplosive and symbol 1 materials and if approved by the fire, chief, firefighting forces may attempt to extinguish the fire. 3. If personal safety is in doubt, take suitable cover.
2	1.2 Ammunition and explosives	Explosion with fragments	1. Give the alarm and attempt to extinguish the fire if in an early stage. 2. Firefighting forces should fight the fire. If not possible prevent the spreading of the fire. 3. Detonations of items could occur. Provide protection from fragments.
3	1.3 Ammunition and explosives	Mass fire	1. May be fought if explosives not directly involved. 2. If WP munitions are involved, smoke is liberated. a. WP munitions may explode. b. Phosphorus should be immersed in water or sprayed with water continuously. 3. For fires in involving HC and incendiaries: a. Water should not be used unless large quantities are available. b. Use dry sand or dry powder agent in the early stage. 4. For fires involving pyrotechnics and magnesium incendiaries: a. Protect adjacent facilities and equipment. b. Do not use CO_2 or Halon extinguishers or water on on or near the munitions. c. Allow magnesium to cool unless upon flammable material. In this case, use a 2-inch layer of dry sand or powder on trhe floor and rake the burning material onto this layer and resmother.
4	1.4 Ammunition and explosives	Moderate fire	1. Fight these fires. 2. Expect minor explosions and hot fragments.

Figure 2–2. Fire symbol hazards.

Chemical hazard symbols

These symbols are used to identify operating buildings and storage facilities containing pyrotechnic and chemical munitions or agents and other hazardous materials. Hazard symbols vary with the different types of agents.

Posting fire symbols

The fire division symbol of the most hazardous material present must be plainly marked on or near all nonnuclear explosive locations. You must make sure symbols are clearly visible from each road or approach firefighters might use. Post the symbols at the time the explosive is stored.

You may additionally identify (by posting the appropriate symbols on the door of each bay) the explosive contents of individual segregated storage bays of a building. One symbol on or near the door end of an igloo-type magazine is normally sufficient. You may need one or more symbols on each side for other buildings to provide proper guidance to firefighters. Place the symbols directly on the exterior of buildings, but use removable symbols because the contents of the building may change. It is the responsibility of the person in charge of the storage area to post or change symbols and to notify the fire department of such postings and any time they change.

NOTE: If chemical munitions are assembled with explosive components, then chemical hazard symbols must be used together with fire division symbols. Procedures for posting chemical hazard symbols on facilities and areas having nuclear weapons are the same as for fire symbols.

218. Safety precautions for explosive areas

Safety precautions and explosive operations need to go hand-in-hand in all instances. This lesson covers some of the most common precautions involved in explosive operations.

Spark-producing devices and smoking

Matches or other flame- or spark-producing devices are not be permitted in any explosive area except as authorized in writing by the commander. The use of heat-producing equipment producing a temperature higher than 228°F in explosives areas should be confined to temporary use to accomplish essential repairs or operations. When such use is required, maintenance operating instructions (MOI) should cover the location, purpose, duration, and detailed general and explosive safety precautions to be exercised. It should also include the names of the people qualified to supervise and operate the equipment.

Smoking may be permitted within an explosive area only where strict control can be maintained as designated in a written letter from the commander. Such smoking may take place only in safe, specifically designated and posted “smoking locations” within an explosives area.

The concurrence of the base fire marshal must be obtained for all designated smoking locations. The following minimum precautions must be taken at designated smoking locations:

- Suitable receptacles must be provided for cigarette and cigar butts and pipe heels.
- Only electric lighters—no matches or fluid lighters—may be used. These lighters must be of the push-button type or designed to provide an automatic cutoff when pressure on them is released or when they are inadvertently tipped over. Lighters should be permanently installed to prevent removal and use outside the designated area.
- At least one serviceable fire extinguisher of an acceptable type must be provided.
- Persons whose clothing is contaminated with flammable materials must not be permitted in such areas.

- People who work with toxic chemical agents or containers, or other toxic materials, must wash their hands before smoking.
- At each entrance to an explosives area a "No Smoking" sign must be posted. Include the notice "flame or spark producing devices must be turned over to the entry controller or placed in the container provided."

Hand lights

All flashlights or other battery-operated lights used in buildings containing explosive or flammable vapors must be the types approved as "permissible" by the United States Bureau of Mines (USBM) or by a similarly recognized testing laboratory for that specific type of exposure.

Flammable liquids for cleaning

You must ensure highly flammable liquids are not used by your workers for cleaning purposes within an explosives area, or near explosives, unless it is authorized by a TO. The use of such liquids must be confined to specially designated work areas. Stocks of these items must *not* exceed a 1-day supply and must be kept in an approved container or dispenser.

Vehicle parking

Parking any vehicle around munitions must be controlled to minimize fire and explosion hazards. Controlling vehicle parking also gives firefighters easy access to all areas. Parking areas for the government vehicles and handling equipment you use may not be closer than 25 feet to any explosive facility or outside storage site.

Operating support equipment

It is impossible for us to do your job without the use of various types of support equipment. The following precautions apply to all support equipment powered by internal combustion engines you must use near explosives:

- Keep all equipment not directly involved in an operation at least 50 feet from explosives. For specific operations, your commander may authorize reduced distances (with the prior approval of the weapons safety office), but never closer than 25 feet.
- Allow only qualified personnel to use the equipment, and ensure the operation is done according to operating instructions or other pertinent safety directives.
- Perform an inspection of the equipment before use to ensure it is clean and free of visible defects. Document any defects in the applicable forms.
- Keep two fire extinguishers for class B/C fires readily available.
- If your equipment runs low on fuel, remove it to a distance of at least 100 feet for refueling.
- If your equipment malfunctions, or you detect a defect, remove it from the site until it is properly repaired.

Public withdrawal distances

In the event of a fire involving munitions or chemicals, all nonessential personnel must withdraw to at least a prescribed minimum safe distance. The minimum withdrawal distances for each fire division symbol are listed in the following table.

Minimum Withdrawal Distances	
Fire Symbol	**Minimum Withdrawal Distance**
1	250 feet for bulk explosives or not less than 4,000 feet for fragmenting ammunition.
2	2,500 feet.
3	600 feet, and 1,350 feet for quantities of explosives in excess of 500,000 pounds.
4	300 feet. (**NOTE:** If chemical agents are involved, special hazards may be present; therefore, the *maximum* possible withdrawal distances must be used.)

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

216. Explosive fire hazard classes and divisions

1. What DOD hazard class includes ammunition and explosives?

2. Class 1, division 1 explosives produce what type of hazard?

3. Class 1, division 2 explosives produce what hazards?

4. What items are classified as class 1, division 4?

217. Fire division and chemical hazard symbols

1. Why do we need fire division and chemical hazard symbols?

2. As the hazard associated with each division of explosives decrease, what happens to the fire symbol number?

3. What fire symbol must be plainly marked on or near nonnuclear explosive locations?

4. When do you post the fire symbol?

218. Safety precautions for explosive areas

1. Who must authorize smoking areas in an explosive area?

2. What type of flashlight may you use in a building containing explosive or flammable vapors?

3. When are you authorized to use flammable liquids for cleaning and under what conditions?

4. How far away from explosives must equipment be when it is *not* directly involved with an explosive operation?

5. How close to explosives can you refuel your support equipment?

Answers to Self-Test Questions

213

1. Toxicity, sensitivity, fragmentation, forward-firing munitions, fire electricity, and the human factor.
2. The type of explosive, type of container, or velocity of detonation.
3. Because of their directional response and potentially long-range impact if activated inadvertently
4. Using proper grounding and/or bonding techniques.

214

1. To keep them off the ground or floor.
2. In the original containers and in a dry, well-ventilated place that is protected from the direct rays of the sun and other sources of excessive heat.
3. Materials of 100 percent polyester, nylon, rayon, silk, or wool.
4. You must *not* put on or removed garments while you are engaged in any explosive operation. If outer garments need to be removed, you must step out of the immediate area of operation, remove the garment, ground yourself, and then reenter.

215

1. Expose the minimum number of people to the minimum amount of explosives for the minimum amount of time.
2. Operations timing, transportation methods, size of the items, and the chemical and physical characteristics of the materials.

216

1. Class 1.
2. Blast hazard and may be expected to mass detonate when a small portion is initiated by any means.
3. Fragment and blast.
4. Pistol and rifle ammunition, safety fuze, and fuze lighters.

217

1. To give guidance to firefighters, security forces, and other personnel as to what type of hazard exists with a fire involving explosives.
2. It increases.
3. The fire symbol that applies to the most hazardous material present at this location.
4. At the time you store the explosive.

218

1. The commander.
2. The types that are approved as permissible by the USBM or by a similarly recognized test laboratory.

3. You must ensure that highly flammable liquids are not used by your workers for cleaning purposes within an explosive area, or near explosives, unless it is authorized by a TO.
4. At least 50 feet.
5. Equipment must be at least 100 feet for refueling.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

44. (213) Because explosives initiate by a form of energy, each type of explosive must be handled according to its specific
    a. toxicity.
    b. sensitivity.
    c. physical size.
    d. fragmentation.

45. (214) When, if ever, are you, as a 2W1X1/aircraft armament systems specialist, authorized to disassemble explosive components?
    a. Never.
    b. When authorized by the technical order.
    c. When authorized by a maintenance operating instruction.
    d. When your supervisor is present and it is authorized by the technical order.

46. (214) Which items *cannot* be permitted in a storage magazine containing explosives?
    a. Dunnage.
    b. Hand-held flashlights.
    c. Open containers of explosives.
    d. Clothing made from cotton or a cotton-synthetic blend.

47. (214) What type of clothing should be worn when working around explosives?
    a. Nylon and rayon.
    b. Polyester and nylon.
    c. Polyester, wool, or silk.
    d. Cotton or cotton-synthetic blend.

48. (214) During explosives operations, personnel who need to remove outer garments
    a. must remove the garment and continue working.
    b. may step out of the immediate area, remove the garment, and reenter.
    c. must step out of the immediate area, remove the garment, ground themselves, and reenter.
    d. may remove them anywhere provided they ground themselves before recommencing work.

49. (215) The *cardinal principle* in conducting any explosive operation concerning personnel limits is to expose the
    a. *minimum* number of people to the *maximum* quantity of explosives for the minimum period.
    b. *maximum* number of people to the *maximum* quantity of explosives for the maximum period.
    c. *minimum* number of people to the *minimum* quantity of explosives for the maximum period.
    d. *minimum* number of people to the *minimum* quantity of explosives for the minimum period.

50. (215) What are explosive limits based upon?
    a. Quantity-distance separation criteria only.
    b. Quantity of explosives sufficient for the operation only.
    c. Quantity of explosives sufficient for the operation and their transportation mode.
    d. Quantity of explosives sufficient for the operation and quantity-distance separation criteria.

51. (216) Explosive hazard class 1 items that are *principally* a blast hazard and expect to mass detonate when a small portion is initiated are in which division?
    a. 1.
    b. 2.
    c. 3.
    d. 4.

52. (216) Which division of explosive hazard class 1 contains nuclear weapons?
    a. 1.
    b. 2.
    c. 3.
    d. 4.

53. (216) Which division of explosive hazard class 1 is principally associated with items that have a fragmentation and blast hazard?
    a. 1.
    b. 2.
    c. 3.
    d. 4.

54. (216) Which division of explosive hazard class 1 contains items that produce fires that burn vigorously and are difficult to put out?
    a. 1.
    b. 2.
    c. 3.
    d. 4.

55. (216) Which explosive hazard class 1 division would include items such as pistol and rifle ammunition or impulse cartridges?
    a. 1.
    b. 2.
    c. 3.
    d. 4.

56. (217) What do the four fire division symbols represent or indicate?
    a. The hazards explosives present.
    b. The different fire extinguishers needed.
    c. How well the storage building is ventilated.
    d. How far the explosives are required to be kept apart.

57. (217) Which hazard symbols or signs are used to identify operating buildings and storage facilities containing pyrotechnic and chemical munitions or agents and other hazardous materials?
    a. Fire division symbols.
    b. Chemical hazard symbols.
    c. Material safety warning signs.
    d. Explosive hazard class symbols.

58. (217) When are fire division symbols posted on or near nonnuclear explosive locations?
    a. Before storing explosives.
    b. Before transporting the explosives.
    c. At the time the explosives are stored.
    d. At the time the explosives are transported.

59. (217) Who has the responsibility to post or change warning and hazard symbols in nonnuclear explosive storage areas?
    a. Commander.
    b. Base fire department.
    c. First person to enter the storage area.
    d. Person in charge of the storage area.

60. (218) What precaution, if any, *must* personnel who work with toxic chemicals take before smoking?
    a. They must wash their hands.
    b. No precautions are necessary.
    c. They must use only electric lighters.
    d. They must wear gloves while smoking.

61. (218) Parking areas for government vehicles may *not* be any closer than how many feet to an explosive area?
    a. 15.
    b. 20.
    c. 25.
    d. 50.

62. (218) At *least*, how many feet away from explosives sites *must* you remove support equipment before refueling it?
    a. 25.
    b. 50.
    c. 100.
    d. 250.

63. (218) What is the *minimum* withdrawal distance in feet for all nonessential personnel if munitions posted with a fire symbol 2 are involved in a fire?
    a. 4,000.
    b. 2,500.
    c. 600.
    d. 350.

Please read the unit menu for unit 3 and continue ➔

Student Notes

Unit 3. Nuclear Safety

PERHAPS NO OTHER type of weapon has had a greater psychological or political impact on the world than nuclear weapons. Most of the world's population realizes the severe consequences of a nuclear war. An effective nuclear surety program is just as important as the capability to deliver these nuclear devices.

The results of an accidental peacetime nuclear detonation could be extremely serious for our country. The political repercussions alone could deal a stunning blow to our foreign relations. Individuals associated in any way with the nuclear weapons program must be constantly alert to prevent such an accident. It is their responsibility to maintain an effective nuclear surety program at all times and under all conditions. You can find the policies and procedures governing the USAF nuclear surety program in AFI 91–101, *Air Force Nuclear Weapons Surety Program*. You, as an aircraft armament systems journeyman, must be particularly concerned with maintaining an effective nuclear surety program.

3–1. Air Force Nuclear Weapons Surety Program

Nuclear weapons, because of their cost and importance to national security, are a critical national resource. They require special protection from risks and threats because of their destructive power and the potentially serious consequences of an unauthorized detonation, whether deliberate or accidental. Protecting nuclear weapons as a critical national resource and ensuring the safety of people and property are of paramount importance in developing nuclear surety policies and procedures in the Air Force nuclear weapons surety program.

219. Nuclear munitions enterprise

Before you learn about programs and topics that surround the topic of nuclear safety, you need to understand the policy, doctrine, and key terms involving nuclear weapons. This is referred to as the *concept of nuclear munitions enterprise*.

Nuclear enterprise

The Air Force fills a major role in the broader nuclear enterprise. Aircraft armament technicians play a significant part of the Air Force's role. This enterprise consists of the people, organizations, processes, procedures, and systems that are used to conduct, execute, and support nuclear operations and forces. It is the set of capabilities and elements conducting the strategic and extended deterrent

nuclear missions. If you are assigned to a nuclear unit, your role is to maintain nuclear weapon systems and their related support equipment. You may also be required to load the weapons.

Nuclear operations

The fundamental purpose of the US nuclear arsenal is to deter an enemy's use of its nuclear arsenal or other weapons of mass destruction. Although nuclear forces are not the only factor in the deterrence equation, our nuclear capability underpins all other deterrent elements. The main way that our nuclear capabilities perform this function of deterring aggression is through the threat of massive retaliation. The nature of nuclear weapons is such that their use can produce political and psychological effects well beyond their actual physical effects.

Types of faults

When a nuclear system fault occurs on a loaded nuclear combat aircraft, cease current operation and take appropriate actions to identify, locate, and correct the fault if permitted according to technical guidance. The engineering major command (MAJCOM) determines whether the system fault is critical by conducting a technical assessment of its potential impact on the nuclear weapons or the weapon system's primary nuclear safety features and the possible hazards associated with troubleshooting the fault. The MAJCOM's determination is the basis for any TO procedure that permits troubleshooting. Troubleshooting procedures must use built-in test system capabilities, rather than determination by the field-level personnel, to identify faults and use only initial fault detection data to identify the faults, and prohibit diagnostic testing to identify the faults while nuclear weapons are electrically mated. Two types of faults are critical and noncritical.

Critical faults

For critical faults, isolate the affected nuclear weapons from the fault before initiating troubleshooting. The manner in which weapons are isolated depends on the type of fault and the potential for inadvertent application of power or control signals to the weapons interface. Ways to isolate weapons include downloading the weapons, demating the electrical signal lines to the weapon and mechanically safing the release system, and demating the electrical signal lines to both the weapons and the release system.

Noncritical faults

For faults that the engineering MAJCOM has determined to be noncritical, the nuclear weapon may remain electrically mated during troubleshooting operations. However, every attempt should be made to isolate the weapons unless isolating the weapons cause a severe operational impact.

Rigid adherence to standards

Because of the incredible power of nuclear weapons and the great responsibilities that power requires, we must maintain the highest standards in any operation that affects our nuclear capabilities. The credibility of the Air Force's nuclear program relies on the skill of the people that support it. The key elements that create the required level of proficiency are realistic and repetitive training, high-technical competence, strong analytical skills, and personal reliability. Personnel working in nuclear operations must maintain the highest standards of competence, rather than simply meeting the minimum. Perfection is the standard for the safety, security, and reliability of nuclear weapons operations. Units supporting nuclear missions must be appropriately trained and capable of performing the full spectrum of nuclear support to include safety, security, and handling of nuclear weapons and components.

Nuclear umbrella

Our extended deterrence strategy provides a nuclear umbrella to friendly and allied nations. Our nuclear umbrella assures allies of our commitment to their security and serves as a nonproliferation tool by rendering their need to develop and field their own nuclear arsenals as redundant. In short, the fact that our allies are protected by our nuclear forces means they have no need of their own.

220. Nuclear surety program principles and responsibilities

This lesson gives you an overview of the Air Force nuclear surety program including basic premises of the program and the associated publications that provide the required guidance.

Nuclear surety

Nuclear surety is ensuring all Air Force activities concerned with nuclear weapons comply with the four DOD nuclear weapons system safety standards. To comply with these standards, Air Force nuclear weapons systems must be designed, maintained, transported, stored, and employed, or used in ways to incorporate maximum safety consistent with operational requirements.

Weapons systems safety rules principles

All nuclear weapons systems must be designed and operated in a manner meeting the four nuclear weapons system safety standards in DOD Directive 3150.02, *Nuclear Weapon System Safety Program.* These four standards (listed below) are also located in AFI 91–101. Both publications state there will be positive measures in place to do the following:

1. Prevent nuclear weapons involved in accidents or incidents, or jettison weapons, from producing a nuclear yield.
2. Prevent deliberate prearming, arming, launching, firing, or releasing of nuclear weapons, except upon execution of emergency war orders or when directed by competent authority.
3. Prevent inadvertent prearming, arming, launching, firing, or releasing of nuclear weapons in all normal and credible environments.
4. Ensure adequate security of nuclear weapons according to DOD directives.

These four standards are the go/no-go gauges for nuclear weapons designers, developers, researchers, manufacturers, and users. Each of the standards was designed to cope with one of four problem areas. These four problem areas are generally the following:

1. Accidents and incidents.
2. Psychotics and saboteurs.
3. Human error.
4. Security.

These are not the only problems in the program, but they serve as general guidelines for the types of problems you can expect.

Weapons Systems Safety Rules responsibilities

Commanders at all levels are responsible for the success of the Nuclear Weapons System Safety Rules (WSSR) Program, but it is ultimately up to the individual performing the operation to stay within the guidelines of the TO or regulation. Per AFI 91–101, duties important to you as an individual concerning WSSR are the following:

1. Inform supervisors if you are not qualified to perform a particular task.
2. Report nuclear safety hazards/deficiencies or security problems to supervisors and unit safety representatives.
3. Comply with the two-person concept.
4. Identify unreliable personnel to their supervisors.
5. Report information which could affect your own ability or reliability to perform a task due to medical or other problems.

These are not all-inclusive responsibilities you have under this program. If you notice a discrepancy or something just doesn’t look right, stop what you are doing and report it to your supervisor immediately.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

219. Nuclear munitions enterprise

1. What does the nuclear munitions enterprise consist of?

2. What is the *main* way that our nuclear capabilities perform the function of deterring aggression?

3. What are the two types of nuclear system faults?

4. How does our nuclear umbrella serve as a nonproliferation tool?

220. Nuclear surety program principles and responsibilities

1. What must be done to comply with DOD nuclear weapons system safety standards?

2. What are the four nuclear safety standards?

3. What are the four recognized nuclear safety problem areas?

3–2. Nuclear Weapons Personnel Reliability Program

The nuclear weapons personnel reliability program (PRP) is designed to screen and continually evaluate personnel selected for nuclear weapons duties.

221. Purpose and application of the personnel reliability program

The PRP program ensures that each person who works with nuclear weapons or nuclear weapons systems meets the highest standards of individual reliability.

Purpose

Department of Defense Manual (DODM) 5210.42,-Regulation, AFMAN 13–501, *Nuclear Weapons Personnel Reliability Program (PRP)*, states the requirements and responsibilities for screening, selecting, and continuously evaluating all personnel who control, handle, or have access to nuclear weapons or nuclear weapons systems. DODM 5210.42-Regulation, AFMAN 13–501 provides for the selection and retention of personnel who are emotionally stable and have demonstrated good judgment and professional competence. It also provides guidance for the removal of individuals of questionable reliability. The nuclear weapons PRP is designed to ensure individuals selected for

nuclear weapon duties are, and remain, emotionally stable and reliable under the stresses brought on by modern living and by the environment of our present and future weapon systems.

Individuals who, because of emotional disorder, personality makeup, character deficit, or habit, are unable to perform consistently at a high level of efficiency have no business working with or around nuclear weapons. They must be screened out and reassigned to less sensitive duties or be discharged from the service. It is necessary to identify, and remove from nuclear weapons duty, all individuals who have demonstrated by their actions that they are not capable of dealing with the stresses involved in such an assignment.

The overall intent of this program is to prevent the possibility of an act leading to the unauthorized launch of a missile or aircraft armed with a nuclear weapon or the unauthorized detonation of a nuclear weapon.

Application

DODM 5210.42-Regulation, AFMAN 13-501 applies to all active duty Air Force personnel, who are presently assigned to or selected for assignment to duties involving the control of, handling of, or access to nuclear weapons or nuclear weapons systems. As a rule, PRP applies during the time of hostilities as well as peacetime. Because you may not perform nuclear duties on a regular basis, it is neither practical nor cost effective to keep you on full-time PRP status. Normally, the units with a nuclear role in terms of contingency, mobility, or emergency tasking have a full-time PRP status. Depending upon the duties you perform, you could be assigned to either a controlled or critical position.

222. Personnel reliability program positions

Not all PRP positions are created equal. Just as all maintainers who require security clearance do not receive a Top Secret (TS) clearance, not all personnel who work around nuclear weapons require the greatest level of scrutiny via the PRP program. This lesson will give you basic information on the different positions within the PRP program.

Types of PRP

The program applies to all active duty Air Force people who are presently assigned or selected for assignment to duties involving the control, handling, or access to nuclear weapons, nuclear weapons systems, or critical components. It also applies to civilians and contract personnel who perform jobs or duties that come under a similar program. DODM 5210.42-Regulation, AFMAN 13-501 divides the people in the program into two categories—critical and controlled positions.

Critical positions

Critical positions are positions in which you have close physical proximity to a nuclear weapon or critical component and the duties require you to use technical knowledge of a weapon or weapon system. Individuals in a critical position could cause or allow a launch or employment of a nuclear weapon. They can control, issue, or use sealed authenticators, codes, strategic missile computer tapes, and emergency a**c**tion messages, or release procedures for nuclear weapons.

Controlled positions

Controlled positions are positions requiring entry into a no-lone zone or close-in security area. The duties of these positions do not require entry into areas or technical knowledge pertaining to launching, releasing, or detonating a weapon or system. For example, Security Forces personnel charged with securing weapons do not have a need for critical information.

Personal responsibilities

If you are assigned to one of the PRP positions (critical or controlled), you have responsibilities that *you* must meet to retain your needed PRP status.

These include but are not limited to the following:

- Being responsible for monitoring your own reliability and the reliability of others performing PRP duties. This is a 24-hour-a-day, seven-day-a-week responsibility. Failure in these responsibilities may cast doubt on your reliability.
- Advising your supervisors or the certifying official of any factors that *will, could, or do* have an adverse impact on your performance, reliability, or safety while performing PRP duties.
- Informing support agencies (medical, legal, etc.) of your active PRP status before treatment or consultation.
- Reporting treatment and/or evaluation to the certifying official and providing appropriate documentation to the competent medical authority (CMA) who must consult the certifying official when you receive any type of medical or dental treatment and/or evaluation (both on and off base).
- Making all medical records available to the CMA for initial and subsequent screening requirements and for inspection when being considered for or holding a PRP position.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

221. Purpose and application of the personnel reliability program

1. How would you determine which individuals need to be screened out of the nuclear weapons program according to the standards of the nuclear weapons PRP?

2. To whom does DODM 5210.42-Regulation, AFMAN 13–501 apply?

3. As a rule, when does PRP apply?

222. Personnel reliability program positions

1. What categories of positions fall under the nuclear weapons personnel reliability program?

2. What type of position is “critical” under the reliability program?

3. What type of position is “controlled” under the reliability program?

3–3. Two-Person Concept and No-Lone Zones

Our nuclear weapons and weapon systems must obviously be protected from people who are not authorized access to them. What about protecting these weapon systems from people who *are* authorized access? As mentioned earlier, part of this protection is afforded by the nuclear weapons personnel reliability program. More protection is gained from using the two-person concept and the no-lone zone.

223. Two-person concept

The two-person concept is designed to ensure that a lone individual is denied access to nuclear weapons, nuclear weapon systems, or critical components. It is also designed to never allow the opportunity for tampering, damage, or an unauthorized act to go undetected. The two-person concept requires the presence at all times of at least two authorized persons, each certified under the PRP, knowledgeable in the task to be performed, familiar with applicable safety and security requirements, and each capable of promptly detecting an incorrect act or improper procedure with respect to the task to be performed. Both members must have completed annual nuclear surety and PRP training.

NOTE*:* The two-person concept is also known as the two-person rule.

Two-person concept terms

The terminology used when referring to the two-person concept is very specific in its meanings. To fully understand the two-person concept itself, we need to start with basic terminology.

Critical component

A critical component of a nuclear weapon system, if bypassed, activated, or tampered with could result in or contribute to deliberate or inadvertent authorizing, prearming, arming, or launching of a combat delivery vehicle carrying a nuclear weapon or the targeting of a nuclear weapon to other than its planned target.

No-lone zone

The policies concerning the two-person concept and no-lone zone are found in AFI 91–104, *Nuclear Surety Tamper Control and Detection Programs.* The no-lone zone is an area containing one or more critical components where a lone individual must be denied access. This is where the two-person concept must be enforced. This prevents a lone person access to launch or direct the launching of a nuclear weapon delivery vehicle, or an area designated by the nuclear weapon system safety group where access by a lone individual must be denied.

Nuclear weapon

A nuclear weapon is a complete assembly in its intended ultimate configuration, where upon completion of the prescribed arming, fuzing, and firing sequence, is capable of producing the intended nuclear reaction and release of energy.

Nuclear weapon system

A nuclear weapon system is a combat delivery vehicle with its nuclear weapon(s) and associated support equipment.

Tamper

Tamper means to intentionally perform an incorrect procedure or unauthorized act involving a critical component, nuclear weapon, or nuclear weapons system.

Policy

The firm and basic rule of the two-person concept is this: In an area where there are nuclear weapons, two authorized people must be present—never a lone individual. This means a minimum of two authorized persons must be present during any operation if it affords access to a critical component or no-lone zone. Each person must be capable of detecting an unauthorized act or incorrect procedure

with respect to the task to be performed and must be familiar with applicable safety and security requirements. The two authorized people are considered present when they are in a physical position from where they can positively detect incorrect procedures or unauthorized acts. Upon detection of an incorrect procedure or unauthorized act, the individual should (1) take positive steps to terminate the task or act and (2) immediately notify proper authorities of the deviation.

224. Relationships of the no-lone zone and the two-person concept

The two-person concept is applicable in no-lone zones. What exactly constitutes a no-lone zone? In this lesson, you are given an overview of what constitutes no-lone zones and what your duties are in respect to them.

No-lone zone

We have seen two-person teams and they are an important part of the two-person concept. These teams must be carefully chosen, and once chosen, the members must perform the assigned tasks in the proper manner. An equally important aspect of the two-person concept is the designation of areas or tasks requiring the use of a two-person team. The no-lone zone is defined as an area where the two-person concept must be enforced because the area contains one or more nuclear weapons, nuclear weapon systems, or critical components.

Designated areas

AFI 91–101 lists the areas and tasks designated as no-lone zones. A no-lone zone is any area that contains any of the following:

- Nuclear weapons/warheads in storage.
- Nuclear weapons/warheads installed in or attached to aircraft or missiles.
- Areas where one person could be capable of launching, arming, firing, or releasing an aircraft or missile loaded with a nuclear weapon.

Designating tasks

A no-lone zone is also an area where operations are conducted involving any of the following tasks:

- Assembly, maintenance, or inspection of nuclear weapons.
- Logistical movement of nuclear weapons.
- Loading and unloading nuclear weapons on aircraft.
- Mating and demating nuclear weapons to reentry vehicles or missiles.
- Application of explosive ordnance disposal (EOD) procedures when nuclear weapons are involved in accidents/incidents.

Any combination of these areas and tasks would be a no-lone zone. A standard igloo containing nuclear weapons is a no-lone zone. The aircraft alert area is a no-lone zone. The accident area where an aircraft carrying nuclear weapons has crashed is a no-lone zone. A truck convoy carrying nuclear weapons and the entire route the convoy travels is a no-lone zone.

The no-lone zone requires strict adherence to all the requirements of the two-person concept. Only authorized persons are allowed to enter a no-lone zone. The entry of any lone person, even if authorized, is strictly prohibited. Only suitable two-person teams can perform tasks in a no-lone zone. While these tasks are being performed, the team members must be present at all times. All persons in the no-lone zone are responsible for ensuring safety and security requirements are strictly enforced. A violation of any of these requirements makes the two-person concept ineffective and weakens our nuclear safety program.

Individual responsibility

Commanders and supervisors are responsible for supervising and enforcing the two-person concept, but they cannot be there for each individual task. This means that each individual is responsible for the application of the two-person concept. The people making up the two-person team must constantly enforce this concept, not only when performing the assigned task or operation but also until leaving the no-lone zone.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

223. Two-person concept

1. What does the term “critical component” mean as it relates to the two-person concept policy?

2. To what does a “nuclear weapons system” refer?

3. What is meant by the term “tamper”?

4. What basic rule is implied by the term “two-person concept”?

5. What must an individual do after detecting an incorrect procedure or unauthorized act?

224. Relationships of the no-lone zone and the two-person concept

1. What is a no-lone zone?

2. What areas are designated as no-lone zones?

3. How is the no-lone zone related to the two-person concept?

4. Who has the responsibility for ensuring that the two-person concept is followed?

3–4. Sealing of Nuclear Components

The nuclear weapons surety program, as we have described it, is a system of controls that ensures that the four nuclear safety standards are followed. However, a system of controls itself needs a network of checks to ensure that the controls are functioning properly. The sealing program is such a network of checks.

225. Necessity of sealing nuclear components

The security of your nuclear components is only as good as your sealing program. A good sealing program is self-evaluating and indicates weaknesses in the controls. A loss of control in a system that safeguards nuclear components is inexcusable and indefensible.

Sealing requirements

The safety rules for each Air Force nuclear weapon system require certain items to be sealed. Each Air Force activity controlling or handling nuclear weapons must give guidance to make sure accidental or unauthorized entry to or activation of specified nuclear weapon system components is promptly detected and appropriate action is taken when deviations from sealing requirements are observed.

These requirements apply to all Air Force units with a mission involving operations, maintenance, security, or logistics movement of nuclear weapons or certified critical components. It also applies to all Air Force units responsible for sealing requirements according to applicable safety rules for nuclear weapon systems or the handling and storage procedures for critical components.

Sealing methods

Seals are used to verify a component or switch has not been tampered with or accidentally activated. AFI 91–104 lists two methods for meeting the sealing requirement. However, one of the methods is used only in Minuteman launch control centers. The type you need to become familiar with involves safety wiring and sealing.

Two types of seals are authorized using the safety wiring and sealing method:

1. Seals composed of a malleable material and used with a crimping device and controlled die to form an impressed distinctive mark or unique identifier.
2. Seals with self-locking, nonreversible feature with a singularly unique serial number/alpha, color control system.

Both types of seals are used with safety wire connected to certain switches, covers, handles, or levers. Any movement of these devices breaks or alters the safety-wire connection, thus providing visual evidence of tampering or accidental activation.

Responsibilities and procedures

Each MAJCOM with an operational nuclear weapon system is responsible for developing and issuing appropriate directives governing sealing. As a minimum, these directives do the following:

1. Provide guidance regarding when seals are to be applied and removed and by whom.
2. Require controls for receipt, storage, issue, inventory, and disposal of lead seals and dies.
3. Make sure the distinctive marking, to be determined locally, is placed on the lead seal by a crimping device and die.
4. Require the integrity of seals be verified after installation; thereafter, the seals must be verified before and after any operation is performed in the immediate area where sealing is required by the nuclear weapon system safety rules.
5. Require the two-person concept be applied when verifying seals.
6. Make sure the maintenance personnel, aircrews, missile combat crews, and other required personnel are aware of the distinctive markings or serial numbers of the seals.

7. Prescribe action to be taken when a seal is found broken or when it shows evidence of tampering. This action must include the following:
   (a) Conducting an investigation and submitting a mishap report according to AFI 91–204, *Safety Investigations and Reports.*
   (b) Performing appropriate checks of the weapon system and reaccomplishing the sealing procedure.
8. Prescribe action to be taken when a seal is accidentally broken during authorized operations.

The seal itself is a very important part of the sealing program. A good seal is immediately noticed if it has been changed, removed, or broken. A good seal provides immediate evidence of activation or tampering. A good seal not changed, removed, or broken certifies to an inspection team a component, the weapon, or a weapon system has not been tampered with. A good seal depends directly on a good sealing program. The sealing program has a definite job—to make sure the four nuclear safety standards are being met. A good sealing program does not interfere with the completion of the mission. The sealing program also provides us with a system of checks on other parts of our nuclear safety program.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

225. Necessity of sealing nuclear components

1. What guidance must the Air Force give to activities that control or handle nuclear weapons?

2. Why are seals used on nuclear weapon system components?

3. What concept must be applied when verifying seals?

3–5. Nuclear Accidents, Incidents, and Deficiencies

An important part of the nuclear safety program is identifying and reporting nuclear safety mishaps. You should be able to distinguish each of these—nuclear accidents, incidents, and deficiencies—mishaps. They are defined in AFI 91–204.

226. Nuclear safety mishaps

A nuclear mishap is one that involves destruction of, or serious damage to, nuclear weapons, nuclear weapons systems, or nuclear weapons components, resulting in an actual or potential threat to national security or life and property. Reportable nuclear surety violations and damage to support equipment unique to a nuclear weapon system are reported under the nuclear safety mishap subcategory.

Flagwords

Flagwords are used to identify nuclear accidents, incidents, and deficiencies. Flagword definitions may be subjective, and it is up to the investigator to determine the best flagword to describe the mishap. If the event status changes after submitting an original report, submit another report using the new flagword.

NUCFLASH

The flagword NUCFLASH identifies a nuclear accident that includes accidental, unauthorized, or unexplained events meeting any of the following criteria:

- Accidental, unauthorized, or unexplained actual or possible nuclear detonation by US forces or US-supported allied forces.
- Accidental or unauthorized launch of a nuclear-armed or nuclear-capable missile by US forces or US-supported allied forces.
- Unauthorized flight or deviation from an approved flight plan by a nuclear-armed or nuclear-capable aircraft of US forces or US-supported allied forces that *could* be perceived as a hostile act.

The key criterion involved in a NUCFLASH event is that the event could be interpreted as a hostile act. A perceived hostile act involving nuclear weapons could easily cause a nuclear response leading to unthinkable costs. This situation is by far the worst-case scenario.

BROKEN ARROW

Nuclear accidents that fall under the flagword BROKEN ARROW consist of accidental, unauthorized, or unexplained events that could *not* create the risk of war and the following criteria apply:

1. Accidental or unauthorized launching, firing, or use by US forces or US-supported allied forces of a nuclear capable weapons system.
2. An accidental, unauthorized, or unexplained nuclear detonation.
3. Nonnuclear detonation (no nuclear yield) or burning of a nuclear weapon or nuclear component.
4. Radioactive contamination.
5. Public hazard, actual or perceived.
6. Jettisoning of a nuclear weapon or nuclear component.

EMPTY QUIVER

The events that constitute an EMPTY QUIVER flagword are when a nuclear weapon is lost, stolen, seized, or destroyed. Loss includes, but is not limited to, intentional nuclear weapon jettisoning according to approved Air Force procedures, or an inadvertent release of a nuclear component. Events that fall into the EMPTY QUIVER are considered a nuclear accident.

BENT SPEAR

The flagword BENT SPEAR constitutes a nuclear incident not in the accident category but meeting any of the following criteria:

1. Radioactive contamination from burning, flooding, theft, seizure, or destruction of a radioactive limited life component.
2. Evident damage to a nuclear weapon or nuclear component that requires major rework, replacement, or examination or recertification by the Department of Energy (DOE).
3. Events requiring immediate action in the interest of nuclear surety (such as render safety procedures or failed positive measures) or which could result in adverse national or international public reaction or premature release of information (such as attempted theft or seizure of a nuclear weapon).

   NOTE: Includes damage to a nuclear weapon carrier that could lead to loss of, or damage to, nuclear components.
4. An event indicating a nuclear weapon or nuclear warhead has been armed without proper authorization.

5. Events which could lead to a nuclear weapon system accident and, thus warrant the informational interest of, or action by, any of the following agencies:
    - Appropriate Military Department or Service.
    - Office of the Assistant Secretary of Defense (Strategy and Threat Reduction).
    - Office of the Assistant Secretary of Defense (Public Affairs).
    - Federal Emergency Management Agency (within the CONUS).
    - Abnormal readings encountered during Non-Nuclear Verification procedures of Joint Test Assemblies.

DULL SWORD

A nuclear safety deficiency is a situation, event, or condition not reportable as a BROKEN ARROW or BENT SPEAR, but could degrade nuclear safety falls under the flagword DULL SWORD. The provisions pertaining to accident/incident investigation and reporting also apply to nuclear safety deficiency reports. The following examples *must* be reported:

- Minor damage to a nuclear weapon or nuclear component requiring rework, replacement, or examination or recertification by the design agency.
- Exposure of a weapon/warhead to unusual or severe environment (flood, earthquake, and lightning).
- Minor damage to a nuclear weapon or nuclear component affecting nuclear surety but not requiring return of the weapon or component to the design agency.
- Loss, theft, seizure, destruction, or jettison of a training weapon.
- Abnormal status of any indicator on a nuclear weapon.

The next two examples must be reported when nuclear safety is involved.

- Failure to function as designed including special tools listed in specific item technical orders for the nuclear weapon system (except common tools or test equipment).
- Structural failure of DOE handling equipment.

Safety deficiencies make up the largest part of the reportable events occurring when nuclear weapons are stored, handled, and loaded. Even though reporting covers every contingency involving nuclear weapons, there are some events not reportable. Weapon components or associated equipment defects detected during routine inspections and before the item is attached to a nuclear component are not reportable. However, these events should be considered for the materiel deficiency reporting system.

The key point to remember is if the unexpected action can contribute to an accident or incident, the event is a safety deficiency.

227. Investigating and reporting nuclear mishaps

In your career, you may be involved in a nuclear mishap investigation. While you may or may not play a key role in the investigation, it is important to know the steps in the process so that you are able to provide the support for the investigation as best you can.

Investigating

The Air Force investigates nuclear mishaps to determine the cause of the mishap and to prevent a recurrence. Many people become involved in these very thorough investigations. The investigating commander determines the extent of investigative effort required and whether an investigating officer or an investigating board should conduct the investigation. When an accident or incident involves more than one safety area, the commander normally appoints a board.

Unless the director of aerospace safety or the director of nuclear surety assumes responsibility, the MAJCOM with command responsibility for the unit having the mishap is responsible for ensuring the

mishap is investigated. When the mishap is in a locality preventing a prompt investigation by the responsible major commander, he or she may request another commander to appoint an investigating commander who is nearer the scene of the occurrence. Such an appointment takes place only with the mutual consent of the two MAJCOMs concerned.

Reporting

There are two main reasons for reporting nuclear mishaps. First is the need to notify the proper authority of the mishap quickly. Second is the need to report the results of the investigation so the Air Force can take necessary steps to prevent a recurrence. AFMAN 91–221, *Weapons Safety Investigations and Reports,* is the governing instruction for reporting accidents and incidents. These reports consist of preliminary reports, progress reports, supplemental reports, and final reports.

Reporting a nuclear accident or incident

The following are types of reports for a nuclear *accident* or *incident* only:

- Preliminary report.
- Supplemental report.
- Final report.

Preliminary report

A preliminary report must be submitted within 8 hours after an accident. Only the first electronically transmitted safety message advising of a mishap is titled “Preliminary Report.” Include purely factual information only. Ensure no privileged safety information is included (nothing based on witness testimony, board analysis, etc.). Include a narrative description of what happened (but not why), stating the best and most complete information available in simple and direct terms. Do not delay the report for lack of information. If complete data is not available, provide it in a supplemental report.

The preliminary report enables the pertinent MAJCOM and other Air Force agencies involved to decide whether they should participate in the investigation and provides Headquarters USAF with immediate information concerning the accident.

Supplemental report

The supplemental report is submitted daily or as directed by the director of nuclear surety. It is sent to the same agencies and in the same format as the preliminary report. This report is required for on-site investigations and is used until all on-site investigative actions have ended.

Final report

This report is the detailed record of the investigation of an accident. It includes the applicable forms, testimony, statements, photographs, sketches, and reproductions of records pertaining to the accident. The final report must be submitted within 30 calendar days after completion of the investigation, unless the reporting deadline is extended by the investigating MAJCOM.

Reporting a safety deficiency

When reporting a nuclear safety deficiency the procedure changes significantly. A safety deficiency report is submitted by message within 15 calendar days after the deficiency is discovered. This report is usually made on a one-time basis. However, if directed by the director of nuclear surety, a final investigation and report must be made. In this case, the report must be submitted within 90 calendar days. A final report must also be generated if the initial report was not made as a one-time, DULL SWORD report.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

226. Nuclear safety mishaps

1. Correlate the types of events in column A with the corresponding flagword in column B. Items in column B may be used only once.

Column A	*Column B*
____ (1) Crash of an aircraft loaded with a nuclear weapon.	a. DULL SWORD.
____ (2) Damaged fin on a nuclear weapon.	b. BENT SPEAR.
____ (3) Attempted theft of a nuclear weapon.	c. BROKEN ARROW.

2. While assigned to a nuclear weapons loading team, you are caught in an earthquake that causes (a) the partial collapse of one igloo causing a fire that consumes several weapons and (b) weapons on the flight line are submerged by a flash flood with two igloos of weapons remaining undamaged. Taking each event separately, how would these events be classified or which flagword would be used to identify these events?

227. Investigating and reporting nuclear mishaps

1. Why is an investigation conducted after a nuclear safety mishap?

2. What are the two main reasons for reporting nuclear safety mishaps?

3. After an accident, when must the following reports be submitted?

   a. Preliminary report.

   b. Supplemental report.

   c. Final report.

4. When must a safety deficiency be reported?

Answers to Self-Test Questions

219

1. The people, organizations, processes, procedures, and systems that are used to conduct, execute, and support nuclear operations and forces.
2. Through the threat of massive retaliation.
3. Critical and noncritical.
4. By rendering our allies' need to develop and field their own nuclear arsenals as redundant.

220

1. Air Force nuclear weapons systems must be designed, maintained, transported, stored, and employed, or used in ways that will incorporate maximum safety consistent with operational requirements.
2. There will be positive measures to do the following:
   (1) Prevent weapons involved in accidents or incidents, or jettisoned weapons from producing a nuclear yield.
   (2) Prevent deliberate prearming, arming, launching, firing, or releasing of nuclear weapons except upon execution of emergency war orders, or when otherwise directed by competent authority.
   (3) Prevent inadvertent prearming, arming, launching, firing, or releasing of nuclear weapons in all normal and credible environments.
   (4) Ensure adequate security of nuclear weapons according to DOD directives.
3. (1) Accidents and incidents.
   (2) Psychotics and saboteurs.
   (3) Human error.
   (4) Security.

221

1. All individuals who are unable to perform at a high level of efficiency because of emotional disorder, personality makeup, character deficit, or habit should be screened out.
2. To all active duty AF personnel who are presently assigned to or selected to be assigned to duties involving the control of, handling of, or access to nuclear weapons or nuclear weapons systems.
3. Generally, PRP applies during hostilities as well as peacetime.

222

1. Critical and controlled.
2. Positions in which close physical proximity to a nuclear weapon or critical component and the duties require you to use technical knowledge or a weapon or weapon system.
3. These are positions that require entry into a no-lone zone or close-in security area.

223

1. A component of a nuclear weapon system that if bypassed, activated, or tampered with could result in or contribute to deliberate or inadvertent authorizing, prearming, arming, or launching of a combat delivery vehicle carrying a nuclear weapon, or the targeting of a nuclear weapon to other than its planned target.
2. A combat delivery vehicle with its nuclear weapon(s) and associated support equipment.
3. To intentionally perform an incorrect procedure or unauthorized act involving a critical component, nuclear weapon, or nuclear weapons system.
4. In an area where there are nuclear weapons, two persons must be present—never a lone person.
5. (1) Take positive steps to terminate the task and (2) immediately notify proper authorities of the deviation.

224

1. An area where the two-person concept must be enforced because the area contains one or more nuclear weapons, nuclear weapons systems, or critical components.
2. Any area containing any of the following: nuclear weapons/warheads in storage; nuclear weapons/warheads that are installed in or attached to aircraft or missiles; and an area where one person could be capable of launching, arming, firing, or releasing an aircraft or missile loaded with a nuclear weapon.
3. The no-lone zone requires strict adherence to the two-person concept. Only authorized persons are allowed to enter a no-lone zone, and even an authorized person is not allowed to enter a no-lone zone alone.
4. Commanders and supervisors enforce and supervise the program, but each individual is responsible for applying it.

225

1. Guidance to ensure accidental or unauthorized entry to or activation of specified nuclear weapons system components is promptly identified and that appropriate action is taken when deviations from sealing requirements are observed.
2. To verify that a component or switch has not been tampered with or accidentally activated.
3. The two-person concept.

226

1. (1) c.
   (2) a.
   (3) b.
2. (a) The weapons destroyed in the collapse of the igloo are reported as BROKEN ARROWS.
   (b) The weapons submerged by the flash flood would be reported as either BENT SPEAR or DULL SWORD.

227

1. To determine the cause and to prevent recurrence.
2. (1) The need for rapid notification to the proper authorities.
   (2) The need to report the results of the investigation so the AF can take steps to prevent a recurrence.
3. (a) Preliminary—Within 8 hours after an accident.
   (b) Supplemental—Daily or as directed by the director of nuclear surety.
   (c) Final—Within 30 calendar days after the investigation is completed.
4. Within 15 calendar days after the deficiency is discovered.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

64. (219) The *fundamental* purpose of the United States' nuclear arsenal is to
    a. impose the will of the United States on foreign powers.
    b. deter an enemy's use of its nuclear arsenal or other weapons of mass destruction.
    c. maintain offensive capabilities for use at the discretion of the national command authority.
    d. maintain preemptive capabilities for use at the discretion of the national command authority.

65. (219) What engineering agency determines whether the nuclear system faults are critical by conducting a technical assessment of its potential impact on the nuclear weapons or the weapon system's primary nuclear safety features?
    a. Department of Energy.
    b. Major command (MAJCOM).
    c. Headquarters US Air Force (HQ USAF).
    d. Headquarters Inspector General (HQ IG).

66. (219) Our nuclear umbrella assures allies of our commitment to their security and serves as a nonproliferation tool by
    a. the threat of massive retaliation.
    b. maintaining foreign nuclear assets at the expense of the United States.
    c. rendering their need to develop and field their own nuclear arsenals as redundant.
    d. maintaining foreign nuclear assets at United States operated facilities and platforms.

67. (220) Ensuring positive measures to prevent inadvertent prearming, arming, launching, firing, or releasing of nuclear weapons is
    a. a nuclear weapon system safety standard.
    b. a nuclear weapon system safety problem area.
    c. an example of the political impact of nuclear weapons.
    d. an example of the psychological impact of nuclear weapons.

68. (221) Personnel who come under the control of ~~DODR 5210.42 Regulation AFMAN 10–3902~~, *Nuclear Weapons Personnel Reliability Program (PRP),* are those with duties involving the
    a. maintenance of aircraft.
    b. handling of classified documents.
    c. control of nuclear weapons systems.
    d. storage of high-explosive conventional weapons.

69. (222) Critical personnel reliability program (PRP) positions are positions where
    a. personnel do not use technical knowledge in performing their duties.
    b. close proximity to a nuclear weapon or critical component is required.
    c. personnel could not cause the launch or employment of a nuclear weapon.
    d. close proximity to a nuclear weapon or critical component is not required.

70. (222) What type of personnel reliability program (PRP) position does *not* require a person to have entry into areas or technical knowledge pertaining to a nuclear weapon system?
    a. Active.
    b. Critical.
    c. Assigned.
    d. Controlled.

71. (223) What concept is designed to ensure that a lone individual is denied access to nuclear weapons, nuclear weapon systems, or critical components and does *not* allow the opportunity for tampering, damage, or an unauthorized act to go undetected?
    a. Two-person.
    b. Critical-position.
    c. Sealing-program.
    d. Personal reliability program.

72. (223) The two-person concept is covered by what regulation?
    a. AFI 91–102, *Nuclear Weapon System Safety Studies, Operational Safety Reviews, and Safety Rules.*
    b. AFI 91–104, *Nuclear Surety Tamper Control and Detection Programs.*
    c. AFI 91–101, *Air Force Nuclear Weapons Surety Program.*
    d. AFI 91–105, *Critical Components.*

73. (223) An area containing one or more critical components where a single individual *must* be denied access to is
    a. a critical area.
    b. a no-lone zone.
    c. an access zone.
    d. a controlled area.

74. (223) When referring to the two-person concept, intentionally performing an incorrect procedure or unauthorized act involving a critical component defines which term?
    a. Alter.
    b. Activate.
    c. Access.
    d. Tamper.

75. (223) A *firm basic rule* of the two-person concept is in an area where there are nuclear weapons;
    a. nobody may enter.
    b. two authorized people must be present.
    c. access can be given to commanders only.
    d. one person must be present with an alternate on standby.

76. (224) The no-lone zone requires *strict* adherence to all the requirements of the
    a. convoy concept.
    b. two-person concept.
    c. deficiency detection program.
    d. personnel reliability program.

77. (224) Who is responsible for ensuring team members observe all safety and security requirements in a no-lone zone?
    a. All personnel.
    b. Supervisors only.
    c. Commanders only.
    d. Security forces only.

78. (225) What are used to verify a nuclear weapon system's component or switch has *not* been tampered with or accidentally activated?
    a. Seals.
    b. Alarms.
    c. Unique dyes.
    d. Radio frequency identity tags.

79. (225) A good sealing program will
    a. meet the requirements of the two-person concept.
    b. not interfere with anyone's access to the weapons.
    c. not interfere with the completion of the mission.
    d. in times of stress or urgency override the four nuclear safety standards.

80. (226) Which nuclear accident or incident could be interpreted as a hostile act?
    a. NUCFLASH.
    b. CODE RED.
    c. BROKEN ARROW.
    d. EMPTY QUIVER.

81. (226) What flagword is given to the unexpected detonation of a nuclear weapon that could *not* create the risk of war?
    a. BROKEN ARROW.
    b. EMPTY QUIVER.
    c. DULL SWORD.
    d. BENT SPEAR.

82. (226) What flagword is given to the jettisoning of a nuclear weapon or nuclear component?
    a. BROKEN ARROW.
    b. EMPTY QUIVER.
    c. DULL SWORD.
    d. BENT SPEAR.

83. (226) What flagword covers when a nuclear weapon is lost, stolen, seized, or destroyed?
    a. BROKEN ARROW.
    b. EMPTY QUIVER.
    c. DULL SWORD.
    d. BENT SPEAR.

84. (226) What is the flagword given to the damage of a nuclear warhead that requires major rework, replacement, or examination or recertification by the Department of Energy (DOE)?
    a. BROKEN ARROW.
    b. HELPING HAND.
    c. DULL SWORD.
    d. BENT SPEAR.

85. (227) Nuclear mishaps are investigated to
    a. determine the cause only.
    b. prevent recurrence only.
    c. determine the cause and prevent recurrence.
    d. determine the cause and identify the responsible individuals.

86. (227) Unless the director of aerospace safety or the director of nuclear surety assumes responsibility, what major command is responsible for ensuring nuclear mishaps are investigated?
    a. Air Combat Command (ACC).
    b. Air Force Space Command (AFSPC).
    c. Air Force Material Command (AFMC).
    d. The major command (MAJCOM) with command responsibility for the unit having the mishap.

87. (227) A nuclear mishap final report must be submitted within what timeframe after the investigation is complete?
    a. 10 hours.
    b. 24 hours.
    c. 10 days.
    d. 30 days.

Please read the unit menu for unit 4 and continue ➔

Student Notes

Unit 4. Security

ALL PERSONNEL whose duties involve working with munitions find themselves in an environment where security is continually being emphasized. Few other areas in the Air Force require as much attention as security. The munitions, equipment, and publications you work with are essential to national defense. If they, or any information concerning them, should fall into enemy hands, serious damage to our national security could result. Because of the great responsibility to protect the equipment and information you are entrusted with, it is necessary for you to further your knowledge of security. This unit gives you such essential information.

4–1. Operations Security

All information about an Air Force operation needs protection because of its value to our enemies. This protection is provided under the Air Force operations security (OPSEC) program. OPSEC is concerned with the information, actions, and activities that are sensitive because they can telegraph our punch to the enemy—they can give advance warning.

228. OPSEC objectives and the application of OPSEC policy

In this lesson, we discuss the Air Force OPSEC program. It is applicable to all peacetime and wartime missions whether operational or supporting. Every Air Force member has the responsibility to maintain operational effectiveness at the highest possible level. This responsibility includes an obligation to apply OPSEC principles and procedures in promoting overall security without detracting from operational effectiveness.

OPSEC objectives

OPSEC is a full-time program, as are all Air Force programs for information and communications security. OPSEC is also similar to these programs in key elements, such as individual responsibility and need-to-know. Specifically, our OPSEC program has four major objectives:

1. Identify those portions of an operation requiring protection.
2. Develop OPSEC procedures and techniques.
3. Systematically assess OPSEC status at all operational levels.
4. Document deficiencies and institute corrective actions.

The enemy can get an advance warning from many sources or possible sources of information. Generally, these sources can be placed in one of three categories common to any military activity: operations, procedures, and communications. Within each of the categories, there are numerous items of sensitive information. Examples of the types of information needing protection are as follows:

- Objectives of the operation.
- Operation times and locations.
- Friendly and enemy forces involved.

- Known or suspected limitations.
- Methods of employment.
- Results of the operation.
- Sources of intelligence data.
- Methods of data collecting.

In looking at these types of information, you should be able to see the relationship of OPSEC to other security programs. OPSEC, communications security (COMSEC), electronic security (ELSEC), information security, and physical security are interrelated and mutually supporting programs.

OPSEC is designed to protect unclassified, highly visible, and classified aspects of an operation. It makes little sense to protect an operation by classifying only parts of it, or protecting information about it, when unclassified conversations, stereotyped procedures, and other readily available data could provide an enemy with meaningful intelligence indicators. An effective OPSEC program eliminates or controls many of these indicators.

Application of OPSEC policy

Successful operations frequently depend on the concealment of capabilities and intentions. OPSEC involves protecting forms of information containing intelligence indicators of value to hostile elements. We must apply this protection through all stages of an operation. Both classified and unclassified information must be protected to provide security for operations. Classified information is protected according to established information security programs. We protect unclassified information by applying OPSEC principles, policies, and techniques.

Your commander must emphasize OPSEC to make sure it is considered to the maximum extent possible at all levels and in all operations. All personnel must be trained in OPSEC techniques and principles so they can determine the degree OPSEC applies to their organization. Many activities, such as developing training, preparing directives, and coordinating logistics movements, can reveal valuable information to hostile agencies if you do not protect all information properly.

During the existence of an operation or activity, OPSEC must be a matter of continuing concern. Operation orders, plans, directives, standard operating procedures, and supporting plans and procedures must be developed with the awareness the enemy can identify and exploit vulnerable activities. They must also be designed to provide the highest degree of security possible without degrading the effectiveness or safety of an operation. You must continue security safeguards throughout an entire operation. Supervisors must ensure sound OPSEC practices are followed during execution as well as during planning. OPSEC survey techniques and assistance from other agencies may be helpful in this supervision. Even after the operation is done, you must continue following OPSEC principles during any critique of the operation and during the completion of reports.

229. OPSEC vulnerabilities pertaining to the 2W1X1 career field

As a member of a career field who has intimate knowledge of aircraft operations and capabilities, you need to be aware of the specific roles the 2W1X1 community plays in the OPSEC system. This lesson will focus on how OPSEC more directly affects you—the aircraft armament systems specialist/technician.

Operations

Operations, themselves, can give a potential enemy a considerable amount of information. Here are some operations intelligence indicators:

- Routine events making up various phases of operations. For example, your procedures for changing aircraft on alert are always the same and are always done the same day of the week.

- Coordination with other agencies that do not have proper safeguards for classified or sensitive information. Your dealings with such base activities as the motor pool, contract maintenance, civil engineers, etc., can reveal much information about your operations.
- Regular patterns of maintenance or other activity at the same location and time. Examples are the routine security checks, routine scheduled inspections, and other things you do routinely and in the same way.
- Submission of unclassified reports at specific intervals to specific units or levels of command. Your shop constantly sends out reports and maintenance data collection forms.

Procedures

A hostile element can just observe normal everyday procedures and pick up valuable information about operations. Some of the following procedures may apply to your organization:

- Public information releases. Such things as media releases or awards given to persons in your shop and accidents happening to someone or something are perhaps the easiest ways for an enemy to obtain information.
- Posting or transmitting operation orders, operation plans (OPLAN), exercises, etc., in unsecured areas.
- Posting duty rosters, transportation schedules, etc., changes because of an operation order in unsecured areas.
- Distinctive emblems or paintings on vehicles, buildings, signs, and uniforms.
- Markings on supplies could reveal the location or starting date of the operations (i.e., delivery deadlines, nicknames, etc.). The use of nicknames is a particular hazard since a nickname provides an easily recognizable “flag” for numerous actions associated with a particular operation. Frequently used nicknames or flagwords in an armament shop include “quick turn,” “combat turn,” “turkey shoot,” “mass load,” and “recall.”
- Logistics buildup or positioning of support materials and facilities. An example is your receiving load binders, trailers, and other equipment you need for weapons positioning.
- Specific briefings, meetings, or possibly even religious services.
- Exercising the plan or testing portions of the plan. Whenever your shop has an exercise of some type, you can be sure someone who shouldn’t be is taking note.

Communications

The OPSEC program is interrelated with the COMSEC program. As far as OPSEC and the communications you use in your job are concerned, you still must be fully aware of the third person listening in, and you must take appropriate precautions in all the communications you use during and in support of any operation. You should be observant of the following communications intelligence indicators:

- Plain language communications associated with a planned operation and conducted during the planning, preparatory, and execution phases. This includes even normal person-to-person conversations you have with other people in the operation.
- Use of unchanging or infrequently changing call signs or radio frequencies.
- Particular message characteristics (voice or teletype) indicate particular types of munitions or maintenance activity.
- Significant increase or decrease in message traffic volume.
- Activities of new communications facilities in support of an OPLAN.
- Use of “flagwords” to talk around key points of an operation.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

228. OPSEC objectives and the application of OPSEC policy

1. What are the four major objectives of the OPSEC program?

2. Generally, what are the three categories you can put sources or possible sources of information that give the enemy advance warning?

3. What is OPSEC designed to protect?

4. During what phases of an operation do you need to apply OPSEC principles?

229. OPSEC vulnerabilities pertaining to the 2W1X1 career field

1. What can give potential enemies a considerable amount of information?

2. Would posting on social media about an upcoming military exercise constitute an OPSEC breach? Why?

3. What type of words should you avoid using during normal conversations to ensure maximum operational security?

4–2. Resource Security

The Air Force concept is to provide the greatest degree of security for the greatest number of resources, for the least cost. This statement means resource protection is a job for everyone, not just the security specialist. It doesn't matter where you work—protecting what you have to work with or what you are working on is vitally important. There are three basic questions you should ask yourself: What are the threats? What resources are vulnerable to these threats? What are the values and sensitivities of the resources we deal with? We will look at these three questions individually in this section.

230. Threats to United States Air Force resources

It's not hard to understand that there are people in the world with bad intentions who would love to have access to materials available to Air Force members. Their gains, whether economic, political, or personal, will be at the cost of the Air Force and its mission. This is something that cannot be allowed to happen. The following paragraphs cover some threats (damage and destruction, loss, theft, and vandalism) to USAF resources.

Damage and destruction

Damage and destruction is any willful act that renders Air Force equipment or property to a state of uselessness. What makes people damage or destroy property? Usually, the short and simple answer is mental disorder or acts of revenge. However, don't be alarmed; we are not going to bore you with a long, involved dissertation on mental disorders. We do want you to realize these acts are common in our society, and our Air Force is not immune to them. Some examples of these damaging acts include the following:

- Throwing a handful of rocks into the air intake of a jet engine.
- Throwing rocks at runway lights.
- Shooting small rifles at passing aircraft.
- Kicking holes in cabinets that house sensitive radar or computer mechanisms.

Granted, the people who commit these acts may not be in the same class as "ISIS," but they are every bit as dangerous to you and to USAF resources.

Loss

Surely, you have heard someone say, "We are our own worst enemy" when describing, as they see it, our involvement in some condition or situation. While in most cases this is too harsh an indictment of our people, the old cliché has merit when used in the context of losses of USAF resources.

Losses generally occur when some person fails to properly safeguard resources. It's that simple. Then, why do we continue to lose resources? Why don't people do their jobs and safeguard their resources? Factors contributing to losses of resources range from inadequate or insufficient management, supervision, training, guidance, and discipline. Other factors also include individual irresponsibility, negligence, complacency, forgetfulness, and laziness. While these factors are mostly intangible, they indeed hamper the capability of the Air Force to do its mission.

Theft

The term "theft," as used here, is synonymous with pilferage, stealing, and larceny. Each involves the illegal and deliberate taking of USAF property either for personal gain or for the benefit of someone other than the Air Force. The term "robbery" is nearly the same as theft, since it also involves the illegal and deliberate taking of someone else's property. Robbery, however, differs from theft because it has the added ingredients of force, violence, or fear.

Theft is committed in many different ways, but it generally is planned. Theft usually involves the circumvention of human controls and physical security measures. On the other hand, impromptu theft is brought about by opportunity. This form is commonly known as *theft of opportunity* and usually stems from another person's failure to safeguard property. The result is thieves stumble upon an insecure piece of property and steal it. Regardless of the form it takes, theft is real. It is a problem throughout the Air Force. Theft is clearly very costly, both in terms of money and mission completion capability.

Vandalism

Vandalism is the willful or malicious destruction of property. Usually an act of vandalism is less severe than a revengeful act of damage or destruction of resources. Vandalism is normally associated with the destruction of parts of equipment; for instance, smashing the windshield out of a truck, as opposed to blowing it up.

231. Resources vulnerable to threats and their protection requirements

Anyone working as a 2W1X1 has seen the security measures that are in place to secure the materials that we work with daily. These take many forms—the bars on the gun room in your armament shop, the armed patrols that cruise your flight line, and many others that you probably have not even noticed. This lesson will cover many of the common security measures and concerns that you will encounter while working as a 2W1X1.

Facilities

You may think protecting areas such as your gun shop, weapons release (WR) shop, or loading shop is just a job for the security forces. Wrong! Everyone working in these areas is responsible for their security. Normally, the secure area you will find yourself working in is the flight line. This area will be cordoned or roped off and guarded by security forces. The MAJCOM, the base where you are stationed, and your mission commitment will determine the measures for protecting this area. If an area is roped off, it is considered a controlled area. Normally, in this situation, you will be issued a controlled area badge. You must display the badge to be allowed entry into the controlled area.

Indoor facilities, such as a gun shop, may require special security precautions, depending upon the type of guns or gun systems you are dealing with. In some shops, special high-security locks are required and proper key control procedures must be established. Other shops have vaults with alarm systems. These particular security systems are determined by the risk categories of equipment and munitions, which we will discuss later in this unit.

Equipment and supplies

Regardless of the assignment, effective management of property must start with each person in the Air Force. All members are charged with the proper safeguarding of all government property under their jurisdiction. This is regardless as to whether or not you have a signed receipt. Property issued to any person does not become private property; it will always belong to the government. The old adage “possession is nine-tenths of the law” does not apply here. Just because you have it, signed for it, or control it does not mean it is yours.

Munitions

Although nonnuclear munitions do not require quite the degree of protection afforded to nuclear weapons, they do require a high degree of security protection. Certain munitions items are in great demand by terrorist groups, while other items are not so desirable for various reasons. With this in mind, nonnuclear munitions are assigned to one of four risk categories and security measures taken are commensurate with the risk based on their relative utility, casualty or damage effect, adaptability, and portability. For example, transportable items, easy to conceal items, and items readily usable for antipersonnel or antimaterial purposes with little or no modification should receive more protection and control than items less useful to terrorists, criminals, or dissidents.

Munitions are routinely used and stored by 2W1X1s. Normally, these items (impulse cartridges and explosive bolts for pylons) are not considered dangerous in small quantities, although they must be protected against theft and stored according to safety criteria. You will probably only be working with a 1-day supply of these type items. On some bases, 2W1X1s do maintain their own supply of impulse cartridges. If you work on one of these bases, your supervisor will acquaint you with the particular storage procedures. The major areas of concern for you in this type of situation will be key control for the storage area and a weekly inventory of the stored items. You must always report any inventory shortages to your supervisor.

Firearms

All aircraft weapons must be provided adequate protection when not installed on aircraft. Portable machine guns (i.e., .50 caliber, M–240D, etc.) because of their size, weight, lethality, and ease of operation are considered particularly vulnerable and must be stored in an appropriate storage area when removed from the aircraft. Other aircraft weapons are less susceptible to theft due to their large size and weight; however, bulk alone cannot prevent them from being stolen.

Minimum protective measures

The following minimum protective measures apply to aircraft weapons not assigned a risk category:

- When a gun is removed from the aircraft, store it in the gun shop or other building with a

heavily reinforced door able to be locked with high-security locks and that has steel bars or equivalent barriers over the windows and other openings.

- If the Resource Protection Executive Committee (RPEC) decides indoor secure storage of aircraft weapons larger than .50 caliber is impractical, apply at least one of the security measures outlined below:
    - Locate the weapons within a restricted or controlled area with an entry controller.
    - Ensure weapons are accounted for at all times, usually by a person who has been assigned responsibility for the weapons. This person must have the knowledge and capability to sound an alarm if a theft is attempted.
    - Make sure the weapons are immobilized to prevent easy removal.
- When practical, link several weapons or pods together to enhance control and protection. Use cables or chains strong enough so they cannot be easily cut or removed. Attach a single weapon to a concrete anchored eyebolt or similarly secured attaching point. Make sure the locks used offer a degree of protection equal to or better than what is afforded by the chain or cable.
- Immobilize trailers and other conveyances where weapons are stored, or reduce mobility as much as possible. When practical, place immobilized weapons inside a secured, locked, and permanently fenced gate.
- In all cases, inform the security forces of the location of these large weapons so periodic patrol checks may be made.

Protecting firearms under deployed conditions

The installation security program guidelines outlined in AFI 31–101, *Integrated Defense (FOUO),* must be executed at deployed locations in support of air and space expeditionary forces (AEF) missions. At deployed locations, the installation security program is used in conjunction with air base defense procedures to provide the best protection possible for protection level resources. The threat posed to affected resources is the most critical element in the process of determining protection needs.

When deployed in the field, firearms (regardless of risk category) must be under continuous positive control. Weapons are never left unattended or unsecured. The deploying commander must establish and enforce procedures for protecting deployed firearms. Commanders may elect to consolidate firearms in a central location to make surveillance easier or have each deployed person maintain positive control of their assigned weapon.

If weapons are consolidated, persons charged with custody of the weapons must be armed and have the capability to sound the alarm if a forceful theft is attempted. An armed response force must be capable of responding within 10 minutes of alarm being sounded.

Demilitarization requirements

Sometimes, securing parts is just simply not enough. Some of the parts we replace on a daily basis must be demilitarized (or demilled for short). Demilitarization is an overlong word with a simple definition. It is simply the process to render something unsuitable for military purposes. For example, after a gun barrel has fired a given amount of rounds the Air Force replaces it before its expected failure point. This barrel is not considered serviceable for the Air Force, but it is still capable of firing military caliber rounds. This is a capability that we do not want to be commonly available. However, if the barrel is demilled, it does not really matter where the part ends up, as it will not be of any use to someone in a military application.

The demilitarization process can take many forms. For example, a gun barrel can be cut up into multiple pieces or it can have a metal plug welded into the breech. A bomb rack breech can be cut into pieces or in some cases crushed flat. The method of demilitarization is tailored to the material being demilled and its intended method of disposal after the Air Force is done with it. More detailed

instructions are contained in DOD Manual 4160.28, *Defense ~~Militarization~~ Manual*. Demilling is just another way of securing our resources and knowledge so they can't be used against us.

232. Values and sensitivities of resources

Why do certain materials require more security than others? Some classifications are obvious. A paperclip does not require the same security precautions as a minigun; however, others are a little harder to understand, such as a handgun verses an AIM–9. This lesson will refine your understanding of what the differing levels of security are, how materials are classified, and what classifications do the more common 2W1X1-related materials fall into.

Values

The monetary value of the resources you deal with range from fractions of a dollar to millions of dollars. The loss, damage, or destruction of our resources from this aspect is of prime concern especially during turbulent economic times such as today. Their value is primarily described as monetary and military. Other areas of prime concern are the value of our resources to terrorists or subversives and the contributory value our resources have for the Air Force mission and national defense. A question you might ask yourself is, "Can we afford to lose our resources monetarily or military?" The answer to this question is quite simply, "No." The safety of the general public is in your hands. Protect our resources and you protect your nation.

Sensitivities

The individual sensitivities of our resources can best be described by placing them into risk categories. These risk categories are the standards and procedures we use for protecting arms and munitions. When more than one risk category of items is stored in a container, structure, or area, the command provides the protection required for the *highest* category involved. Classified items with operational characteristics are secured according to criteria for a particular risk category. For example, if there is a risk Category II item and a risk Category III item stored in the same container, structure, or area, then protection is required at the highest category—in this case, Category II—involved.

AFI 31–101 provides the requirements for physical security. Major parts for arms (such as barrels and major subassemblies), as well as arms frames and receivers, must be afforded the same protection as Category II, III, and IV arms. Risk category identification codes are published in Air Force cataloging directives. Some examples of risk category assignment for arms and munitions items are provided here for information purposes. The lists in the following table are not all-inclusive.

Arms and Munitions Risk Categories	
Category	**Description**
I	Man-portable missiles and rockets in a ready to fire configuration: • Redeye. • Stinger. • Dragon. • Javelin. • Light antitank weapon (LAW) (66mm). • Shoulder-launched multipurpose assault weapon (SMAW) rocket (83mm). • M136 anti-armor launcher and cartridge (84mm). **NOTE:** When these weapons are jointly stored or transported with the launcher tube and/or grip stock and the explosive round, though not in a ready to fire configuration, they must be considered Category I items.
II	Munitions. High-explosive and white phosphorous grenades. Explosives used in demolition operations (i.e., C–4, military dynamite, Trinitrotoluene [TNT], etc.).

Arms and Munitions Risk Categories	
Category	**Description**
	Light, automatic weapons up to and including .50 caliber and M–240D machine guns. Weapon components such as silencers, mufflers, and noise suppression devices antitank or antipersonnel mines (unpacked weight of 100 pounds or less each). Missiles and rockets that are crew-served or require platform—mounted launchers and other equipment to function. Included in this group are the tube-launched, optically tracked, wire-guided weapon (TOW) missile and Hydra–70.
III	Blasting caps. Bulk explosives. Detonating cord. Supplementary charges. Tracker for Dragon missiles. Launch tube, sight assembly, and grip stock for Javelin missile. Incendiary grenades and grenade fuzes. Launch tube and grip stock for Stinger missiles. Rocket and missile launchers with sights and firing systems (unpacked weight of 100 pounds or less). Caliber .50 and larger ammunition with explosive-filled projectile (unpacked weight of 100 pounds or less each). Launcher and/or missile guidance set and/or the optical sight for any of the tube launched, optically tracked, wire-guided (TOW) series weapons.
IV	Handguns. Incendiary destroyers. Recoilless rifles up to and including 90 mm. Illumination, smoke, and practice grenades. Riot control agents, 100-pound package or less. Fuzes, other than for grenades (bomb and ammunition). High risk weapons ammunition if not otherwise categorized above. Manually operated, shoulder-fired weapons other than grenade launchers. Ammunition with nonexplosive projectile (unpacked weight of 100 pounds or less each).

233. Cybersecurity overview

The US military's dependence on cyberspace for its operations led the Secretary of Defense in 2011 to declare cyberspace as an operational domain for purposes of organizing, training, and equipping US military forces. The Defense Department must be able to secure its own networks against attack and recover quickly if security measures fail. In the grand scheme of things you are vital in the protection of Air Force property that requires cybersecurity, especially when you consider the advanced nature of our newer aircraft and their computer systems.

Cyber strategy

The Department of Defense (DOD) has established a cyber strategy to help defend against cyber-attacks and it is up to you to understand your role when it comes to cyber systems. The purpose of the cyber strategy is to guide the development of DOD's cyber forces, strengthen our cyber defense, and cyber deterrence posture. It focuses on building cyber capabilities and organizations for DOD's cyber missions.

AF cybersecurity program

According to AFI 17–130, *Air Force Cybersecurity Program Management*, the objective of the AF cybersecurity program is to manage the risk presented by adversary cyber capabilities (purposeful attacks) and intelligence, environmental disruptions, human or machine errors, and to maintain mission survivability under adversary offensive cyber operations. The Air Force implements and

maintains the cybersecurity program to adequately secure its information and information technology (IT) assets. The cybersecurity program does the following:

- Ensures AF IT operate securely by protecting and maintaining information systems (IS)/platform information technology (PIT) resources and information processed throughout the system's life cycle.
- Protects information commensurate with the level of the risk and magnitude of harm resulting from the loss, misuse, unauthorized access, or modification.

As a 2W1 you will need to be aware of the systems you will be working with and the cybersecurity requirements required. Your attention to detail in this regard will be critical in the protection of your aircraft and weapons systems.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

230. Threats to United States Air Force resources

1. What are the threats to USAF resources?

2. When does the loss of any resource generally occur?

3. Describe what is meant by each of the following threats to USAF resources.

   a. Damage and destruction.

   b. Theft.

   c. Vandalism.

231. Resources vulnerable to threats and their protection requirements

1. Explain how the following resources might be protected from threats.

   a. Facilities.

   b. Equipment and supplies.

   c. Munitions.

   d. Firearms.

2. Who decides on indoor secure storage of aircraft weapons requirements?

3. What are two items that may need to be demilitarized?

232. Values and sensitivities of resources

1. What values should we consider our resources to have?

2. What do risk categories of our resources describe?

3. To what risk categories are our resources assigned?

4. Which risk category is an M–240D machine gun assigned to?

5. What type of munition is assigned to the very highest risk category?

6. Fifty caliber and larger ammunition with explosive-filled projectiles are assigned to which risk category?

7. Bomb fuzes are normally assigned to which risk category?

233. Cybersecurity overview

1. What is the purpose of the cyber strategy?

2. What is the objective of the AF cybersecurity program?

3. Why does the AF implement and maintain the cybersecurity program?

Answers to Self-Test Questions

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1. (1) Identify those portions of an operation that require protection.
   (2) Develop OPSEC procedures and techniques.
   (3) Systematically assess OPSEC status at all operational levels.
   (4) Document deficiencies and institute corrective actions.
2. Operations, procedures, and communications.
3. Unclassified and highly visible aspects of an operation as well as classified aspects.
4. During all phases of an operation.

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1. Operations.
2. Yes, because posting and transmitting operation orders, operation plans (OPLAN), exercises in unsecured areas is not authorized.
3. Flagwords.

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1. Damage and destruction, loss, theft, and vandalism.
2. When someone fails to properly safeguard resources.
3. a. Damage and destruction—any willful act that renders Air Force equipment or property to a state of uselessness.
   b. Theft—the illegal and deliberate taking of USAF property either for personal gain or for the benefit of someone other than the Air Force.
   c. Vandalism—the willful or malicious destruction of property.

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1. a. Facilities–The flight line is normally a controlled area. It is patrolled by security forces teams and you must have a controlled area badge to enter the area. In the gun shop, special high-security locks are required and proper key control procedures must also be established.
   b. Equipment and supplies–Effective management on everyone's part is the most effective way to protect these resources.
   c. Munitions—Proper inventory procedures and key control can go a long way in protecting munitions.
   d. Firearms—Storing these items in an appropriate storage area is probably their best protection.
2. RPEC.
3. Gun barrels and bomb rack breech assemblies.

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1. Monetary and military.
2. The individual sensitivities of the resource.
3. Categories I, II, III, and IV.
4. Category II.
5. Complete man-portable nonnuclear missiles and rockets.
6. Category III.
7. Category IV.

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1. To guide the development of DOD's cyber forces, strengthen our cyber defense, and cyber deterrence posture.
2. To manage the risk presented by adversary cyber capabilities and intelligence, environmental disruptions, human and machine errors, and to maintain mission survivability under adversary offensive cyber operations.
3. To adequately secure its information and information technology (IT) assets.

Complete the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field-Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

88. (228) Which is *not* an operations security (OPSEC) objective?
    a. Develop OPSEC procedures and techniques.
    b. Document accidents and perform corrective actions.
    c. Systematically assess OPSEC status at all operational levels.
    d. Identify those portions of an operation that require protection.

89. (229) During normal conversations, you should avoid using what type of words to ensure *maximum* operational security?
    a. Sign.
    b. Down.
    c. Flag.
    d. Up.

90. (229) Under operations security (OPSEC), you should be looking for what communications intelligence indicator?
    a. Any use of secure voice.
    b. Any use of automatic digital network.
    c. Use of Public Affairs to communicate with the local media.
    d. Use of unchanging or infrequently changing call signs or radio frequencies.

91. (230) Damage and destruction to Air Force resources is described as
    a. the deliberate act of taking Air Force equipment or property.
    b. any willful act that renders Air Force equipment or property useless.
    c. the willful or malicious destruction of Air Force equipment and property.
    d. the deliberate act of not properly safeguarding Air Force equipment or property.

92. (230) Which threat to Air Force resources *usually* involves the circumvention of human controls and physical security measures?
    a. Loss.
    b. Theft.
    c. Vandalism.
    d. Destruction.

93. (230) Which threat to Air Force resources is described as the willful or malicious destruction of property?
    a. Loss.
    b. Damage.
    c. Vandalism.
    d. Destruction.

94. (231) If weapons are consolidated at a deployed location, the persons charged with custody of the weapons must be
    a. armed and able to immobilize weapons.
    b. able to sound an alarm and immobilize weapons.
    c. armed and have the capability to sound an alarm.
    d. a member of the response force who is available for deployment within 10 minutes.

95. (231) Which term is the process of rendering something unsuitable for military purposes?
    a. De-arming.
    b. Disabling.
    c. Disablement.
    d. Demilitarization.

96. (232) How are the values of Air Force resources described?
    a. Monetary and military.
    b. Sensitivity and military.
    c. Monetary and sensitivity.
    d. Sensitivity and capability.

97. (232) The sensitivities of Air Force resources can *best* be described by placing them into what kind of categories?
    a. risk.
    b. value.
    c. sensitivity.
    d. capability.

98. (232) Which item is an example of a risk category I arms and munitions item?
    a. Explosives used in demolition operations.
    b. Man-portable missiles and rockets in a ready to fire configuration.
    c. Caliber .50 and larger ammunition with explosive-filled projectile.
    d. Light, automatic weapons up to and including .50 caliber and M–240D machine guns.

99. (233) Why did the Department of Defense establish a cyber strategy?
    a. To help defend against cyber-attacks.
    b. To help develop operational security.
    c. To establish cybersecurity operations.
    d. To help defend base installation attacks.

100. (233) Why does the Air Force implement and maintain the cybersecurity program?
    a. To adequately secure its information and information technology assets.
    b. To provide protection against demilitarization attacks by adversaries.
    c. To assist the development of the AF Technical Order System.
    d. To be able to conduct AF integrated base defense.

Student Notes

Glossary Abbreviations and Acronyms

AEF	air and space expeditionary forces
AF/A10	Air Force Assistant Chief of Staff for Strategic Deterrence and Nuclear Integration
AFI	Air Force instruction
AFMAN	Air Force manual
AFOSHSTD	Air Force Occupational Safety and Health Standard
AFPAM	Air Force pamphlet
ALC	Air Logistics Center
API	Airmen Powered by Innovation
CAFSC	Control Air Force specialty code
CMA	competent medical authority
COMSEC	communications security
CONUS	Continental United States
CPR	cardiopulmonary resuscitation
CTK	composite tool kit
DOD	Department of Defense
DODM	Department of Defense Manual
DOE	Department of Energy
ELSEC	electronic security
EOD	explosive ordnance disposal
ICBM	intercontinental ballistic missiles
IG	inspector general
IS	information systems
IT	information technology
LAW	light antitank weapon
LCAT	logistics compliance assessment team
LCC	launch control center
MAJCOM	Major Command
MHU	munitions handling unit
mm	millimeter
MOI	maintenance operating instruction
NEC	national electrical code
NEW	net explosive weight

NSC	National Safety Council
OPLAN	operation plan
OPSEC	operations security
OSHA	Occupational Safety and Health Administration
PA	Public Affairs
PAO	Public Affairs Office
PDR	product deficiency report
PIC	positive inventory control
PIT	platform information technology
PPE	personal protective equipment
psi	pounds per square inch
PRP	personnel reliability program
QA	quality assurance
QD	quantity-distance
RPEC	Resource Protection Executive Committee
S	Secret classification
SDS	safety data sheet
SMAW	shoulder-launched multipurpose assault weapon
S/N	serial number
TDY	temporary duty
TNT	Trinitrotoluene
TO	technical order
TOW	tube launched, optically tracked, wire guided
UII	unique item identifier
USBM	United States Bureau of Mines
V	Volt
WP	white phosphorous
WR	weapons release
WSSR	weapon system safety rules

Student Notes

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