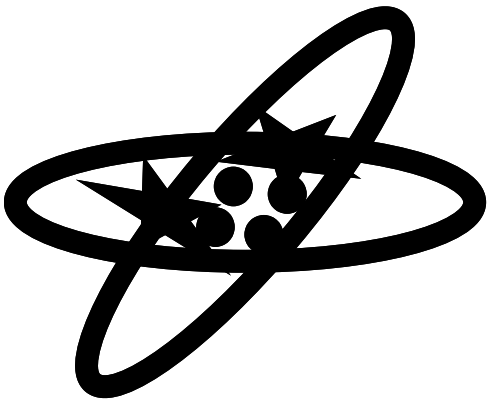
U.S. Department of
Homeland Security

United States
Coast Guard

ET2 UNIT 3: SPECIAL AND EMERGENCY PROCEDURES



Coast GUARD
Training Center Petaluma

U. S. Coast Guard
Pamphlet No. P22204
(11/09)

ET2 UNIT 3: SPECIAL AND EMERGENCY PROCEDURES

Creation Date: 11/09
Revision Date: 11/12

U. S. Coast Guard
Training Center
Petaluma, CA. 94952
(707) 765-7129

QUESTIONS ABOUT THIS TEXT SHOULD BE
ADDRESSED TO THE SUBJECT MATTER SPECIALIST
FOR THE ET RATING

Record of Changes			
Change Number	**Date of Change**	**Date Entered**	**By Whom Entered**

TABLE OF CONTENTS

TITLE	PAGE
Acknowledgements and References	ii
Notice to Students	iii
Lessons	
#1 How to Inspect electronics equipment spaces to ensure proper Warning signs are posted.	1-1
#2 How to Demonstrate safety precautions required to eliminate/ limit exposure to RF radiation	2-1
Appendixes	
A. Pamphlet Review Quiz	A-1
B. Pamphlet Review Quiz Answers	B-1

Acknowledgments and References

Acknowledgments

Material is included in this pamphlet through courtesy of the designated source. The Coast Guard appreciates permission of the source to use this material, which contributes greatly to the effectiveness of this course. No copies or reproductions of the material are authorized without permission of the appropriate source.

The Coast Guard wishes to thank the following individuals for their expertise and support in the development of this document

ETC Chris Meyer

ETCS Aaron Cordell

ETC Kevin Odom

ETC Dave Baker

List of References

This pamphlet contains original material developed at the U. S. Coast Guard Training Center, Petaluma, California, and excerpts from the following technical publications:

- Electronics Manual, COMDTINST M10550.25 (series)
- Enclosures 4, 5, 6, and 7 of DODINST 6055.11
- COMDTINST M6260.21 (series)

Notice to Students

Purpose

This pamphlet serves as a training aid to provide you with a general knowledge of Special and Emergency Procedures tasks required of an ET2.

Important Note

This text has been complied for TRAINING ONLY. It should NOT be used in place of official directives or publications. The test information is current according to the references listed. You should, however, remember that it is YOUR responsibility to keep up with the latest professional information available for your rating. Current information is available from the Enlisted Performance Qualifications version (03-2009).

Course Content

This course content is based on the requirements stated in the Enlisted Performance Qualifications version (03-2009).

Record of Changes

From time to time courses, after they are printed, have minor editorial changes made to them by the Subject Matter Specialist that do not require a new course. The student is responsible for any changes made to the course after printing and receipt from the Coast Guard Institute. The Coast Guard Institute will post on their web site a listing of current changes based on the course code and edition that should be downloaded in a **.pdf** format and entered in the current course material. The Coast Guard Institute will send an errata sheet out with each ordered course that list the required changes.

Pamphlet Content

This pamphlet contains two lessons:

Lesson 1: How to Inspect Electronics Equipment Spaces to ensure proper Warning Signs are posted

Lesson 2: How to Demonstrate Safety Precautions required to Eliminate/ Limit exposure to RF Radiation

Notice to Students

Learning Objectives

Read the learning objectives before you begin reading the text. The objectives will guide you through the text and help you answer the questions in the self-quiz at the end of each lesson.

Quizzes

Each lesson has a self-quiz and each pamphlet has a pamphlet review quiz. You will find the answers to each quiz on the pages following the quiz. Included are the reference pages for the answers.

These self-quizzes are meant to check your comprehension of the material you covered. If you are having problems understanding a section, go through it again or ask someone for help. The pamphlet review quiz questions are samples of the type of questions you will find on the End-Of-Course-Test (EOCT).

SWE Study Suggestion

Servicewide exam questions for your rate and pay grade are based on the Professional and Military Requirements sections of the Enlisted Performance Qualifications version (03-2009).

If you use the references from this text and consult the Enlisted Performance Qualifications, you should have good information for review when you prepare for your Servicewide Exam (SWE).

Lesson 1

HOW TO INSPECT ELECTRONICS SPACES FOR POSTED WARNING SIGNS

Overview

Introduction

Accidents do not happen without a cause; when each individual can be made aware of the hazards involved with his work, fewer accidents will result. Warning signs and posters shall be placed in electronics spaces to help prevent personnel from accidentally coming in contact with dangerous voltages, radio frequency (RF) radiation, poisonous gases, and other hazards.

Objectives

Given a job aid, **INSPECT** electronics spaces to ensure that the following warning signs are posted:

1. RF radiation hazard
2. High voltage warning
3. Shock hazard warning
4. CPR
5. Multiple power sources
6. Permissible RF exposure areas
7. Toxic gas warning
8. Hearing protection requirements

- Identify the regulations for warning signs in electronic equipment spaces
- Identify the requirements for each warning sign listed above
- Identify the procedures required when a discrepancy is found during an inspection

References

The following references were used for this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- COMDTINST M6260.21 (series)
- Enclosures 4, 5, 6, and 7 of DODINST 6055.11 “Protection of DOD Personnel from Exposure to RF Radiation and Military Exempt Lasers

Regulations

Introduction

Executive Order 12196, Occupational Safety and Health Programs for Federal Employees, requires the Coast Guard to maintain a safety and occupational health program IAW the Occupational Safety and Health Act of 1970 for civilian employees under the Occupational Safety and Health Administration (OSHA).

Although exempted from OSHA standards, Coast Guard military personnel except where engaged in unique military operations shall comply with and enforce OSHA standards.

OSHA Standards

OSHA CFR 29 Part 1910 Occupational Safety and Health Standards contain the specifications for accident prevention signs and tags. These specifications apply to the design, application, and use of signs or symbols intended to indicate and, when possible, define specific hazards of a nature such that failure to designate them may lead to accidental injury to workers, the public or property. These specifications are intended to cover all safety signs except those designed for streets, highways, railroads, and marine regulations.

CG Policy

The fundamental safety and environmental health risk management process is a subset of the Coast Guard's overall risk management policy as described in Operational Risk Management, COMDINST M3500.3 (series).

In addition, the Coast Guard's Safety and Occupational Health Manual, COMDTINST M5100.47 (series), provides policy on hazard identification and discrepancy reporting procedures.

Continued on next page

Regulations (Continued)

Risk Management Process

Risk management is a continual process and is primarily an individual and unit responsibility, facilitated, where necessary, and monitored by safety and environmental health professionals. There are three primary steps within the risk management process.

1. Identification of hazards
2. Risk assessment
3. Risk control

Risk Control

Risk control is the overall goal of the safety and environmental health risk management process.

This topic pertains to a portion of the risk control step, which is defined as the process of developing and implementing measures to control risk. The preferred priority is:

- Engineering controls
- Administrative procedures/work practices (training, procedures, and signs)
- Personnel protective equipment (PPE)

RF Radiation Hazards

Introduction

RF radiation from radar, communications, and Loran transmitters is hazardous and causes undesirable effects under certain conditions both ashore and on ships. There are eight types of RF radiation hazard signs used for specific areas of RF radiation.

Location

Each sign has been designed for a specific location. In general these signs shall be posted in locations where personnel may be exposed to radiation hazards (RADHAZ). For specific locations, see each type of sign in the chart below.

Types of Warning Signs

Each sign is labeled according to type (1 through 8). All RADHAZ signs have the following specifications:

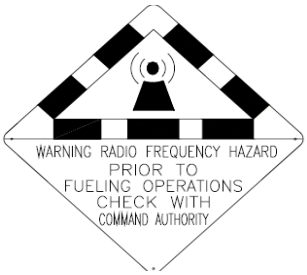
- Base Material 0.004” thick outdoor white vinyl
- Permanent acrylic adhesive backing
- Screen-printed labels with ultra-violet inks
- Bleeds screened as requested by artwork
- Black ink for lettering
- Red and yellow checked triangle
- 5” square for normal shipboard use
- 12” square for COMMSTA’s, DGPS Broadcast Sites, shore installations, and flight deck use
- Must be posted at eye level when applicable

Continued on Next Page

RF Radiation Hazards (Continued)

Examples of Signs

Types of RF RADHAZ signs are described below:

Type	Example	Description	Size	Stock Number
1.	TYPE 1	Used in areas surrounding RF antennas to advise personnel not to remain within the Permissible Exposure Limit (PEL) longer than the MPE limit allows. Signs should be posted outside the PEL and at the end of the boundary.	5 inch 12 inch	7690-01-377-5893 7960-01-377-5894
2.	TYPE 2	Used to restrict personnel from proceeding past a designated point unless they are in compliance with the established radiation hazard safety procedures.	5 inch 12 inch	7690-01-377-5895 7960-01-377-5082
3.	TYPE 3	Used to advise personnel of an RF burn hazard source and not to touch metal objects or to use special operating procedures when touching metal objects.	5 inch 12 inch	7690-01-377-5896 7960-01-377-9905
4.		Used to warn personnel of Hazards of Electro-Magnetic Radiation to Fuel (HERF). Should be posted above fueling stations.	5 inch 12 inch	7690-01-377-5899 7960-01-377-5900

RF Radiation Hazards (Continued)

Type	Example	Description	Size	Stock Number
5.	TYPE 5	Used below decks in a system equipment room to advise operators of specific safety precautions. Sign contains blank area where special precautions can be written. Should be posted near equipment controls.	5 inch 12 inch	7690-01-377-5374 7960-01-377-5375
6.		Used to advise personnel not to operate transmitters, cellular phones, or other wireless communication devices within a designated area.	5 inch 12 inch	7690-01-377-5444 7960-01-377-5477
7.		Used to ensure that personnel follow the Hazards of Electro-magnetic Radiation to Ordnance (HERO) practices. Should be posted in areas where ordnance is loaded, offloaded or stored.	5 inch 12 inch	7690-01-377-5899 7960-01-377-5900

Continued on next page

RF Radiation Hazards (Continued)

Type	Example	Description	Size	Stock Number
8.		Used to advise operators to refer to HERO Emission Control Plan before operating transmitters.	5 inch	7690-01-377-5902

High Voltage Warning

Introduction

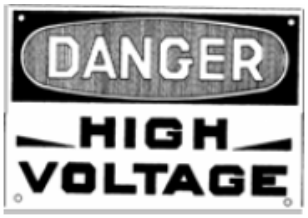
Compartments or walk-in enclosures containing equipment with exposed conductors presenting shock hazards in excess of 500V RMS or DC must be clearly marked with a sign stating “DANGER HIGH VOLTAGE.”

Location

The signs shall be posted so that they are obvious and can be clearly read upon entrance. Additional signs may be posted at or near the exposed conductors within the space.

Types of Signs

There are three sizes or high-voltage warning signs. Refer to the chart below:

Type	Picture	Description	Size	Stock Number
1.		Black, white, and red fiberglass for use inside and outside.	10 x 14 in.	9905-01-050-7960
2.		Black, white, and red steel with a baked enamel finish.	10 x 14 in.	9905-00-971-7168
3.		For use inside only, laminated placard. Colors for danger and warning signs shall be red and black with a white background.	8 x 4 in.	Currently available only through commercial sources.

Circuit Breaker Panel

An example of a circuit breaker panel with a stenciled warning is depicted below:

Shock Hazard Warning

Introduction

Compartments or walk-in enclosures containing equipment with exposed conductors at potential of 30V RMS or DC and 500V RMS or DC shall have either a “Danger High Voltage” or a “Danger Shock Hazard” sign.

Location

The signs shall be posted so that they are obvious and can be clearly read upon entrance. Additional signs may also be posted at or near the exposed conductors within the space.

Types of Signs

“Danger Shock Hazard” signs may be manufactured IAW NAVSEA Drawing Number 807-2699757. There are two sizes of shock hazard warning signs. Refer to the chart below:

Type	Example	Description	Size	Stock Number
1.		Made with 18-guage sheet steel. Colors for danger and warning signs shall be red and bleach with a white background.	7 x 10 in. and 3 ½ x 5 in.	

CPR Warning

Introduction

Coast Guard regulations do not specify where and what type of cardiopulmonary resuscitation sign is required within electronics spaces. However, the Office of Health Services (CG-112) stated that a CPR sign is required.

Location

CG-112 states that the CPR sign should be conspicuously posted where electronic equipment is present or personnel work. The sign must be viewable and readable from anywhere in the space.

Types of Signs

CPR signs must present the American Heart Association standard for providing cardiopulmonary resuscitation to adults.

The following is a link to the American Safety & Health Institute; approved CPR posters may be procured through ASHI's online store found at the link below:

http://www.ashinstitute.org

Multiple Power Sources

Introduction

Any equipment that has more than one power source (any equipment with 12V or more) shall be labeled, indicating multiple power sources, as per Naval Ships' Technical Manual, Chapter 300.

Location

The multiple power sources labeling tag shall be affixed to the equipment or the equipment's power sources in a conspicuous place that can be viewed by personnel working on equipment.

Types of Signs

There are several different types of safety tags that can be used to warn personnel of multiple power sources. Refer to the chart below:

Type	Picture	Description	Size
1.	*"Do Not Throw Switch, men at Work on Circuits"*	Cardboard tag with an attached cord stating "Do not throw switch, men at work on circuits."	7 ½ x 4 in.
2.		Plastic tag with an attached cord. Tag provides a place for the technician to sign name and date. Colors are white letters on a red background, for danger. The body has a white background with black letters for the message.	5 5/8 x 3 ¼ in.
3.		Plastic tag with a large brass grommet used to attach a string for hanging. Tag provides a place for the technician to sign name and date. Colors are the same as Type 2.	5 5/8 x 3 ¼ in.

Permissible RF Exposure Areas

Introduction

Permissible Exposure Limits (PELs) are times set to allow the human body time to dissipate or "cool" before returning to the RF field to ensure that no injury occurs. PELs are determined by the antenna's effective radiated power, power density, and distance to the source of the radiation. PEL boundaries are used to restrict or limit access to RADHAZ zones and ensure that personnel entering a zone do not exceed the PEL. These RADHAZ zones are also known as *permissible RF exposure areas.*

Location

Permissible RF exposure areas shall be marked with RADHAZ warning signs at eye level (or where it can easily be seen) outside the PEL boundary area.

Shipboard Location

A four-inch wide red (11105) warning line shall be painted on the deck to designate RADHAZ zones in areas where posting of signs is not applicable. Location of the warning lines will be found in a modification to the ship's drawings.

Types of Signs

Permissible RF exposure areas use an RF RADHAZ type 1 sign with a red and yellow-checkered triangle and black lettering. Refer to the chart below for a picture, size, and ordering information:

Picture	Description	Size	Stock Number
	Advise personnel not to linger in the area surrounding RF antennas where the MPE can be exceeded. Install at eye level (or where sign can easily be seen) outside the PEL boundary. When applicable, post a sign at each end of the boundary.	5 inches 12 inches	7690-01-377-5893

Toxic Gas Warning

Introduction

All areas near smoke pipe (stack) gases shall have warning signs posted to alert personnel working aloft. These gases are toxic and can quickly incapacitate personnel working near smoke pipes.

Location

One sign should be mounted near the bottom of each access ladder leading aloft, and another sign should be located at the top of each ladder mounted on the outside of the antenna pedestal.

Types of Signs

The toxic gas warning should read as follows:

> **DANGER**
>
> Personnel are cautioned to guard against poisonous effects of smoke pipe gases while servicing equipment aloft. When servicing equipment in the way of smoke pipe gases use oxygen breathing apparatus and a chest telephone or throat microphone set for communication with others in the working party. Obtain necessary equipment before going aloft.

For description and ordering info refer to the following table:

Type	Example	Description	Size	Stock Number
1.		Steel with baked enamel finish. Colors are white letters on a red background for danger. The body has a white background with black letters for the message.	8 ½ x 10 in.	0177-LF-226-2900

Hearing Protection Requirements

Introduction

COMDTINST M5100.47 (series) provides the latest requirement for noise standard. Environments or equipment that produces an eight hour TWA of 85 db or greater are considered hazardous, and protective measures must be taken to reduce exposure to personnel.

Location

The actual measurements and posting of the hearing protection, high noise sign are the responsibility of an industrial hygienist or environmental inspector, under the cognizant MLC.

Types of Signs

For descriptions and ordering information for hearing protection warning signs, refer to the table below:

Type	Example	Description	Size	Stock Number
1.		The small size is made of plastic or fiberglass. The large can be aluminum or fiberglass. Some versions have self-adhesive backing. Colors are white letters on a red background for danger. The body has a white background with black letters for the message.	10 x 14 in. 7 x 10 in.	Industrial and safety supplies item # 17665PLLSS
2.		Semi-rigid plastic sign. Colors are yellow letters on a black background for caution. The body has a yellow background with black letters for the message.	10 x 7 in.	Industrial Safety Company; Item # 16031

Review Quiz – Lesson 1

Questions

1. Which type of sign should be used to warn personnel of the hazards HERF?

   A. Type 2
   B. Type 4
   C. Type 6
   D. Type 8

2. Which type of sign should be used to warn personnel of the hazards of HERO?

   A. Type 1
   B. Type 3
   C. Type 5
   D. Type 7

3. Which type of sign should be used to warn personnel of the PEL hazards?

   A. Type 1
   B. Type 6
   C. Type 3
   D. Type 8

4. The requirement to place a CPR sign in all work areas has been established by _____?

   A. OSHA
   B. CG-6
   C. Office of Health Services (CG-112)
   D. Headquarters

5. In shipboard applications, what type of indicator can be used in the place of an RF warning sign?

   _____

   _____

Review Quiz Answers – Lesson 1

Answers

Question	Answer	Reference
1.	B	1-5
2.	D	1-6
3.	A	1-5
4.	C	1-10
5.	A four-inch wide red (11105) warning line painted on the deck.	1-12

Lesson 2

HOW TO DEMONSTRATE SAFETY PRECAUTIONS TO REDUCE/ELIMINATE RF EXPOSURE

Overview

Introduction

Radio frequency (RF) radiation from radar, communications and Loran transmitters is hazardous and can cause undesirable effects under certain conditions. As an ET, you may be responsible for the safe operation of radars and weapons. The systems you have control of can be hazardous to you and members of your unit if not operated properly. The Coast Guard has established safety programs to manage the hazards associated with RF radiation.

Objectives

Given various terms or definitions associated with RF radiation:

- **Define** various hazards of RF radiation
- **Define** various safety precautions to prevent exposure
- **Determine** the maximum permissible exposure (MPE) limits associated with various equipment and environments
- **Determine** the permissible exposure limits (PEL) associated with various equipment and environments

References

The following references were used for this lesson:

- Electronics Manual, COMDTINST M10550.25 (series)
- Enclosures 4, 5, 6, and 7 of DODINST 6055.11 “Protection of DOD Personnel from Exposure to RF Radiation and Military Exempt Lasers

RF Radiation Exposure Hazards

RF Radiation Exposure Hazards

The hazards of exposure to RF radiation are described in the table below:

RF Radiation Hazard	Description
Thermal Effect	Tissue damage caused from high levels of RF radiation on the human body results primarily from the body's inability to cope with or dissipate excessive heat. The eyes and testes are particularly susceptible to tissue damage from high frequencies.
Potential Biological Effects	Evidence from experimental research indicates that immunological, neurological, and behavioral changes may result from lower levels of RF radiation.
Burns	RF radiation can induce a current on improperly grounded or ungrounded conductors, such as metal objects (poles, fences, or wires) or wet objects. If you touch a conductor with an induced current, a discharge path is created that could result in burns to your skin.
Electric Shock	Electric shock (and possibly burns) can occur when the: • Voltages at the transmitter, antenna feed cables, and the antenna are large enough to create a discharge path • Distance between two conductors (that is, the antenna and your hand) exceed the breakdown voltage of the dielectric (the air) ***Note:*** This potential hazard exists because ionization occurs and a very low impedance path develops between the conductors.

Continued on next page

RF Radiation Exposure Hazards, Continued

Safety Practices The safety practices for preventing injury from related hazards are described in the table below:

Safety Practice	Reason
Avoid extended exposure, even if exposure is at lower power level and frequencies. ***Note:*** The electromagnetic frequency of RF radiation is as important as the radiation level in determining the magnitude of the hazard.	The maximum rate of absorption by the human body can occur within the maximum permissible exposure (MPE) limit frequency range of 30 – 300 MHz (VHF band). Extended exposure at the frequency range of 30 -300 MHz is dangerous.
Use extreme caution when working near energized broadcast equipment.	Various hazards exist within the proximity of broadcast antennas. Although these hazards become greater the closer you are to an antenna, you should assume that hazards exist wherever MPE limits are exceeded.
The most effective way to prevent the "startle" effect is to be aware of all hazards involved in working with energized broadcast equipment.	Additional injuring can occur from a reflexive reaction "startle" effect after sustaining a burn or electric shock. ***Example:*** Injuries from falling off a ladder after sustaining a shock.

HERF and HERO Safety Regulations

Introduction

This lesson contains information on the following topics:

- Occurrence of Hazards of Electromagnetic Radiation to Fuel (HERF) and Hazards of Electromagnetic Radiation to Ordnance (HERO)
- HERF safety instructions for each unit
- HERO safety plans for applicable units
- HERF/HERO safety practices for fueling aircraft and vehicles and conducting an evolution

Occurrence of HERF and HERO

HERF and HERO occur when the operation of electronic transmitters used for radio and radar:

- Induce RF voltages in the standing rigging, parts of the superstructure, and the antennas or cables
- Arc between closely spaced conductive metal objects or cause sparks when contact is made or broken by personnel
- Contain sufficient energy so the heat of the arc (or spark) ignites fuel vapors or other explosive mixtures

HERF Safety Instructions for Each Unit

Each unit should have HERF safety instructions to prevent explosions or fires. These instructions shall address safety practices as they relate to the following conditions:

- In areas where gasoline vapors are present
- During fueling of aircraft
- When handling volatile liquids or gases

HERO Safety Instruction in Applicable Units

A HERO safety plan should be in place in applicable units to limit the exposure of ordnance to RF energy.

During loading and unloading of ordnance, RF energy can enter a weapon as a wave radiated through a hole or crack, or be conducted into the weapon by the firing leads or other wires penetrating the weapon's enclosure.

Although the most likely effect is duding and reduction in reliability, there is a low probability of detonation.

Continued on next page

HERF and HERO Safety Practices, Continued

Safety Practices for Fueling

The HERF/HERO safety practices for fueling aircraft or vehicles are described in the table below:

HERF/HERO Safety Practice	Description
Make connections *before* the aircraft or vehicle is fueled.	Electrical, static ground wire, tie-down, or any other metallic connections must be made before the aircraft or vehicle is fueled.
Do *not* energize a radar or communications transmitter during fueling.	A radar or communications transmitter on an aircraft or vehicle being fueled, or on adjacent aircraft or vehicles, must NOT be energized during the fueling.
Break connections *after* fueling is completed.	Do NOT break electrical, static ground wire, tie-down, or any other metallic connections to the aircraft or vehicle while it is being fueled.

Safety Practices for Ordnance

HERF/HERO safety practices MUST be followed when conducting an evolution that requires the handling of ammunition and volatile liquids or gases. The procedure for safely conducting an evolution is described in the table below:

Step	Action
1.	Inform the personnel involved with the evolution of the potential hazards of HERF/HERO.
2.	Secure all transmitting antennas located within the quadrant of the ship in which the evolution will be conducted.
3.	Ensure that the area is adequately ventilated.
4.	Request that the use or presence of tools and metal objects in the area be minimized.
5.	If possible, insulate the loading hook from crane or boom cables with manila rope or RF insulators.
6.	Use an insulated steering hook to guide the boom or hook cables.

Maximum Permissible Exposure (MPE) Limits

Introduction

This lesson contains information on the following topics:

- Maximum Permissible Exposure (MPE) Limits
- The average exposure time limits for individuals in the occupational and general population categories to be exposed to RF radiation without injury
- Compliance with the averaging exposure time limits for the occupational and general population categories

MPE Limit Description

Maximum permissible exposure (MPE) limits define the maximum time and intensity of RF fields that an individual can be exposed to without sustaining injury.

The Federal Communications Commission (FCC) has published guidelines to be used for evaluating human exposure to RF emissions, which include MPE limits for the following categories:

- For equipment operating at frequencies between 300 kHz and 100 GHz
- In terms of electric and magnetic field strengths and power density

The MPE limits are based on:

- Recommendations of the National Council on Radiation Protection and Measurements (NCRP)
- Limits developed by the Institute of Electrical and Electronics Engineers (IEEE) that were adopted by the American National Standards Institute (ANSI)

Continued on next page

Maximum Permissible Exposure (MPE) Limits, Continued

Averaging Exposure Time Limits

The averaging exposure time limits – that is, the maximum time that an individual can be exposed to RF radiation without injury – for individuals in the occupational and general population categories are described in the table below:

Population Category	Description	Averaging Exposure Time Limit
Occupational Population/Controlled Exposure	This category applies to all Coast Guard personnel who: • Work, or might work, near RF fields • May be exposed to radiation as a consequence of their employment • Are fully aware of the risk • Are able to exercise control over their exposure	6 minutes
General Population/Uncontrolled Exposure	This category is used for the general public or employees (as a result of their employment) who: • Do not work, or will not work near RF fields • May be exposed to radiation • May not be aware of the risks • Cannot exercise control over their exposure	30 minutes

Permissible Exposure Limit (PEL) Boundaries

Introduction

This lesson contains information on the following topics:

- The permissible exposure limit (PEL) boundaries established at shore units and ships
- PEL fences used at shore units and broadcast sites
- Typical PEL boundaries for different classes of ships and Coast Guard and Navy supported radar antennae
- How PEL boundaries are determined for ships, radar antennae, and broadcast sites

Description: PEL Boundary

A permissible exposure limit (PEL) boundary physically marks an area as a radiation hazard zone.

A PEL boundary is used to

- Define and restrict areas where RF radiation may exceed the general population MPE limits
- Alert Electronics Technicians (ETs) of their averaging time limits

IMPORTANT: RF radiation hazard (RADHAZ) warning signs must be posted at all PEL boundaries.

Boundaries for Shore Units

PEL boundaries at shore units should restrict access to areas where exposure exceeds the MPE limits for the general population.

The methods for restricting access include:

- Locking doors to the restricted areas
- Installing a PEL fence with a lockable gate

Notes:

- At remote sites, not generally visited by the general population, a RF RADHAZ sign may be considered as the PEL boundary
- PEL fences are generally used at shore-based broadcast sites, such as DGPS broadcast sites, VTS radar sites, and communication stations (COMMSTA)

Continued on next page

Permissible Exposure Limit (PEL) Boundaries, Continued

PEL Boundaries on Ships

Generally, the PEL boundary to mark a restricted area on a ship is a painted red line or circle, four inches in width, on the deck.

Other methods, based on the extent and level of the radiation hazard, include:

- Temporarily restricting access to a section of the ship where equipment is operating
- Limiting the power or frequency range when the general population is in the area

IMPORTANT: Because each unit has a different layout and equipment, the PEL boundaries for ships vary (even for ships within the same class). For this reason, a radiation hazard policy for each ship must be promulgated.

Boundaries for Different Classes

Radiation hazard surveys were conducted on several classes of cutters and shore units to determine the distance from transmitting antennae for typical PEL boundaries.

Note: When an antenna is used for more than one frequency range, differing power levels, or there are overlapping PEL boundaries, the PEL boundary should mark the largest area of the restricted zone.

The typical PEL boundaries for different classes of ships are listed in the table below:

Equipment	Watts	Frequency	Distance/Radius
99 Foot WAGB Platform			
CCEM-229F	100 W	MF/HF	15 feet
Long Wire	1000 W	HF	6 feet
CDFL-MLA-324	100 W	MF/HF	12 feet
CDFL-MLA-115	1000 W	MF/HF	10 feet

Continued on next page

Permissible Exposure Limit (PEL) Boundaries, Continued

Boundaries (Continued)

Equipment	Watts	Frequency	Distance/Radius
378 Foot WHEC Platform			
CCEM-390-2	100 W	HF	4 feet
CDFL-MLA-324	1000 W	HF	12 feet
CDFL-MLA-115	1000 W	HF	10 feet
5/16 inch wire rope	1000 W	HF	13 feet
270 Foot WMEC Platform			
CCEM-229F	1000 W	MF/HF	10 feet
CDFL-MLA-324	1000 W	HF	10 feet
CDFL-MLA-115	1000 W	HF	12 feet
210 Foot WMEC Platform			
CCEM-229A	100 W	MF/HF	6 feet
CCE-390-2	100 W	MF/HF	6 feet
CDFL-MLA-115	1000 W	MF/HF	12 feet
CCEM-229	1000 W	HF	10 feet
180 Foot WLB Platform			
CCEM-390-2	100 W	HF	6 feet
CCEM-229F	1000 W	HF	12 feet
110 Foot WPB Platform			
CCEM-390-2	100 W	HF	6 feet
82 Foot WPB Platform			
CCEM-390-2	100 W	HF	4 feet

Permissible Exposure Limit (PEL) Boundaries, Continued

PEL Boundaries for Radar Sites

Most Coast Guard radar sites operate in the super high frequency (SHF) band with output powers as high as 30 kW and antennae with very high gains (+25 dB). However, due to the narrow bandwidth and pulse nature of radar operations, the radiation hazard from radar antennae is relatively small.

A PEL boundary is generally determined by measuring the distance of the radiation hazard when the radar antenna is rotating.

The exact level of RF energy and data used to establish PEL boundaries for radar antennae are determined by using the following devices:

- Radiation hazard meter
- Holaday induced current meter and probe

Note: The established PEL boundary should ensure that the general population can work within the area during normal radar operations.

PEL Boundaries for Radar Antennas

The typical PEL boundaries for Coast Guard radar antennae are listed in the table below:

Radar	Max. Power	Antenna Size	Non-Rotating PEL	Rotating PEL
SPS-69	4 kW	3.9 feet	3.6 feet	NA
Bridge Master	30 kW	6 feet	35 feet	NA
SPS-73	30 kW	12 feet	20 feet	10 feet
VTS Furuno	25 kW	10 feet	25 feet	10 feet

Continued on next page

Permissible Exposure Limit (PEL) Boundaries, Continued

PEL Boundaries for Navy Radar Antennas

The typical PEL boundaries for Navy supported radar antennae are listed in the table below:

Mode	Non-rotating PEL	Rotating PEL
Radar – MK-92 CAS		
CWI	320 feet	NA
Search	160 feet	NA
Track	120 feet	NA
Radar AN/SPS – 40		
Search	60 feet	NA
Radio – AN/WSC-3		
SATCOM	4 feet	NA
Radar –CIWS		
Track	90 feet	NA
Search	60 feet	NA

Continued on next page

Permissible Exposure Limit (PEL) Boundaries, Continued

PEL Boundaries for Broadcast Sites

The conditions for determining PEL boundaries at Loran, DGPS, and communication station (COMMSTA) broadcast sites are described in the table below:

Broadcast Site Conditions	PEL Boundaries
LORAN Broadcast equipment operates in the LF band with a peak power of 1,400 kW for some transmitters.	**No** PEL boundaries are required for Loran equipment because of the frequencies used, however, because of the electric shock hazard, stations must comply with MPE requirements.
DGPS Broadcasts use several types of antennas with an MF frequency range from 250 to 2,500 W.	The standard PEL boundary at all sites is 25 feet from the broadcast antenna. ***Note:*** SMEF is responsible for determining PEL boundaries.

Important: COMMSTA sites use many different antennas due to varying environmental conditions. Each site is responsible for conducting a radiation hazard survey to establish the appropriate PEL boundaries.

This page intentionally left blank

Review Quiz – Lesson 2

Questions

1. What are the four major effects of RF radiation?

   _____

   _____

2. The human body is susceptible to exposure to RF radiation at the _____ frequency band.

   A. HF
   B. LF
   C. VHF
   D. MF

3. What is the averaging exposure time limit for occupational population/controlled exposure?

   A. 6 minutes
   B. 10 minutes
   C. 20 minutes
   D. 12 minutes

4. What is the averaging exposure time limit for general population/uncontrolled exposure?

   A. 10 minutes
   B. 15 minutes
   C. 30 minutes
   D. 45 minutes

5. What is the PEL for DGPS broadcast sites?

   A. 10 feet
   B. 15 feet
   C. 20 feet
   D. 25 feet

Review Quiz Answers – Lesson 2

Answers

Question	Answer	Reference
1.	Thermal effects, potential biological hazards, burns, electric shock	2-2
2.	C	2-3
3.	A	2-7
4.	C	2-7
5.	D	2-13

Appendix A – Pamphlet Review Quiz

Pamphlet Review Quiz

1. What is the purpose of a PEL boundary?

   _____

   _____

2. What is the purpose of MPE limits?

   _____

   _____

3. What organs are particularly susceptible to tissue damage from high frequencies? Choose all that apply.

   A. Lungs
   B. Eyes
   C. Testes
   D. Lips

4. What is the "startle" effect?

   _____

   _____

5. What is the MPE limit for a Coast Guard ET working in an antenna field?

   A. 30 minutes
   B. 15 minutes
   C. 12 minutes
   D. 6 minutes

6. How is a power source defined?

   _____

   _____

7. What type of sign should be used to advise operators to refer to HERO Emission Control Plan before operating transmitters?

   A. Type 4
   B. Type 6
   C. Type 5
   D. Type 8

This Page Intentionally Left Blank

Appendix B – Pamphlet Review Quiz Answer Key

Pamphlet Review Quiz Answers

Question	Answer	Reference
1.	Physically marks an area as a radiation hazard zone.	2-8
2.	Maximum permissible exposure (MPE) limits define the maximum time and intensity of RF fields that an individual can be exposed to without sustaining injury.	2-6
3.	B and C	2-2
4.	A reflexive action after sustaining an electric shock or burn, possibly causing additional injury.	2-3
5.	D	2-7
6.	Any power source above 12Vdc.	1-11
7.	D	1-7

Request for Feedback – Electronics Technician 2nd Class

Suggestions and Corrections

Please note your suggestions, corrections, and comments below.

Page	Location on Page	What Correction is Needed

Your Comments

If you were writing this pamphlet, what improvements would you make? What was good about it? What did you not like about it? Please be specific in your comments/suggestions.

_____

_____

_____

_____

To Contact You

Please provide the following so that we can contact you if needed.

Name	Unit	Phone
		( )

Mail, Fax, or Call

Please mail, fax, or call your information to:

Commanding Officer (CED)
U.S. Coast Guard
Training Center Petaluma
599 Tomales Rd. Petaluma, Ca 94952

PHONE: (707) 765-7129
FAX: (707) 765-7033

ATTN: ET Subject Matter Specialist

LIST OF MATERIALS FURNISHED

COURSE TITLE: **ET2** COURSE CODE: **0222** EDITION: **3**

1. The materials for the course you requested are listed below. If any item listed is not enclosed in this package, report that fact to your Educational Service Officer (ESO).

2. If you enrolled in this course for credit, you have **36 months** to complete the course. If you requested course materials only, you will not receive an End-of-Course Test (EOCT) and will not receive credit for the course.

COMPONENT	NUMBER	QTY
PQG Certification Pamphlet	P22201	01
Administration	P22202	01
Performance and Training	P22203	01
Special and Emergency Procedures	P22204	01
Electronic Installation Standards	P22205	01
Electronic Systems Planned Maintenance	P22206	01
Electronic Systems Corrective Maintenance	P22207	01