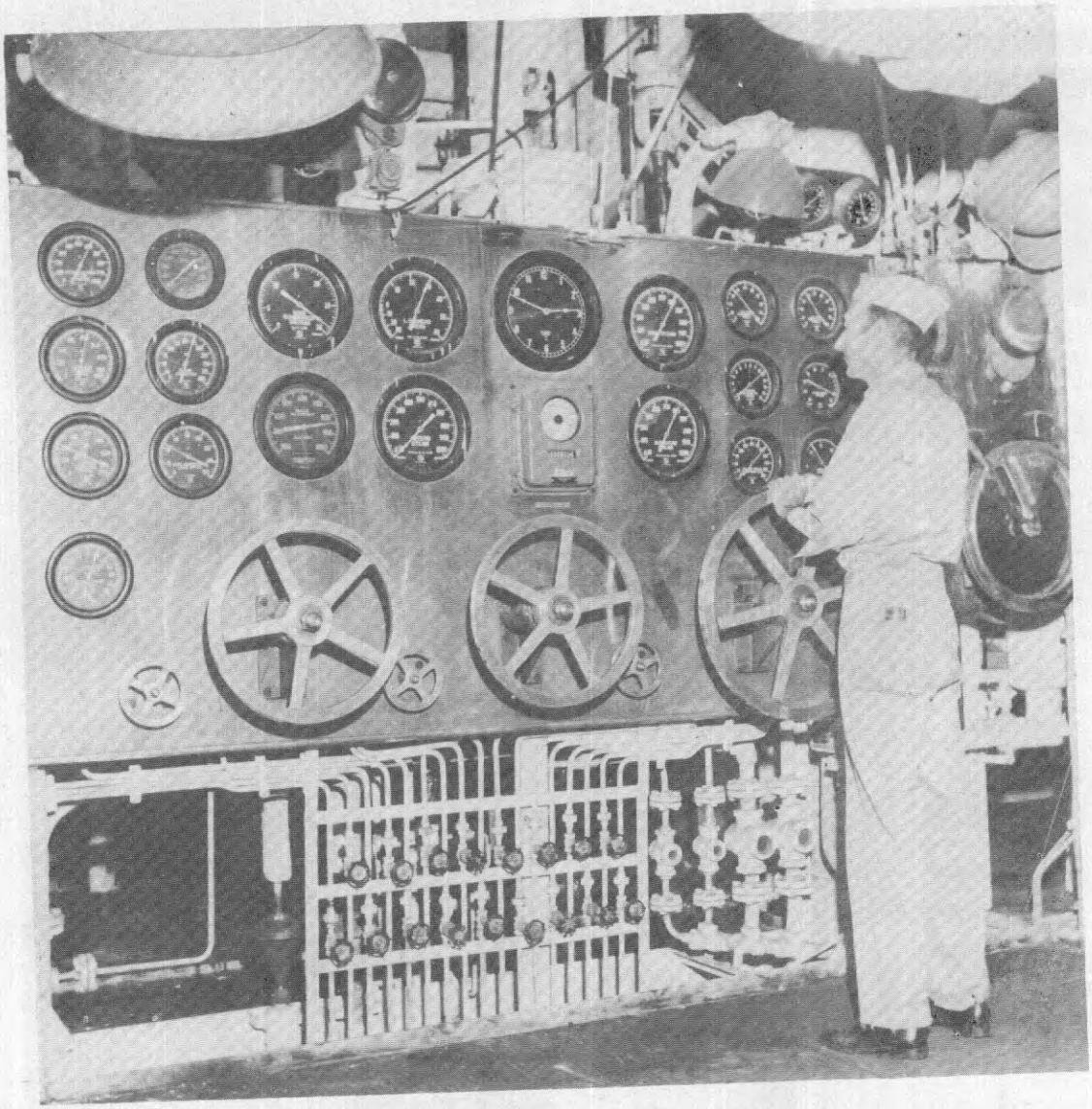
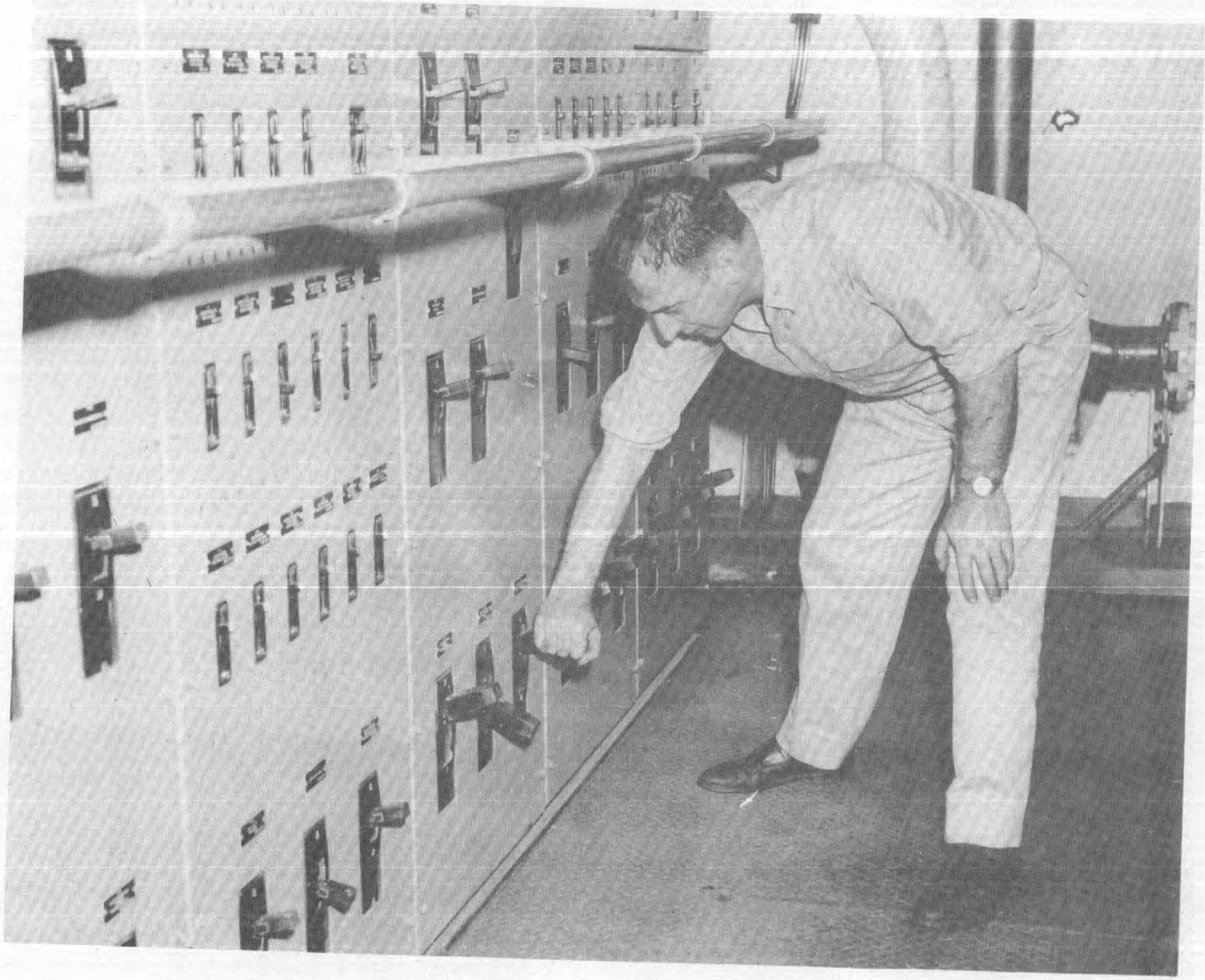
B. Application. Apply knowledge of these symptoms, causes and remedies during engineering casualty exercises and drills for each watch so that they can demonstrate their ability to cope with these casualties. In those cases where casualties can only be simulated, questions should be asked on their symptoms, causes and remedies.





CHAPTER 6

ENGINEERING CASUALTY CONTROL - For All Engineering Personnel (Lesson Plan)

Section 6.4

ELECTRICAL CASUALTY CONTROL

I. OBJECTIVES.

A. To describe typical casualties of the ship's electrical equipment.

B. To instruct all engineering personnel in the basic practices and procedures to follow in controlling or minimizing electrical casualties.

C. To emphasize the importance of observing sound engineering and safety practices when performing casualty control action.

II. MATERIALS.

A. Training Aids.

1. The Chief Engineers' Organization Manual.
2. Engineers' standard watch list.
3. Machinery and equipment operating instructions.
4. Manufacturers' instruction and operating manuals.
5. MSTSPACAREA Engineering Casualty Exercise Book.
6. Ship's blue prints.

B. References.

1. COMSTS INSTRUCTION P3120.2B, Chapter 2, Section 8.
2. BUSHIPS Technical Manual, Chapters 60, 61, 62, 63, 64.
3. Engineering Operation and Maintenance (NAVPERS 10813-A).
4. U. S. Coast Guard Regulations.

III. INTRODUCTION.

A. Introduce self and subject - Electrical Casualty Control.

B. Establish the scope of the lesson.

1. Initial action by engineering watch personnel.
2. Types of electrical casualties.

a. Ship's service generator casualties.

b. Emergency Diesel generator casualties.

c. Loss of electric power (generator failure).

d. Fluctuating voltage (ship's service switchboard).

e. Overheated ship's service generator.

f. Overheated ship's service generator bearings.

g. Short circuit in the main circuit breaker.

h. Loss of electric power to the steering engine.

i. Rudder angle indicator failure.

j. Fire behind the ship's service switchboard.

C. Safety precautions to be observed when handling electrical casualties.

IV. PRESENTATION Engineering casualties are generally a result of personnel failure. The best casualty control is casualty prevention.

A. Initial Action. In the event of a casualty, the following initial action must be taken immediately:

1. Notify the bridge via the telephone and/or engine room telegraph if the maneuvering capabilities of the ship are impaired, or if a change of speed is necessary to correct or minimize the casualty.

2. Notify the chief engineer.

3. Control the casualty to prevent further damage.

4. Restore the normal operating effectiveness of the ship as soon as possible by using isolation or bypass methods, or by utilizing available standby units.

B. Types of Electrical Casualties. The types of electrical casualties and their remedial procedures are:

1. Ship's service generator casualties. In the event of a casualty to the ship's service generator, it is necessary to start the standby generator and cut out the affected generator. The following general procedures may be used as a guide:

a. Direct current generators.

(1) To start the standby generator:

(a) Check both the steam and electrical ends to make sure all rotating parts are clear.

(b) Check the lube oil for correct level.

(c) See that all switches are open and that the rheostat is set so that all field resistance is cut in.

(d) Crank hand lube oil pump.

(e) Start the steam end according to the manufacturer's instructions.

(f) Bring the machine up to its rated speed.

(g) Check for normal voltage with rheostat in low voltage position.

(h) Test the overspeed trip. (Do not allow the speed to exceed that prescribed for overspeed tripping.)

(i) Turn up the rheostat to bring the voltage to three or four volts above the bus voltage.

(j) Throw in the circuit breaker.

(k) If the machine is of the compound type, throw in the equalizer switch.

(l) Close the positive and negative switches.

(m) Regulate the voltage and transfer the load to the incoming machine.

(2) To cut off the affected direct current generator:

(a) Take the load off the machine by rheostat.

(b) Trip the curcuit breaker.

(c) Open the positive and negative seitches.

(d) Open the equalizer (if installed).

(e) Secure the steam end.

(f) Continue lubrication by use of the hand pump until the machine has stopped.

b. Alternating current generators.

(1) To start the standby generator:

(a) Make sure all rotating parts are clear and that the lube oil level is correct.

(b) Start the steam end according to manufacturer's instructions.

(c) Bring the machine up to rated speed and test the overspeed tripping mechanism.

(d) Adjust the exciter voltage and close the field switch.

(e) Adjust the generator field resistance so that the generator voltage will be the same as the bus-bar voltage.

(f) Synchronize the machines and close the circuit breaker.

(g) Transfer the KW load to the incoming machine by increasing speed on the incoming machine; at the same time decrease speed on the other machine using the speed-governor control.

(2) To cut out the affected alternating current generator:

(a) After all load has been transferred to the incoming machine, trip the circuit breaker of the machine being secured.

(b) Turn the voltage regulator switch to the "Manual" position.

(c) Secure the steam end.

(d) Continue lubrication by use of hand pump until the machine has stopped.

c. Emergency Diesel generator and switchboard. When the ship's service generator fails, the emergency Diesel generator should automatically cut in and energize the emergency switchboard.

(1) Keep the emergency generator and the emergency switchboard lined up for automatic start and transfer of emergency circuits.

(2) When the ship's service generator fails:

(a) Clear the main switchboard.

(b) Energize the main switchboard from the emergency board.

(c) Operate auxiliaries within capabilities of the emergency generator.

(3) When the ship's service generator power is restored, the emergency generator should stop automatically.

2. Loss of electric power (generator failure). When the generator fails, the emergency Diesel generator will provide lights and a limited amount of power if lined up for automatic operation. To remedy the generator failure, take the following action:

a. Close the throttle valve to the main engine (if the engine is operating).

b. Conserve all possible steam by securing all unnecessary supply systems.

c. Start the standby generator and put it on the line.

d. Secure the affected generator.

e. Start the forced draft fans and the fuel oil service pump.

f. Start the boiler feed pump, if electric, and secure the standby.

g. Start the remaining systems and auxiliaries as time and conditions permit.

3. Fluctuating voltage (ship's service switchboard). Usually this condition is accompanied by steady fluctuating of the lights and hunting of the generator governor; it may lead to overspeeding and tripping out of the machine, with a loss of electric power. When this condition occurs, the following control action should be taken:

a. Start standby generator and shift the electrical load to it.

b. Secure the affected unit.

c. Check out the following items on the affected unit and make repairs as necessary:

(1) Governor.

(2) Voltage regulator.

(3) Commutation and/or excitation generator.

(4) Check for loose connections, shorts or grounds in the system.

d. Clean the generator and regulator, and adjust as necessary in accordance with manufacturer's instructions.

4. Overheated ship's service generator. Overheating of generators may be caused by various conditions. If allowed to continue, a very serious casualty may result.

a. Causes. Some of the causes of overheating are:

(1) Insufficient or restricted ventilation.

(2) Running at an improper speed.

(3) Brushes not set properly.

(4) Restricted cooling water to the coolers.

(5) Short circuit in the armature or field coils.

b. Action. When it is discovered that a generator is operating above normal temperatures, the following action should be taken:

(1) Check the ventilation for restrictions.

(2) Check the speed of the generator.

(3) Check for overloading.

(4) Check the brushes for excessive sparking.

(5) Check for restriction of cooling water on water-cooled machines.

c. If heating continues after checking the machine thoroughly, start the standby generator and shift the electrical load to it. Secure the affected unit and make the following checks:

(1) Check for a short circuit in the coil.

(2) Check for a short ciucuit or ground in the armature or commutator.

(3) Check on air gaps and/or rotor rubbing on stator.

(4) Check for proper setting of brush rigging.

5. Overheated ship's service generator bearings.

a. Causes. Overheating of generator bearings may be due to one or more of the following:

(1) Lube oil pump failure.

(2) Restriction in the lube oil system.

(3) Insufficient cooling by the lube oil coolers.

(4) Worn bearings or misalignment of bearings.

b. Action. The following corrective measures should be taken:

(1) Check for proper lube oil level.

(2) See if the lube oil is being circulated to all bearings and gears.

(3) Shift the lube oil to clean strainer.

(4) Check the quantity of water leading to the lube oil coolers. Increase the supply, if possible.

c. If the bearings continue to overheat:

(1) Start the standby generator and shift the load to it.

(2) Secure the affected machine.

(a) Clean the lube oil coolers.

(b) Check the bearings for wear and alignment.

6. Short circuit in the main circuit breaker. If the main circuit breaker short circuits, a brilliant flash will probably occur, with the possibility of starting a fire at or near the area of the short circuit. The following procedure will serve to remedy this casualty:

a. Trip out or secure the generator in service.

b. If a fire exists, extinguish it with a CO^2 fire extinguisher. Do not use water.

c. Open the disconnect switches ahead of the circuit breaker.

d. Start the standby generator and cut it in.

e. Replace or repair the circuit breaker, observing all safety precautions.

7. Loss of electric power to the steering engine. A loss of electric power to the steering engine is accompanied by the sounding of an alarm, and the rudder and rudder angle indicator will not shift with the movement of the helm (wheel).

a. Causes. Listed are some of the causes for loss of electric power to the steering engine. The outlined causes and procedures are very general in order to apply to all types of ships. The systems and procedures for each individual ship should be checked out and personnel instructed in that particular system.

(1) Severance of power cables between the steering engine room and the engine room.

(2) Heavy shock from collision or explosion.

(3) Power failure due to overload, blown fuses, or tripping of the circuit breaker.

b. Result. A loss of power to the steering engine may result in:

(1) Loss of steerage.

(2) A derangement of the hydraulic telemotor system.

(3) A derangement of steering motors.

c. Action. The following procedures will be required to restore the steering engine to emergency operation:

(1) Check the control panel for electric power.

(2) Check the electric power leading to the steering motors.

(3) Shift to the alternate power supply (if available).

(4) Rig casualty power (jury rig jumper).

(5) Operate emergency hand-operated hydraulic pump to rams, if installed.

(6) Jury rig chain falls for emergency steering, if required.

8. Rudder angle indicator failure.

a. Cause. Failure of the rudder angle indicator may be due to any of the following:

(1) Blown fuse.

(2) Loss of power at the I.C. board.

(3) Opening in the circuit.

b. Action. A check of the following should be made to locate the source of failure:

(1) Power to the system at the I.C. board.

(2) Cut-out switches for open position.

(3) Fuses.

(4) Mechanical operation of the system.

(5) Opening in the circuit.

9. Fire behind the ship's service switchboard. Short circuits, loose connections and overloads are the principal causes of switchboard fires. Remedial action should be as follows:

a. De-energize the affected circuits.

b. Extinguish the fire with CO^2 or dry chemical. Use a portable extinguisher or the semi-portable installed hose and reel type extinguisher.

c. Where CO^2 is being used in a confined space, or if smoke and fumes are heavy, use an oxygen breathing apparatus when fighting fires.

d. Do not return circuits to use until they have been carefully checked out and repairs made.

C. Safety Precautions. The following safety precautions should be observed when handling electrical casualties:

1. De-energize circuits before attempting repairs. All circuits must be considered as energized until a personal check has been made.

2. Make sure all portable electric tools are grounded.

3. Before making electrical connections, be sure they are the correct ones.

4. Do not remove guards from equipment.

5. Be cautious when using hand tools in the vicinity of energized circuits.

V. SUMMARY.

A. Personnel failures cause electrical casualties because of:

1. Improper maintenance.

2. Inattention to standard operating practices and procedures.

B. Action required of engineering watch personnel during electrical casualties.

1. Notify the bridge of all casualties requiring speed changes or affecting the maneuvering capabilities of the ship.

2. Notify the chief engineer.

3. Control the casualty.

4. Restore the ship to normal operation as soon as possible.

C. Safety in handling electrical casualties. Stress safety precautions.

D. Review the key points in the following electrical casualties:

1. Ship's service generator casualties.

2. Emergency Diesel generator and switchboard.

3. Loss of electric power (generator failure).

4. Fluctuating voltage (ship's service switchboard).

5. Overheated ship's service generator.

6. Overheating of the ship's service generator bearings.

7. Short circuit in the main circuit breaker.

8. Loss of electric power to the steering engine.

9. Failure of the rudder angle indicator.

10. Fire behind the ship's service switchboard.

E. Stress the importance of a combination of prompt action, proper procedures, and safety in controlling casualties.

F. (Restate) Casualty prevention is the most effective form of casualty control.

VI. TEST AND APPLICATION.

1. Test. The following questions may be used for an oral quiz.

1. Q. State three causes of a rudder angle indicator failure.

A. (1) Blown fuse.
(2) Loss of power at the I.C. board.
(3) Opening in the circuit.

2. Q. If the maneuvering capabilities of the ship are impaired, or speed changes are required to correct or minimize a casualty, what action must be taken?

   A. The bridge must be notified immediately by telephone and/or the engine order telegraph.

3. Q. By what general means would you restore a ship to normal operating effectiveness?

   A. Through isolating methods, through by-passing and/or using available standby units.

4. Q. Would you attempt to make repairs to an electrical circuit which had not been de-energized?

   A. No. Circuits should always be de-energized before working on them.

5. Q. When the ship's service generator fails, what means are provided to allow electric auxiliaries to operate?

   A. Emergency diesel generator and switchboard.

6. Q. Fluctuating of the voltage on the ship's service switchboard may result in what casualty?

   A. Overspeeding and tripping out of the generator, with loss of electric power.

7. Q. What are some of the causes of overheating of the ship's service generator?

   A. (1) Insufficient or restricted ventilation.
   (2) Running at improper speed.
   (3) Brushes not set properly.
   (4) Restricted cooling water to coolers.
   (5) Short in armature or field coils.

8. Q. If the ship's service generator continued to heat up excessively and you could not correct the condition immediately, what control measure should be taken?

   A. Start up the standby generator and shift the electrical load to it; then cut out the affected machine.

9. Q. What condition would indicate the failure of the rudder angle indicator?

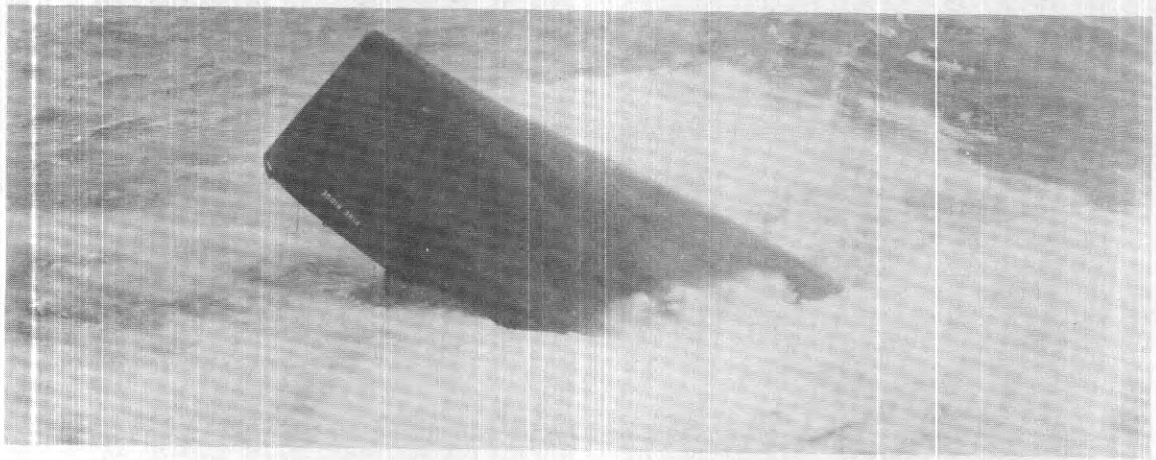
   A. Failure of the rudder angle indicator is revealed when the electric indicator does not correspond to the mechanical angle indicator at the helm.

10. Q. What procedure is followed when a fire occurs behind the ship's service switchboard?

    A. De-energize the affected circuits and extinguish the fire with CO^2 or dry chemical. If the space is confined, or if smoke and fumes are heavy, use oxygen breathing apparatus. Then check and repair the affected circuits before returning them to use.

B. Application. Check the ability of engineering personnel to identify and cope with electrical casualties during continuing practical engineering casualty control excerises and drills conducted as part of the ship's regular program of instruction and drills.

AMERICAN TANKER "PINE RIDGE" BROKEN IN-TWO BY HEAVY SEAS OFF CAPE HATTERAS 21 DECEMBER 1960. 7 LOST IN BOW SECTION, 28 RESCUED BY HELICOPTER FROM STERN SECTION.



APPENDIX A

LESSON PLAN AND PRESENTATION OUTLINES

All the planning and effort devoted to the preparation of this Manual would serve little purpose if the shipboard instructor is unable to present this material in an interesting and logical manner. Therefore, these lesson plan and presentation outlines are appended as aids in the planning, arrangement and presentation of instructional material. Additional instructor training guides available aboard ship are Manual for Navy Instructors, NAVPERS 16103B and Shipboard Training Manuals, NAVPERS 90110 and 90110-A.

PART 1 - KNOWLEDGE-TYPE LESSON PLAN AND PRESENTATION OUTLINE

TITLE. Identifies lesson - should be descriptive and concise.

OBJECTIVES.

I Establish aims and goals.
II A guide in preparing more detailed presentation.
III Use such terms as to acquaint, familiarize, give, show, impress, stress, and develop.

MATERIAL.

I Training aids.
II References.
III. Expendable supplies and handouts.

INTRODUCTION. (The preparation phase) To stimulate interest and relate to objectives--keep it brief.

I Establish friendly relations.
II Establish scope of lesson and state objectives.
III Arouse general interest. Relate lesson to past experience.
IV Create personal interest. State benefits of the lesson.
V Secure group's cooperation. Give instructions regarding questions, notes, etc.
VI Reestablish scope of the lesson. What should students know at the end of the lesson?

PRESENTATION. (The "putting-over" and "application" phases).

I Develop a complete outline with directions for presentation, application, use of training aids, and questions.
II Guides instructor in presentation and application phases.
III Use proper outlining (as I - A - 1 - a - (1) - (a), etc.).
IV Use appropriate method of instruction.

A. Teaching by "telling" - for imparting knowledge.
B. Teaching by "showing" - for knowledge or operations difficult to describe--includes teaching by "telling" and utilizes training aids.

V Make presentation effective:

A. Talk on the level of the class.
B. Maintain two-way contact by means of:

1. Eye contact.
2. Class participation.

C. Use effective gestures.
D. Emphasize and repeat important points.
E. Work class mentally by posing questions.
F. Appeal to as many of the senses as possible.
G. Use appropriate training aids properly.

VI Check on application by:

A. Watching class reaction.
B. Oral questions.
C. Class participation.

SUMMARY.

I Outline "must know" subject matter.
II Assure that students take with them all "must know" subject matter, either through notes or handouts.

TEST.

I List and use representative questions to measure effectiveness of the instruction and to gauge progress.
II Give questions orally or in writing.

ASSIGNMENT.

I Provide for individual self-improvement outside class.
II Explain what, when, where, how, and why of assignment.

PART 2 - SKILL-TYPE LESSON PLAN AND PRESENTATION OUTLINE

TITLE. Identifies lesson - should be descriptive and concise.

OBJECTIVES.

I Establish aims and goals.
II A guide in preparing more detailed presentation.
III Use such terms as to acquaint, familiarize, give, show, impress, stress, and develop.

MATERIAL.

I Training aids.
II References.
III Expendable supplies and handouts.

INTRODUCTION. (The preparation phase) To stimulate interest and relate to objectives--keep it brief.

I Establish friendly relations.
II Establish scope of lesson and state objectives.
III Arouse general interest. Relate lesson to past experience.
IV Create personal interest. State benefits of the lesson, the importance of mastering the skill.
V Secure group's cooperation. Give instructions regarding questions, notes, etc.
VI Reestablish scope of the lesson. What should students know at the end of the lesson?
VII Stress the application periods and safety precautions.

PRESENTATION.

I Develop a complete outline with directions for presentation, application, use of training aids, and questions.
II Guides instructor in presentation and application phases.
III Use proper outlining (as I - A - 1 - a - (1) - (a), etc.).
IV For physical skills, prepare a job analysis--what to do--how to do it--and key points. Use it as the basis for preparing the presentation.
V Define terms, explain equipment, and give background information.
VI Use actual equipment or appropriate training aids.
VII Use the teaching by "doing" four-step method to teach complex skills.

A. For large groups:

1. Instructor does and tells slowly (presentation).
2. Instructor repeats at almost normal rate (presentation).
3. An average trainee does and tells.
4. All students practice under supervision (application and inspection).

B. For a small group:

1. Instructor does and tells slowly (presentation).
2. Instructor does and students tell (presentation).
3. Students do and tell (application).
4. Students practice under supervision (inspection).

VIII Use the "coach and pupil" method to teach simple skills to large groups. Students are paired off and each pair given the necessary equipment.

A. Instructor does and tells slowly (presentation).
B. One of each pair does and other checks and coaches (application).
C. Pairs reverse and repeat the procedure.
D. Instructor checks each pair (inspection).

SUMMARY.

I May be omitted since sufficient repetition in presentation part.

TEST.

I Need only cover related knowledge since skill was demonstrated in application.

ASSIGNMENT.

I As necessary to provide for additional individual practice and self-improvement.

APPENDIX B

INSTRUCTOR'S GUIDE FOR MSTS DAMAGE CONTROL FILM

Navy Training Film MN-8387
"Damage Control Training in Civilian-Manned Ships"

Size and Type - 16mm sound
Running Time - 20 minutes
Photography - black and white

I. PURPOSE. This film is used to acquaint crew members with the organization, equipment and methods applicable to control and repair of damage in merchant-type ships.

II. PREPARATION. During emergencies, a ship, lives, or valuable cargo and equipment may be saved by prompt, intelligent action. What you learn of damage control through this film may some day save your life.

III. CONTENT. This film emphasizes the importance of damage control in ships by reviewing prominent marine disasters. It defines responsibility for safety-at-sea, outlines damage control training and organization, and shows damage control in action, including care of personnel casualties.

IV. CONTENT OUTLINED.

A. Introduction to Damage Control--and importance to MSTS (3 minutes).

1. Shots of marine disasters and commentary relative to damage control as a save-the-ship-measure.

2. MSTS responsibility for safety-at-sea of passengers and cargo.

3. Damage control in MSTS.

a. Definition and scope of the damage control safety-training program.

b. The importance of material readiness and preparation.

c. Standard station bills and standardized marking of built-in safety features.

4. Shots of an MSTS ship underway.

a. Crew activity in maintenance of built-in safety features.

b. Use of station bills and bunk emergency assignment cards.

c. Use of standardized damage control markings.

B. Damage Control Training (6 minutes).

1. Phase I - Initial afloat training in damage control. Shots of damage control instructor at conference with the master and department heads discussing and planning Phase I training. Shots of damage control instructor conducting training sessions for ship's force.

2. Phase II - Continued shipboard instruction and drilling of ship's force by ship's officers with shots of ship's officers conducting lifeboat training.

3. Phase III - Annual one or two-day damage control cruise. Observation, evaluation, and on-the-spot training of the ship's force in resolving all types of marine casualties. Shots of underway observer team conducting emergency exercises and drills and providing helpful on-the-spot instruction in problem areas.

4. Phase IV - Training ashore in practical fire fighting, damage control and ABC defense. Shots of fire fighting school; patching, pumping, and shoring in Treasure Island "Buttercup" (floating compartment); and radiological monitoring.

C. Damage Control Organization (6 minutes).

1. Description of shipboard damage control organization and coordination.

2. Animated shots of the inboard profile of the ship showing zone area activity, manning of emergency stations, repair parties standing by at damage control lockers, and damage control central on the bridge.

3. Ship's organization for ABC defense: Closures, securing of vents, the washdown countermeasure, radiological monitoring, and decontamination stations.

D. The Damage Control Organization in Action (4 minutes).

1. Collision casualty. Shots of master conning ship and meeting this emergency; bridge plotting and reports; activities of repair parties and zone area personnel; activities of the medical officer.

2. Engineering casualty control. Shots of loss of fuel oil suction to boilers, sputtering burners, loss of fire, casualty action to get boiler back on the line, and related engineering requirements.

3. Personnel casualty control.

a. Hospital corpsmen providing first aid during casualty.

b. Use of high line to transfer injured personnel from or to another ship.

E. Summary of Damage Control Training (1 minute).

1. Importance of damage control to MSTS and crewmen of the fleet.

2. Importance of damage control to the shipper services. Shots of MSTS ships arriving safely in port with a full load of passengers and cargo.

V. POINTS TO LOOK FOR.

A. Mention that investigation of major marine disasters discloses that only a few ships have ever been lost due to severity of initial damage. Almost all of the disasters could have been coped with by trained personnel with adequate equipment.

B. Point out that MSTS takes particular pride in its safety-at-sea achievements, including rescue, mercy and salvage missions.

C. Explain that all MSTS ships which exceed 1500 tons have smoke detecting systems. Mention that only passenger ships have fire detecting systems and fire screen doors.

D. Emphasize the relationship of training and equipment. Stress this point: Trained men have successfully handled serious casualties with minimum or improvised equipment but many minor emergencies have developed into casualties and total losses despite excellent equipment, because crews were not trained.

E. Outline the basic qualifications of damage control instructors.

1. Possession of a USCG license not lower than chief mate or first assistant engineer.

2. Specialized training in damage control.

F. Explain the four-phases of damage control training.

1. Phase I, initial organization and instruction by damage control instructors, provides orientation to and preparation for participation in the ship's continuing program.

2. Phase II, the ship's continuing program of instruction and drills under ship's officers, ensures development of the program as an integral part of shipboard administration and operations.

3. Phase III, the annual damage control one or two-day training cruise, provides for evaluation of the ship's damage control organization and skills and appraises progress of the program.

4. Phase IV, practical damage control, fire fighting, and ABC defense training ashore, offers training ashore to improve individual skills and thus aid the afloat program.

G. Stress the importance of general drills.

1. Fire has long been a major hazard to men in ships.

2. Drills and exercises which provide practice in control of flooding are essential for safety-at-sea.

3. Defense practice against radiation, germs, gas, or any other warfare agent is vital to your welfare and the security of your ship and country.

4. It is hoped that your ship can and will be saved, however, should this be impossible, abandoning ship in a safe, orderly manner is of paramount importance. To assure this, regular drills must be conducted.

H. State that drills and exercises to be effective must:

1. Be held regularly.

2. Be planned for maximum realism.

3. Include related instruction.

4. Provide for constructive criticism and improvement of performance.

5. Be repeated until mastery of casualties is assured.

I. One of the most important features of damage control is clear, standardized markings to identify damage control equipment, systems, and compartments.

J. Damage control organization in MSTS civil-service-manned ships is designed for practical application in merchant-type ships. The organization overcomes, in part, the disadvantages of limited manning scales and pressing operating schedules.

K. Point out that there are no professional actors in the film. All actions are performed by crew members or seamen with skills they have acquired through regular exercises aboard ship.

L. Emphasize that proper training during drills is a small investment; the saving of ships and lives is a large return.

M. Read and explain the statement on the back of MSTS Certificate of Training: "Their want of practice will make them unskillful, and their want of skill, timid. Maritime skill, like skills of other kinds, is not to be cultivated by the way or at chance times." -- Thucydides, 500 B. C.

VI. GLOSSARY.

A. Damage Control is any action which controls or repairs damage; prevents the loss of a ship, lives of passengers and crew, or it's cargo

or equipment; or contributes to the prevention, control, or repair of, damage and thus to the ship's operational readiness.

B. Drills are practical exercises to assure readiness of equipment and crew to cope with emergency situations. Various exercises may be combines in one drill, and several drills may be run at the same time or in sequence. For example, pumping and shoring exercises could be part of a collision drill, followed by a fire drill and abandon ship drill.

C. Built-in Features are items built into, or installed permanently in, a ship for the safety of passengers and crew and for protection of the ship, its equipment and cargo. Examples are watertight bulkheads and doors, fire pumps, emergency diesel generators and diesel fire pumps, fixed CO_2 fire extinguishing systems, etc.

D. Smoke Detectors are devices through which air samples from unattended compartments are exhausted; smoke activates an alarm and an indicator identifies the smoke-filled compartment.

E. The Electric Fire Detecting System consists of a series of electrical circuits with devices (thermostats) which short the circuit and cause an identifying alarm to be sounded. The location of the fire can then be determined.

F. Firescreen Doors are doors of special fire-resistant construction. They prevent the spread of fire.

G. Watertight Doors are doors designed to prevent progressive flooding from one damaged compartment to another.

H. Emergency Power Generators produce electricity for emergency use in event the main power equipment is damaged.

I. Intercommunications Systems include announcers, service telephones, sound-powered telephones, voice tubes and push-button signals.

VII. KEY QUESTIONS.

A. Q. Why are so many damaged ships lost in marine disasters?

A. The crews lacked understanding of and training in damage control.

B. Q. Are drills necessary if damage control techniques are thoroughly understood?

A. Yes. Knowledge is of no value unless it is applied in practice.

C. Q. Give five examples of built-in features.

A. Watertight bulkheads and doors, firescreen doors, smoke detectors, emergency generator, fire extinguishing equipment.

D. Q. What phase of damage control training provides for continued training during drills and exercises while on a regular operating schedule?

A. Phase II.

E. Q. What is phase IV of the MSTS damage control program?

A. Damage control training ashore in practical fire fighting, damage control, and ABC defense.

F. Q. Who is responsible for the direction, control, and safety of passengers in MSTS civil-service-manned ships?

A. The commanding officer of the military department, COMILDEPT.

G. Q. Where are the emergency duties of the crew outlined?

A. On the station bill and on berth emergency assignment cards.

H. Q. How do new crew members know where to go and what to do during emergency drills?

A. The station bill lists stations and general duties. More details of duties are shown on berth emergency assignment cards. Department heads also familiarize new crew members with their emergency stations and duties in routine indoctrination.

I. Q. How does a standard damage control marking system help improve damage control?

A. Markings help the crew to identify equipment and locations readily and accurately.

J. Q. Where is damage control central located?

A. On the bridge.

K. Q. Would central control be lost if the bridge (damage control central) was severely damaged?

A. No. A secondary damage control central would be established in the engine room.

L. Q. How is the initial investigating and reporting of damage done?

A. Crewmen, supervised by a zone area officer, investigate and report all damage in their assigned patrol stations.

M. Q. Who repairs damage or takes direct damage control action in emergencies?

A. One or more repair parties.

N. Q. Why does the crew "button up" or make all closures during emergencies?

A. Sometimes a crew member may not know the nature of the emergency, but he knows that:

1. If there is a fire, closed doors will keep it from spreading.

2. If there has been a collision, closed watertight doors, ports and fittings will avoid progressive flooding.

3. If there has been an atomic explosion, the hazards of spreading contamination will be reduced.

SUGGESTED DAMAGE CONTROL ATTENDANCE RECORD (Afloat Training)

RECORD ATTENDANCE BY NUMBER OF MONTH AND LAST NUMBER OF YEAR.
(Example: 25 JUNE 1959 WOULD BE RECORDED "6-9".)

CLASSIFICATION	PROGRAM
Safety Training	Damage Control

	CHAPTER	TITLE	TRAINEES
[X]	2.	BASIC DAMAGE CONTROL	ALL HANDS
[ ]	3.	ADVANCED DAMAGE CONTROL	DECK AND ENG. PERSONNEL
[ ]	4.	OFFICERS DAMAGE CONTROL	LICENSED OFFICERS
[ ]	5.	EMERGENCY SEAMANSHIP	DECK PERSONNEL
[ ]	6.	ENG. CASUALTY CONTROL	ENGINEERING PERSONNEL

USNS CODE NO.	NAME OF STUDENT	SUBJECT NUMBER AND TITLE														GRADE
		2.1 Introduction to Damage Control	2.2 Watertight Integrity	2.3 Damage Control Markings	2.4 Chemistry of Fire	2.5 Classes of Fire	2.6 Portable Fire Extinguishers	2.7 Fire Prevention, Afloat	2.8 Navy Standard Couplings, Hoses and Nozzles	2.9 Fire Detecting System	2.10 Confinement of Fire	2.11 Organization of Shipboard Fire Parties	2.12 Zone Area Organization	2.13 Effects of ABC Attacks		

Note 1. Headings capitalized are recommended for preprinting on the form.
Note 2. Lower case entries will be filled in by the instructor to indicate the subjects covered in each course. This form shows proper entries for the Basic Damage Control Course.

APPENDIX D

INSTRUCTOR'S GUIDE FOR MSTS RADIOLOGICAL DEFENSE FILM

"Radiological Defense in Civilian-Manned Ships"

(MN-8923)

Size and Type - 16 mm Sound
Running Time - 27 minutes
Photography - Black and White

I. PURPOSE. This film is used to acquaint officers and crew members of civilian-manned ships with the radiological defense procedures that should be followed before, during, and after a nuclear explosion.

II. PREPARATION. The effects of nuclear explosions vary with type and place of burst. The important effects are--blinding light, heat, air blast and/or underwater shock, penetrating radiation by gamma rays, and residual radiation from alpha and beta particles. Standard damage control measures will protect you from heat, blast and shock. Protection from radiation requires special knowledge and preparation. This film will show you these special procedures for radiological defense.

III. CONTENT. After showing some actual bomb bursts, this film diagrams the effects from three different types of bursts and shows the specific hazards from gamma rays and alpha and beta particles. The film goes on to show the six defensive measures required to protect against nuclear attack--button-up, shielding, washdown, distance, monitoring and decontamination.

IV. CONTENT OUTLINED.

A. Introduction to Radiological Defense (5 minutes).

1. Any ship, no matter how peaceful its mission, may find itself under nuclear attack or radiological fallout.

2. Types of nuclear explosions:

a. Air burst - effects are blinding light, heat, air blast, penetrating radiation and a high altitude radioactive cloud.

b. Surface burst - effects are blinding light, heat, blast, some underwater shock and a radioactive cloud.

c. Underwater burst - effects are underwater shock, some air blast, a radioactive cloud and a radioactive base surge.

3. Radiation hazards:

a. Alpha-emitting particles are easily stopped and are dangerous only if you swallow them, or breathe them in, or get them in an open cut.

b. Beta particles are high speed electrons. They are dangerous if swallowed or inhaled or if they get on your skin. Ordinary heavy clothing securely buttoned up and work gloves will stop beta particles.

c. Gamma rays are highly penetrating, like X-rays. They travel at the speed of light. It takes lead, thick steel or other dense material to protect you.

d. Although our bodies receive 10 to 12 roentgens (the unit of radiation) in a lifetime from natural sources, an overdose can cause radiation sickness, such as nausea, skin burns, anemia, and perhaps serious internal damage.

B. ABC Defense Organization (3 minutes).

1. The ship's station bill and the ABC defense bill call for the following six protective measures:

a. Button-up the ship.

b. Shielding of personnel.

c. Washdown water curtain.

d. Maneuvering for distance and to avoid fallout.

e. Monitoring.

f. Decontamination.

2. These emergency bills also assign the following responsibilities:

a. The First Officer is the Damage Control Officer.

b. The First Assistant Engineer is the ABC (Atomic, Biological, Chemical) Defense Officer.

c. The Third Officer is in charge of a repair party (in passenger ships) and directs rigging for the washdown.

d. The Chief Steward and Junior Deck Officers are in charge of their assigned zone areas.

e. The Senior Radio Officer maintains the monitoring equipment and trains personnel in its use.

f. The CO, Military Department directs troop and cabin class passengers to areas providing the best shielding.

3. Each crew member can refer to his bunk-side emergency assignment card for his station and duties under ABC attack.

C. Procedure after Warning of an Imminent Attack (7½ minutes).

1. The Master, upon receipt of message, orders the Senior Watch Officer to sound the ABC alarm.

a. This is a steady signal for 10 seconds on the general alarm followed by 10 seconds of dot-dash (the letter "A"). announcement on the PA. System

b. In ships equipped with a PA system, the Senior Watch Officer announces - "Atomic attack, atomic attack, man your ABC stations, button up the ship, rig for washdown, and then take cover."

c. Note that the film shows both methods of sounding the ABC alarm. In practice, sounding the letter "A" on the general alarm would be used only in ships not equipped with a PA system or if the PA system is inoperative. However, if desired, both the PA announcement and "A" on the alarm bells may be used to ensure positive understanding by all.

2. The watch officer trips the ventilation controls to stop fans and blowers, except for engine and fireroom blowers.

3. The First Officer mans Damage Control Central to direct all emergency action.

4. Passengers and troops are led below decks to designated shelter areas.

5. The ship is buttoned-up.

a. All weather deck openings are secured or covered.

b. Zone area personnel secure all ports and deadlights, manually controlled firescreen doors and all manual watertight doors.

6. The ship is prepared for washdown.

a. Engine Department personnel temporarily secure main fire pumps while fire hoses are being rigged.

b. At all weather deck fire stations, hoses are led out and hydrants are opened. All-purpose fog nozzles are hung on the special MSTS brackets which, under pressure, hold the nozzles in open fog spray position.

c. All loose gear is stowed below. Line is stowed because it is almost impossible to decontaminate.

7. After all personnel are in assigned areas, all bridge controlled firescreen and watertight doors are closed.

8. When all areas have reported to Damage Control Central that they are secured and ready, the washdown is started.

a. All emergency fire pumps are put on the line and at maximum pressure.

b. In some ships, with hoses rigged in advance, the washdown can be started from inside the ship by using root valves.

9. The Master maneuvers the ship to improve washdown coverage and to drain off water on deck. The continuous flow of water prevents radioactive particles from adhering to the surfaces of the ship.

10. Personnel shift to more protected locations.

a. Bridge personnel man their alternate stations. The Master conns the ship from a space providing better shielding. The steering engine room is manned and Damage Control Central shifts below.

b. All unassigned personnel sit on deck against bulkheads in shelter areas--no smoking, eating or drinking until conditions are determined to be safe.

D. Procedure If There Is No Warning ($\frac{1}{2}$ minute).

1. The ship should be buttoned up and the washdown started immediately after the burst.

2. The Master puts as much distance as possible between the burst and the ship. His problem is to escape before fallout arrives or, if close in, to avoid the base surge of radioactive mist.

E. Monitoring Procedures (3 minutes).

1. First, emergency control of any major physical damage (e.g. fire, flooding) must be carried out, regardless of radiation hazard.

2. Injured personnel must be tended to.

3. Determine if fallout has ended as follows:

a. Use a low-range radiac.

b. Check radiation level periodically at the same location, such as at the wheelhouse.

c. When readings remain constant for half an hour or decrease, assume that fallout has ceased.

4. If fallout has ended, secure the washdown.

5. Rough survey:

a. Monitor wears boots, foul weather gear, gloves, gas mask.

b. Uses high-range survey meter, held waist high.

c. Exits to weather decks through a designated door, checking inside of door first.

d. Follows a designated route, noting the readings, and enters at a specified door leading directly to a decontamination station.

e. ABC Defense Officer evaluates reports and recommends:

(1) Either waiting for dose rate to decrease through natural decay.

(2) Or, it is safe to start detailed survey.

6. Detailed survey:

a. Two man team, monitor and recorder, dress as for the rough survey.

b. Monitor uses low-range survey meter.

c. Vital operational areas are covered first, from windward, topside down, and from bow and stern to amidships.

d. Data obtained will be used to determine stay time for personnel and will pinpoint areas requiring decontamination (masts, stacks, stays, antennas, etc. will be left for industrial decontamination by the shipyard).

F. Decontamination (5 minutes).

1. Weather Deck.

a. Teams dress like the monitors, in foul weather gear and masks.

b. They wet down contaminated areas, scrub with salt water detergents, and flush away the contaminants with straight streams.

c. Areas are then checked with a low-range radiac. If two scrubbings do not reduce the radiation level to acceptable limits, the area is marked with atomic hazard signs and later roped off.

2. Decontamination of Messing and Berthing Areas.

a. Monitor all interior vital areas. All contaminated areas must be thoroughly cleaned.

b. Assume that uncovered food and liquids are unsafe. "Deep six 'em."

c. The food inside cans will be safe, but the cans must be monitored and cleaned if necessary. The man washing the cans should use rubber

gloves.

3. Personnel Decontamination.

a. Personnel decontamination is necessary because contaminants may adhere to clothing and shoes and spread throughout the ship. Decontamination stations are laid out along a one-way route.

b. The team's self-reading dosimeter will indicate the accumulated dosage and when the team has been exposed up to its stay time.

Each man also wears around his neck a personal dosimeter which indicates the total amount of radiation to which he has been exposed.

d. Procedure for Decontamination.

(1) All personal gear and clothing are removed and stowed in metal cans. (Note that the monitor in the film should have removed his jumper before taking his mask off. This would avoid possible contamination of his skin.)

(2) Each man turns in his personal dosimeter.

(3) Each man takes a thorough soap shower, paying particular attention to hair and fingernails.

(4) The man is monitored and if necessary the shower is repeated.

(5) Clean clothes are provided.

(6) Anyone receiving a high accidental dosage will be relieved from duty and placed under medical observation.

(7) The station itself must be monitored periodically and decontaminated as required.

G. Summary (3 minutes).

1. Advance preparation in radiological defense and knowing your specific duties in the overall team is important.

2. The ship must be completely buttoned up.

3. All hands take cover (shielding).

4. Washdown is started.

5. The Master maneuvers the ship to escape the base surge and/or the fallout.

6. After washdown has been stopped, a rough survey determines the extent of contamination and permissible stay time.

7. A detailed survey will identify those vital areas requiring further decontamination.

8. Decontamination teams start working.

9. Exposed personnel must also be decontaminated.

V. POINTS TO LOOK FOR.

A. Mention that radiological fallout can be a hazard to a ship and its crew even in peacetime. The crew of the Japanese fishing boat "Lucky Dragon" were

caught under fallout from a test hydrogen bomb. The radio officer gathered up samples of the white ash and stowed it under his pillow. Several months later he died of radiation sickness.

B. Point out the main differences between the air burst and the underwater burst. (Surface burst would be a compromise between the two.) Air burst gives off blinding light, great heat and blast, penetrating radiation and a radioactive cloud. Underwater burst results in underwater shock, some air blast, a radioactive base surge.

C. Explain the three types of radiation hazards. Alpha-emitting particles are easily stopped and are dangerous only if you swallow them, or breathe them in, or get them in an open cut. Beta particles are dangerous if breathed or swallowed or if they get on your skin. Gamma rays are very penetrating, like X-rays, and can only be stopped by dense material such as lead, thick steel or concrete.

D. Review the ABC defense organization for the ship as outlined in the ship's station bill and the ABC defense bill. Mention the duties and responsibilities of the First Officer, First Assistant Engineer, the Third Officer, the Zone Area Commanders, the Senior Radio Officer, and the CO Military Department.

E. Explain that the film shows in considerable detail the six main steps in defending against radiological attack or fallout. These six steps are:

1. Buttoning up the ship.
2. Shielding of personnel.
3. Rigging for washdown.
4. Maneuvering for distance and to avoid fallout.
5. Monitoring (Rough, then a detailed survey).
6. Decontamination.

F. It will be noted in the film that some specialized gear is required for the best radiological defense, such as survey meters, dosimeters, masks, and all-purpose fog nozzles. However, if a ship were caught in the situation that the "Lucky Dragon" found itself in, some defensive measures could be improvised. After the film has been shown, discuss these impromptu measures. Note that the washdown clips shown in the film are those in MSTSLANTAREA ships. A different type clip serves the same purpose in MSTSPACAREA ships. In fact, hoses may be lashed in position if necessary.

G. Stress the importance of advance preparation, including regular drills and related instruction, to assure that your ship, your passengers, and you yourself will survive under atomic attack or radiological fallout.

VI. GLOSSARY.

A. Radiological Defense consists of the protective measures taken before, during and after a nuclear bomb explosion.

B. Roentgen is the standard unit of exposure dose of gamma (or X-ray) radiation.

C. Atom. The smallest particle of an element that still retains the characteristics of that element. When the nucleus of an atom is split, or combines with other nuclei to form heavier elements, great amounts of energy are released in a nuclear explosion.

D. Air Blast. A pressure pulse of air, accompanied by winds, which results

from a nuclear explosion.

E. Underwater Shock. A pressure pulse or wave in the water which is started by the expansion of the hot gases produced by a surface or underwater burst.

F. Button-Up. The process of making the ship, as nearly as possible, gas tight and water tight. This is done by securing all openings to the weather

G. Shielding. The process of getting as many layers or thicknesses of dense material--lead, steel, water--between you and the burst for protection from the penetrating gamma rays.

H. Washdown. Rigging of the weather deck fire hoses using all-purpose nozzles in the fog spray position (or the ship's built-in washdown system) to produce a curtain of fog spray over the whole ship.

I. Decay. The decrease in activity of any radioactive material with the passage of time due to the giving off of atomic nuclei of either alpha or beta particles, sometimes accompanied by gamma radiation.

J. Radiac Instrument. Stands for RAdiation, Detection, Identification, And Computation. Thus the term includes all high and low-range survey meters, pocket dosimeters, the glass dosimeter (non-indicating), film badges, and all instruments used in measuring and computing radiation.

K. Dosimeters. Simple instruments carried by individuals or teams to measure the amount of accumulated radiation. The pocket dosimeter is self-reading while the glass dosimeter must be "read" by an associated instrument.

L. Monitoring. The procedure of locating and measuring, by means of survey instruments, the rate of radioactivity. The individual performing this operation is a monitor.

M. Decontamination. The reduction or removal of contaminating radioactive material from a structure, area, object or person.

N. Fallout. The process of the fall back to the earth's surface of particles contaminated with radioactive material from the atomic cloud.

VII. KEY QUESTIONS.

A. Q. Give at least three effects of a nuclear explosion.

A. Blinding light, heat, blast or shock, penetrating radiation, and a radioactive cloud.

B. Q. What radiation hazard requires heavy shielding for protection?

A. The highly-penetrating, speed-of-light, gamma rays.

C. Q. List some of the effects of radiation sickness.

A. Nausea, skin burns, anemia, perhaps serious internal damage.

D. Q. Who is the Damage Control Officer and the ABC Defense Officer in an MSTS civilian-manned ship?

A. The First Officer is the Damage Control Officer, and the First Assistant Engineer is the ABC Defense Officer.

E. Q. Give two places where you can learn what your specific duties are under ABC attack.

A. The ship's standard station bill and your bunk-side emergency assign-

ment card.

F. Q. What is the ABC alarm?

A. A steady signal for 10 seconds on the general alarm followed by ~~an announcement over the PA system or~~ by 10 seconds of dot-dash (the letter "A") ~~in~~ and announcement over the PA system in ships so equipped. ~~ships not equipped with a PA system or if the PA system is inoperative~~.

G. Q. When the ship is buttoned-up, why is it a good idea to stow line below?

A. Line is virtually impossible to decontaminate. This is also true of other porous materials.

H. Q. With the washdown system operating, what is the purpose of maneuvering the ship?

A. To improve washdown coverage and to drain off water that is on the deck.

I. Q. What is the purpose of the Master, bridge personnel, and Damage Control Central shifting below after the ship is buttoned-up and washdown started.

A. To seek greater shielding deeper in the ship against the highly penetrating gamma rays.

J. Q. How can you determine that fallout has probably ceased?

A. When the readings taken at a specific door remain constant for half an hour or decrease, you can assume that fallout has ceased.

K. Q. What is the purpose of the rough, waist-high survey?

A. This is to determine if it is safe to start the detailed survey and if so what "stay-times" will be set.

L. Q. Why is a one-way route followed during the surveys and through the decontamination station?

A. To prevent the spreading of contamination which might adhere to clothing and shoes and be spread unnecessarily about the ship.

M. Q. How are masts, stacks, stays, antennas, etc. decontaminated?

A. They are left for industrial decontamination by the shipyard. Only vital areas are decontaminated at sea by ship's personnel.

N. Q. What are the six main steps in defending against radiological attack or fallout?

A. Button-up, shielding, washdown, distance, monitoring and decontamination.

O. Q. If your ship were not equipped with all-purpose nozzles and gas masks, how could you improvise to provide some degree of radiological defense?

A. Straight stream nozzles could be lashed down pointing forward, and the ship's head kept into the wind. As an emergency measure only, wet handkerchiefs could be used over the nostrils to filter out contaminants.