

OPNAVINST 5100.19E  
30 May 2007

NAVY  
SAFETY AND OCCUPATIONAL HEALTH (SOH)  
PROGRAM MANUAL  
FOR FORCES AFLOAT



OPNAV INSTRUCTION 5100.19E  
VOLUME II  
SURFACE SHIP SAFETY STANDARDS

DEPARTMENT OF THE NAVY

OFFICE OF THE CHIEF OF NAVAL OPERATIONS



DEPARTMENT OF THE NAVY  
OFFICE OF THE CHIEF OF NAVAL OPERATIONS  
2000 NAVY PENTAGON  
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

OPNAVINST 5100.19E  
N09F  
30 May 07

OPNAV INSTRUCTION 5100.19E, VOLUME II

From: Chief of Naval Operations

Subj: NAVY SAFETY AND OCCUPATIONAL HEALTH (SOH) PROGRAM  
MANUAL FOR FORCES AFLOAT, VOLUME II

Ref: (a) OPNAVINST 5100.19E, Volume I

Encl: (1) Navy Safety and Occupational Health Program Manual for  
Forces Afloat, Volume II

1. Purpose. To provide the second volume of the Navy Safety and Occupational Health (SOH) Program for Forces Afloat.

2. Cancellation. OPNAVINST 5100.19D, Volume II

3. Discussion

a. This instruction provides surface ship safety standards and precautions necessary to carry out the program established in reference (a). Representatives of the Fleet Commanders and Type Commanders staffs provided significant input to this document.

b. This instruction reflects modifications to regulatory requirements, embodies lessons learned from mishaps, and incorporates changes directed the Navy Executive Safety Board to enhance the SOH Program. Since this document modifies every chapter and most of the paragraphs from OPNAVINST 5100.19D, it does not identify modified, added, or deleted paragraphs.

4. Action

a. Replace the current Volume II of OPNAVINST 5100.19D with enclosure (1).

b. Each command should have sufficient copies of enclosure (a) to ensure that personnel in each workcenter have access to the information.

5. Forms and Reports

The following forms are available at Navy Forms On-line,  
<https://forms.daps.dla.mil>

(1) NAVSEA 9890/8, Danger, Do Not Operate Tag, S/N 0116-LF-115-4300

(2) OPNAV 5100/23, Working Aloft Check Sheet (For Ships)

(3) OPNAV 5100/24, Working Over the Side Check Sheet (For Ships)

(4) OPNAV 5100/25, Working in Vertical Trunk Check Sheet (For Ships)



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TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

<b>CHAPTER C1. BASIC SAFETY .....</b>	<b>C1-1</b>
C0101. DISCUSSION.....	C1-1
C0102. GENERAL SAFETY STANDARDS.....	C1-1
C0103. TRAINING.....	C1-6
C0104. SAFETY COLOR CODE AND SIGNS FOR MARKING PHYSICAL HAZARDS..	C1-6
CHAPTER C1 REFERENCES.....	C1-8
<b>CHAPTER C2. DRY CARGO OPERATIONS/STORES HANDLING .....</b>	<b>C2-1</b>
C0201. DISCUSSION.....	C2-1
C0202. PRECAUTIONS - WORKING PARTIES MOVING STORES.....	C2-1
C0203. PRECAUTIONS - CARGO HANDLING FOR SUPERVISORS.....	C2-2
C0204. PRECAUTIONS DURING CARGO OPERATIONS.....	C2-4
C0205. STOWAGE PRECAUTIONS.....	C2-7
C0206. NETS.....	C2-7
C0207. PALLETS.....	C2-7
C0208. CONVEYORS.....	C2-8
CHAPTER C2 REFERENCES.....	C2-9
<b>CHAPTER C3. UNDERWAY REPLENISHMENT .....</b>	<b>C3-1</b>
C0301. DISCUSSION.....	C3-1
C0302. PRECAUTIONS TO BE OBSERVED PRIOR TO UNREP OPERATIONS ....	C3-1
C0303. PRECAUTIONS DURING UNREP OPERATIONS.....	C3-3
CHAPTER C3 REFERENCES.....	C3-6
<b>CHAPTER C4. SMALL BOATS .....</b>	<b>C4-1</b>
C0401. DISCUSSION.....	C4-1

TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

C0402.	PRECAUTIONS FOR LAUNCHING AND RETRIEVAL.....	C4-1
C0403.	SMALL BOAT FUELING.....	C4-3
C0404.	OPERATIONS.....	C4-4
C0405.	CONTRACT LIBERTY BOAT SAFETY.....	C4-7
	CHAPTER C4 REFERENCES.....	C4-9
<b>CHAPTER C5.</b>	<b>WIRE AND FIBER ROPE .....</b>	<b>C5-1</b>
C0501.	DISCUSSION.....	C5-1
C0502.	GENERAL PRECAUTIONS.....	C5-1
C0503.	NATURAL LINES.....	C5-3
C0504.	SYNTHETIC LINES .....	C5-4
C0505.	WIRE AND SPRING LAY ROPE.....	C5-5
C0506.	CABLE CLEANER/LUBRICANT .....	C5-6
	CHAPTER C5 REFERENCES.....	C5-6
<b>CHAPTER C6.</b>	<b>GROUND TACKLE AND TOWING .....</b>	<b>C6-1</b>
C0601.	DISCUSSION.....	C6-1
C0602.	GROUND TACKLE PRECAUTIONS.....	C6-1
C0603.	TOWING PRECAUTIONS.....	C6-4
	CHAPTER C6 REFERENCES.....	C6-4
<b>CHAPTER C7.</b>	<b>HELICOPTER OPERATIONS .....</b>	<b>C7-1</b>
C0701.	DISCUSSION.....	C7-1
C0702.	PRECAUTIONS.....	C7-1
	CHAPTER C7 REFERENCES.....	C7-3

TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

**CHAPTER C8. WORKING OVER THE SIDE OR ALOFT; VERTICAL TRUNKS;  
DRYDOCK SAFETY .....C8-1**

C0801. DISCUSSION.....C8-1

C0802. GENERAL PRECAUTIONS.....C8-1

C0803. PROCEDURES FOR WORKING OVER THE SIDE.....C8-3

C0804. PROCEDURES FOR PERSONNEL WORKING ALOFT.....C8-3

C0805. DRYDOCK SAFETY PRECAUTIONS.....C8-4

C0806. OPERATING AERIAL LIFTS.....C8-5

C0807. PROCEDURES FOR WORKING IN VERTICAL TRUNKS.....C8-7

CHAPTER C8 REFERENCES.....C8-8

**CHAPTER C9. ELECTRICAL AND ELECTRONIC SAFETY AND TAG-OUT  
PRECAUTIONS .....C9-1**

C0901. DISCUSSION.....C9-1

C0902. DEFINITIONS.....C9-1

C0903. ELECTRICAL PRECAUTIONS.....C9-1

C0904. WET CELL BATTERIES.....C9-5

C0905. LITHIUM AND MERCURY BATTERIES.....C9-7

C0906. ELECTRICAL FIRES.....C9-8

C0907. FIRST AID FOR ELECTRICAL SHOCK.....C9-9

C0908. ELECTRONIC PRECAUTIONS.....C9-10

C0909. ELECTRICALLY AND ELECTRONICALLY SAFE WORK BENCHES.C9-13

C0910. TAG-OUT.....C9-14

CHAPTER C9 REFERENCES.....C9-14

TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

<b>CHAPTER C10. SHIPBOARD FUELS .....</b>	<b>C10-1</b>
C1001. DISCUSSION.....	C10-1
C1002. DEFINITIONS.....	C10-1
C1003. PRECAUTIONS.....	C10-1
CHAPTER C10 REFERENCES.....	C10-4
<b>CHAPTER C11. WELDING, CUTTING, BRAZING, AND HOT WORK .....</b>	<b>C11-1</b>
C1101. DISCUSSION.....	C11-1
C1102. PRECAUTIONS.....	C11-2
C1103. EXTRA PRECAUTIONS FOR WORK IN RESTRICTED ACCESS SPACES .....	C11-10
CHAPTER C11 REFERENCES.....	C11-11
<b>CHAPTER C12. SHIPBOARD AIRCRAFT SAFETY .....</b>	<b>C12-1</b>
C1201. DISCUSSION.....	C12-1
C1202. GENERAL FIRE PRECAUTIONS .....	C12-1
C1203. HOUSEKEEPING.....	C12-2
C1204. FOREIGN OBJECT DAMAGE (FOD).....	C12-3
C1205. LIQUID OXYGEN.....	C12-3
C1206. ARRESTING GEAR AND BARRICADES.....	C12-5
C1207. HAZARDS OF ELECTROMAGNETIC RADIATION OF ORDNANCE (HERO) .....	C12-6
CHAPTER C12 REFERENCES.....	C12-6
<b>CHAPTER C13. MACHINERY .....</b>	<b>C13-1</b>
C1301. DISCUSSION.....	C13-1
C1302. GENERAL PRECAUTIONS .....	C13-1
C1303. MAINTENANCE.....	C13-4

TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

C1304.	INDUSTRIAL EQUIPMENT.....	C13-4
	CHAPTER C13 REFERENCES.....	C13-19
<b>CHAPTER C14.</b>	<b>ORDNANCE .....</b>	<b>C14-1</b>
C1401.	DISCUSSION.....	C14-1
C1402.	GENERAL ORDNANCE PRECAUTIONS.....	C14-1
C1403.	ORDNANCE HANDLING PRECAUTIONS.....	C14-2
	CHAPTER C14 REFERENCES.....	C14-3
<b>CHAPTER C15.</b>	<b>MARINE SANITATION DEVICES (SEWAGE SYSTEMS) ....</b>	<b>C15-1</b>
C1501.	DISCUSSION.....	C15-1
C1502.	SANITARY, HYGIENIC, AND SAFETY PROCEDURES.....	C15-1
C1503.	GAS FREE ENGINEERING FOR MSD SYSTEMS.....	C15-3
C1504.	CONTROL OF TOXIC GAS HAZARDS IN SEWAGE MSD SYSTEMS .....	C15-4
C1505.	GRAYWATER COLLECTION/TRANSFER SYSTEMS AND GRAYWATER HOLDING TANKS .....	C15-5
C1506.	DISCHARGE REQUIREMENTS AND ADDITIONAL GUIDANCE ...	C15-5
	CHAPTER C15 REFERENCES.....	C15-6
<b>CHAPTER C16.</b>	<b>HEAVY WEATHER .....</b>	<b>C16-1</b>
C1601.	DISCUSSION.....	C16-1
C1602.	LIFELINES.....	C16-1
C1603.	TIE-DOWNS.....	C16-1
C1604.	SAFETY PRECAUTIONS UNDER HEAVY WEATHER CONDITIONS.	C16-1
<b>CHAPTER C17.</b>	<b>ABANDONING SHIP .....</b>	<b>C17-1</b>
C1701.	SAFETY PRECAUTIONS DURING ABANDONING SHIP.....	C17-1
	CHAPTER C17 REFERENCES.....	C17-2

TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

<b>CHAPTER C18. PAINTING AND PRESERVATION .....</b>	<b>C18-1</b>
C1801. DISCUSSION.....	C18-1
C1802. SAFETY PRECAUTIONS FOR PAINT REMOVAL .....	C18-1
C1803. SAFETY PRECAUTIONS FOR SURFACE PREPARATION AND PAINTING OPERATIONS .....	C18-3
CHAPTER C18 REFERENCES.....	C18-4
<b>CHAPTER C19. FOOD SERVICE AND TRASH AND GARBAGE DISPOSAL EQUIPMENT .....</b>	<b>C19-1</b>
C1901. DISCUSSION.....	C19-1
C1902. GENERAL PRECAUTIONS .....	C19-1
C1903. COOKING UTENSILS.....	C19-3
C1904. FOOD PREPARATION.....	C19-4
C1905. SAFE OPERATION OF FOOD SERVICE EQUIPMENT.....	C19-5
C1906. TRASH AND GARBAGE PROCESSING EQUIPMENT .....	C19-11
CHAPTER C19 REFERENCES.....	C19-13
<b>CHAPTER C20. LAUNDRIES AND PHOTOGRAPHY LABS AND DARKROOMS ..</b>	<b>C20-1</b>
C2001. DISCUSSION.....	C20-1
C2002. LAUNDRY PRECAUTIONS.....	C20-1
C2003. PRECAUTIONS FOR LITHOGRAPHIC, PHOTOGRAPHIC, AND RADIOGRAPHIC DARKROOMS AND LABORATORIES.....	C20-3
CHAPTER C20 REFERENCES.....	C20-4
<b>CHAPTER C21. MEDICAL AND DENTAL FACILITIES .....</b>	<b>C21-1</b>
C2101. DISCUSSION.....	C21-1
C2102. SAFETY PRECAUTIONS FOR MEDICAL AND DENTAL FACILITIES ....	C21-1
CHAPTER C21 REFERENCES.....	C21-3

TABLE OF CONTENTS

VOLUME II  
SECTION C

SURFACE SHIP SAFETY STANDARDS

---

<b>CHAPTER C22. CO<sub>2</sub> FIXED FLOODING SYSTEMS SAFETY PRECAUTIONS AND PROCEDURES</b>	<b>C22-1</b>
C2201. DISCUSSION.....	C22-1
C2202. HEALTH HAZARDS OF CARBON DIOXIDE.....	C22-1
C2203. SAFETY PRECAUTIONS.....	C22-2
C2204. GENERAL PROCEDURES DURING MAINTENANCE WORK.....	C22-4
C2205. DISABLING PROCEDURES.....	C22-4
C2206. RESCUE PERSONNEL PROCEDURES.....	C22-5
<b>CHAPTER C23. HAZARDOUS MATERIAL CONTROL AND MANAGEMENT STANDARDS</b>	<b>C23-1</b>
C2301. DISCUSSION.....	C23-1
C2302. HMC&M - HAZMINCEN STANDARDS.....	C23-2
C2303. HM STORAGE SEGREGATION STANDARDS.....	C23-12
C2304. GENERAL HANDLING AND USE REQUIREMENTS.....	C23-18
C2305. SPECIALTY MATERIAL.....	C23-20
CHAPTER C23 REFERENCES.....	C23-22
APPENDIX C23-A HAZARDOUS MATERIAL STORAGE SEGREGATION MATRIX .....	C23-A-1
APPENDIX C23-B HAZARDOUS MATERIAL CONTROL AND MANAGEMENT (HMC&M) CHECKLIST SURFACE SHIP PROGRAM.....	C23-B-1

30 May 2007

**CHAPTER C1****BASIC SAFETY****C0101. DISCUSSION**

a. Shipboard life is one of the more hazardous working and living environments that exist. The existence of hazardous materials and equipment, in addition to the fact that a ship is a constantly moving platform subject to conditions such as weather, collision, and grounding contribute to a potentially hazardous environment. Any chain of mishaps could lead to a major catastrophe. It is for this reason, PRACTICAL SAFETY must be followed and the prescribed safety regulations strictly followed to prevent personal injury and illness.

b. As a risk control measure, and a consideration when using operational risk management (ORM) to plan an evolution, consider assigning a safety observer, whose only responsibility is safety, during any evolution that could injure personnel or damage equipment. This safety observer should be knowledgeable in the proper performance of the evolution. Reference C1-1 contains additional guidance on ORM.

c. The general safety standards in the following section are applicable to all shipboard operations and spaces. These standards have been adopted from requirements from the Naval Sea Systems Command (NAVSEA), the Occupational Safety and Health Administration (OSHA), USCG, Safety of Life at Sea (SOLAS), American National Standards Institute (ANSI), and previous OPNAV directives. The standards provided in this chapter may not be all inclusive for every possible evolution on board ship, and the lack of a specific standard does not imply that a practice is safe just because it is not mentioned. Use ORM to determine the safety requirements for unique evolutions and operations.

**C0102. GENERAL SAFETY STANDARDS****a. Ladders and Egress**

(1) Be familiar with all exits and egress routes from working and living spaces.

(2) Always move up or down a ladder with one hand on the railing. Never slide down inclined ladder rails or material

handling trays. Do not carry loads up or down ladders that obstruct your movement or sight.

(3) Always ensure exits are not locked or blocked with equipment or any other type of interference.

(4) Do not run in passageways or up or down ladders.

(5) Always be cautious when nearing a "blind" corner or when opening doors with no port light or window.

(6) Never lock escape scuttles or other accesses so they cannot be opened from the inside.

(7) Never dismantle or remove any inclined or vertical ladder without permission of the commanding officer. Secure such areas with temporary lifelines and post with a warning sign.

(8) After opening and prior to passing through a watertight hatch, scuttle, or manhole cover ensure hatch brace pins and/or safety pawls and scuttle/manhole covers are positively locked.

(9) Provide temporary barriers using guardrails, line, or chains, suitably supported by stanchions or pads, when opening accesses in bulkheads or decks that are normally closed, if the opening will be unattended or unguarded at any time.

(10) Ensure that low overheads above inclined ladders (less than 72 inches (") in height), ladder grab bars, passageways (less than 75" in height) and obstructions in passageways (less than 72" in height), are padded or protected to prevent head injury if struck.

b. Damage Control

(1) Know the location and operation of life preservers, emergency escape breathing devices (EEBDs), and other emergency equipment in or near your working and living spaces.

(2) Know the location of all fire stations and other firefighting equipment in or near the living and working spaces you frequent.

(3) If you pass through a watertight door, hatch, or scuttle designated to be closed during normal operations, be certain to properly close and dog it.

(4) Never tamper with any damage control fittings or equipment.

(5) Never open or enter a tank, void, manhole or other space suspected or confirmed of containing hazardous vapors (e.g., flammable liquids) without permission of the gas free engineer.

(6) When working in a tank, void, or space containing a hazardous vapor source ensure a gas free certificate is properly posted. Personnel entering the tank, void, manhole or hazardous area shall wear a harness with attached safety line, wear proper protective equipment, and have a second person tending the safety line outside the space.

c. Stowage and Hazardous Materials

(1) Make sure that all movable objects in your spaces are secured for sea using appropriate materials. Whenever feasible, provide permanent secure-for-sea mountings with metal bands, bolts, or other securing devices.

(2) Ensure all hazardous materials, including cleaners and paints, are properly labeled, safely used, and returned after use, per the ship's procedures.

d. Machinery

(1) Wear short sleeves or roll up sleeves when operating rotating industrial machinery. See chapter B12 for specific protective clothing requirements.

(2) Know the emergency shut down procedures for all equipment you use.

(3) Do not wear rings, watches, key rings, bracelets, cell phones, pagers, and other items that may become entangled or caught on projections, or may be a shock hazard when working with electrical or electronic equipment.

(4) Always wear approved safety shoes when required by the job.

(5) Do not operate machinery and tools without proper training and authorization.

(6) Keep decks free of obstacles and materials causing slippery conditions, particularly in work areas. Post warning signs in areas that are slippery. Ensure non-skid decking material (non-skid paint or adhesive non-skid strips) are installed at the top and bottom of each ladder, on both sides of doors and arches with a high coaming, both sides of crew messing space doors (may be on exit side only if non-skid tiles are installed in messing spaces), and in the machinery operators work areas.

(7) Never operate machinery or equipment with defective or missing safety devices.

(8) Never tamper with or render ineffective any safety device, interlock, ground strap or similar device intended to protect operators or the equipment without specific approval of the commanding officer.

(9) Only open or close electrical switches and pipe valves when authorized to do so.

e. Ventilation. Always ensure ventilation ducts are free of blockage. Never alter ducts or diffusers without permission. Know where ventilation controllers are located for your work and living areas.

f. General Space Safety

(1) Keep constantly familiar with the whereabouts of crewmembers in the space where you are working, especially if they are working in tanks, voids or other restricted movement areas.

(2) Smoke only in designated areas.

(3) Observe and enforce all personal protective equipment requirements.

(4) Promptly report all unsafe conditions discovered.

(5) Never straddle or step over lines, wire, and chains under tension.

(6) Never hesitate to stop a shipmate from doing something that may be hazardous or unsafe, and never leave a worksite in an unsafe condition.

(7) Ensure hazardous areas such as spaces containing flammable liquids, around machinery and elevators, pinch points, rotating shafts and belts, and trip hazards, are marked with red color coding or signs to warn people of danger areas. See

chapter C10 for more information on signage for gasoline hazard areas.

(8) Use of personal earphones is not authorized throughout the ship except in the berthing spaces, in recreation/study areas, or in other authorized ship spaces.

g. Topside

(1) Wear sunglasses only when topside. Sunglasses will not be worn as a substitute for impact safety glasses, sun and wind goggles, flight deck goggles, or as protective equipment for operations such as fire watch or welding.

(2) Know where all life rings, dye markers, and flares are located for man overboard emergencies.

(3) Do not lean against lifelines. Never dismantle or remove any lifeline, or hang or secure any weight or line to any lifeline except as authorized by the commanding officer. When no lifeline is available, temporary lifelines shall be used.

(4) Wear a life preserver topside where the potential exists of falling, slipping, being thrown, or carried into the water.

(5) Never dismantle any permanent lifeline system without permission of the commanding officer and without providing temporary lifelines.

(6) Know the location of all lifeboat and life raft stations. Be familiar with access routes to the stations from the living and working spaces you frequent.

**C0103. TRAINING**

a. While most of the standards specified in this chapter are covered during basic training and at specific training schools, new crewmembers, upon reporting on board, must be given an orientation on these standards, their intent and importance, and where specific safety items and personal protective equipment (PPE) can be found aboard ship. This training shall be conducted within 72 hours of the crew member reporting aboard and shall include; egress, self-contained breathing apparatus (SCBA)/oxygen breathing apparatus (OBA), and EEBD training. The training listed shall be reinforced with follow-on training every six months thereafter.

b. All personnel should be consistently reminded of these safety standards through the use of Plan of the Day notes, divisional training, or quarters.

c. While enforcement of safety standards is important, consider rewards and recognition for those reporting and correcting safety hazards and watching out for their shipmate's safety.

**C0104. SAFETY COLOR CODE AND SIGNS FOR MARKING PHYSICAL HAZARDS**

a. DANGER. Red is the basic color for the identification of dangerous equipment or situations:

(1) Safety cans or other approved portable containers of flammable liquids (see C23). These metal cans shall be painted red with some additional clearly visible identification either in the form of a yellow band around the can or the name of the contents conspicuously stenciled or painted on the can in yellow.

(2) Danger signs are red with black and white lettering, to indicate a hazardous situation, equipment, area, or condition, which has a high probability of death or severe injury.

(3) Emergency stop bars on hazardous machines, such as rubber mills, wire blocks, or flat work ironers. Stop buttons or electrical switches, on which letters or other markings appear and are used for emergency stopping of machinery, shall be red.

(4) Guards or barriers enclosing rotating machinery, shafts, or moving parts which could cause death or severe injury, if removed.

b. CAUTION. Yellow is the basic color to denote caution.

(1) Yellow is the basic color for designating caution and for marking physical hazards such as: striking against, stumbling, falling, tripping, and "caught in between." Solid yellow, yellow and black stripes with suitable contrasting color should be used interchangeably, using the combination, which will attract the most attention in the particular environment. Overhead obstructions (less than 72" in height), monorails and turntables are painted solid yellow.

(2) Yellow and black are the colors of caution signs used to indicate a hazardous situation, which may result in minor or moderate injury. Caution signs are yellow with black lettering, and are used for eye hazard and noise hazard signs.

(3) Use yellow and black striping or checkerboard designs, painted or tape, to indicate industrial eye hazardous areas, trip hazard areas, or other areas where caution should be exercised.

c. Safety Information. Green is the color of general safety information and instructional signs, such as the location of emergency eye wash stations and safety precaution placards.

d. Workshop Deck Markings. Deck markings are used around permanently installed workshop machinery to alert personnel nearby of potential hazards. Markings may be applied using commercially available safety tape or painted onto surfaces. Markings are to be applied around each machine. Avoid marking an entire space as hazardous by applying deck markings only at a doorway or entrance. Operator and eye hazard areas may overlap if machines are installed close together.

(1) Operator Work Areas - The area at the machine where the operator normally stands while using the machine is marked to alert personnel to not enter that operator area. An operator area is marked by painting the entire operator area as a solid yellow block. The operator area must also have non-skid decking to prevent slipping on oily decks and falling into the machines. The non-skid may be non-skid paint or adhesive non-skid strips with no spaces between the strips.

(2) Eye Hazardous Areas - Any area around a machine determined to pose an eye hazard must have those boundaries outlined in black and yellow strips or checkerboard paint or tape. To determine the extent of the eye hazard, note areas where chips or debris are thrown or materials splashed during operation. That area or machine must also be labeled with a "Caution - Eye Hazard" sign in yellow and black.

(3) Safe Passage and Caution Areas - If space permits, lanes used for normal traffic through a machine shop or around industrial machinery should be outlined using solid white (safe) or yellow (caution) lines.

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**CHAPTER C1**

**REFERENCES**

C1-1. OPNAVINST 3500.39B

30 May 2007

**CHAPTER C2****DRY CARGO OPERATIONS/STORES HANDLING****C0201. DISCUSSION**

a. Dry cargo and stores are any material that are carried in their own containers and is not in bulk form, such as fuel. Examples of dry cargo are stores, equipment and machinery that are carried in a ship for its own or another vessel's use.

b. This chapter does not discuss underway replenishment (UNREP) operations or refueling at sea (FAS) operations except fuel used in drums or other approved containers. UNREP and FAS operations are covered in other chapters.

c. Dry cargo and stores handling evolutions are extremely dangerous, even though they appear routine. Cargo and stores being handled can fall or shift, causing injury to personnel and damage to the ship. Additionally, damaged hazardous material cargo may cause illness or death from resulting spills in extreme conditions. Cargo and stores handling gear can fail, causing not only cargo damage, but additionally the failed cargo handling gear can itself maim and even kill, as well as cause physical damage. It is for these reasons that extreme care must be used during cargo and stores handling operations.

d. Working parties and personnel moving stores throughout a ship are a source of numerous injuries. Handlers may need hand and foot protection, back injury prevention training, and supervision to prevent injuries.

e. Complete an operational risk management (ORM) review, in accordance with reference C2-1, before the evolution and mitigate risks as feasible.

**C0202. PRECAUTIONS - WORKING PARTIES MOVING STORES**

The following precautions are for personnel assigned to temporarily assembled or routine working parties, and their supervisors, when handling and moving stores through a ship.

a. Ensure the path throughout the ship where stores will be moved is clear of obstructions and traffic through those areas restricted during stores movement.

b. Wear hand protection (when handling wire rope or banded material), and steel-toed safety shoes.

c. Ensure there are sufficient personnel assigned to allow passing of boxes or material and that all members are fit to handle the anticipated weight.

d. Arrange sufficient numbers of personnel in the working party to minimize twisting or exertion while passing the material. Never toss or throw boxes, cases, or materials from one person to the next.

e. Prior to each handling evolution, review proper handling techniques to avoid back injury (lift with legs, do not bend at waist to lift, get help with heavier loads, get a firm grip before releasing to next person, and stop and report any strains immediately).

f. Ensure slides at inclined ladders are firmly in place and do not have sharp edges or protrusions.

g. Review spill response procedures if handling hazardous materials.

**C0203. PRECAUTIONS - CARGO HANDLING FOR SUPERVISORS**

The following precautions are for cargo handling supervisors. Supervisors must initiate these precautions as well as those in reference C2-2 before beginning any cargo handling operations:

a. Ensure open hatches in use are cleared of adjacent loose equipment that might fall into the hold and injure personnel below.

b. Restrict traffic about hatches to the side away from where cargo is being worked. Rope off areas to traffic over which loads are traveling.

c. Secure or remove hatch beams or other structures in the way of hatches where cargo is being worked. Personnel engaged in moving hatch beams shall wear a safety harness with associated safety lines, which shall be tended at all times.

d. Ensure that all personnel handling cargo gear are familiar with the use of their equipment and limitations on load

capacity and outreach and are personnel qualifications standard (PQS) qualified.

e. Ensure that trained and qualified signalmen are designated and posted during crane or boom operations.

f. The following crane crew personnel will be qualified, per reference C2-2: tagline handler; rigger; signalman; crane operator; crane safety observer; and crane maintenance technician. Where applicable, NAVEDTRA Personnel Qualification Standards (PQS) are available and should be used to supplement the reference C2-2 qualification requirements.

g. Ensure that there are no obstructions to cargo movement.

h. Verify that all designated cargo handlers are wearing the required personal protective equipment, including hand protection (when handling wire rope or banded material), head protection (hard hats), and steel-toed safety shoes. Ensure all other personnel immediately involved in the cargo handling operations (i.e., safety observer, rig captain, signalmen, winch operator, and winch checker), including personnel observing for training, wear head protection (a hard hat) with the chin strap in place under the chin.

i. Ensure that all cargo holds to be used are open and hatch covers properly stowed. Ensure all hinged or folding cargo hatches, normally stowed in an upright position are secured with hatch securing pawls and safety preventer chains engaged.

j. Visually verify that all pallets and containers are of the correct type and safe for the intended use. If a pallet appears unsafe, discard or repair it prior to use.

k. Inspect the cargo handling area and ensure that dunnage is properly stowed clear of all proposed cargo handling activity.

l. Visually check and ensure that all required cargo handling warning signs are properly posted near personnel transit areas.

m. Ensure that all required trim and stability calculations have been completed **before** the cargo is loaded or off-loaded.

n. Visually check and verify that all cargo boom preventer guys, straps, and whips are rigged correctly.

o. If handling ordnance, ensure that all applicable safety standards are followed and enforced. Chapter C14 provides additional guidance.

p. Use caution when using dock or mobile cranes. Rotary cranes, booms and structures can strike and damage the ship's superstructure.

q. Ensure that all suspected unsafe cargo handling gear is tagged out of commission, removed, repaired and/or replaced, and tested prior to re-issue.

r. Ensure that all holds and levels being utilized have the required safety barriers (rope, chains, and nets) installed.

s. Verify that all required cargo (save-all) nets are in place.

t. Ensure there are no oily or slick decks where cargo is to be handled.

u. Ensure adequate lighting is provided at the boom heads, cargo holds, and draft areas when conducting nighttime cargo operations.

v. Do not operate any cargo handling system with inoperative safety devices or guards without the specific approval of the commanding officer.

w. Rig suspended baskets/buckets per reference C2-1. Personnel in the basket/bucket shall wear a safety harness with safety lines attached when not suspended over water. When suspended over the water, personnel shall wear approved life preservers according to reference C2-3.

x. Use correct and well-maintained blocks and sheaves for safe load handling operations.

y. Conduct an informal safety brief for all participants prior to the start of first cargo operations after port calls and thereafter as warranted.

z. Ensure that safety observers are not involved in any other aspects of cargo handling operations except observing safe procedures.

**C0204. PRECAUTIONS DURING CARGO OPERATIONS**

All personnel handling cargo should follow the following precautions during cargo handling operations:

- a. Always know where the cargo is during a transfer.
- b. Wear head protection (a hard hat) with chinstrap in place under chin, gloves (when handling wire rope or banded material), and steel-toed safety shoes.
- c. When transiting a cargo operations area, walk only in the designated transit areas that are located on the side of the ship opposite the cargo handling operations.
- d. Never look into a hold when cargo is being handled or cargo gear is in use unless controlling the movement of the cargo.
- e. Never walk under suspended cargo or tensioned highline.
- f. Do **not** ride on pallets, containers, or hooks.
- g. Know the firefighting and safety equipment locations.
- h. Do not walk backwards.
- i. Always listen to equipment. Abnormal sounds usually mean trouble.
- j. Never allow cargo to swing or remain suspended for a period longer than necessary.
- k. When cargo is being lowered, keep feet and hands clear.
- l. Never allow unsecured cargo gear or equipment to go unattended.
- m. Never put hands **under** cargo during transfer.
- n. Never throw anything down a hold or onto a dock.
- o. Never step into bights of line.
- p. Never grab or hold onto cargo lines.

- q. Know the location of all exits from holds.
- r. Know the location and use of emergency cut-off switches.
- s. Do not oil or lubricate equipment while it is in use.
- t. Check cargo-handling equipment for damage should cargo being handled strike the cargo handling equipment.
- u. Ensure cargo never exceeds cargo handling equipment's listed safe working load limit at the outreach being used.
- v. Avoid making side pulls.
- w. Never climb up or down exposed ladders when cargo is being handled within the immediate area.
- x. Do not smoke.
- y. Inform supervisors of unsafe or damaged equipment or conditions.
- z. Do not ride on conveyors.
- aa. Do not use personnel-only elevators for cargo.
- ab. Always lift loads evenly.
- ac. When suspending a load, only do so over the deck, not the hatch.
- ad. Wear eye and face protection when removing steel strapping. Stand to one side and out of the path of the strapping as strapping will recoil when cut.
- ae. Do not overload hand and fork trucks. Ensure trucks are below handlers when going up or down an incline.
- af. Remove, repair, or replace defective or broken strapping on cargo.
- ag. Provide loads requiring continuous manual guidance while in motion with tag lines.

**C0205. STOWAGE PRECAUTIONS**

- a. Before handling vehicles, inspect and ensure that all fuel has been emptied from the vehicle's tanks with the exception of combat loaded military vehicles.
- b. Stow vehicles fore and aft, chock wheels, use approved or installed tie downs or wire rope lashings.
- c. Always brace, shore, and lash cargo that may shift.
- d. Always preplan the location of material to be stowed so that heavier items are stowed below lighter ones.
- e. Use dunnage only when necessary.
- f. For specific tiedown information, see the appropriate transportability guidance technical manual.

**C0206. NETS**

- a. Use cargo nets when loading or unloading packages, bundled and bagged materials, or other objects that might roll or shift, creating an unsafe condition if lifted on a sling.
- b. When cargo nets are used to discharge cargo onto trucks, land the load slowly to prevent damage to the truck and possible injury to personnel. Carefully disconnect the net from the sling and leave the net in the truck with its load.
- c. Inspect nets prior to and during use for wear and damage. Remove worn or damaged nets from service until repaired or replaced.
- d. Refer to reference C2-4 for additional precautions associated with vertical replenishment.

**C0207. PALLETS**

- a. Palletizing speeds up the handling of cargo, prevents damage to easily crushed items, and increases the amount of cargo that can be stacked in a pile. For these reasons, pallets are extensively used in cargo handling operations.
- b. When loading a pallet, stack the cargo so that no possibility of cargo spilling exists, and the pallet will be stable and level when lifted. When loading a pallet with cases

of uneven size, place the highest and strongest cases at each end of the pallet with the smaller and more fragile cases in the center. In this manner, when piling one pallet on top of another, a stronger and more level surface is offered. This will result in safer stowage of the pallets. Do not lift pallets on which items are loose or broken and which cannot be properly reloaded in cargo nets.

c. Palletize round commodities, such as cylinders, by using specially constructed chocks, made up and spaced to fit the particular cargo. For safe handling, tie the chocks together by two narrow strips that lie in the space between the chocks and are flush with the top of the pallet's platform. Lay the second tier in the cantlines of the first.

d. Use pallet bridles and bars whenever possible and especially when loading or unloading pallets containing even-sized cases or cartons.

e. Do not lift a load on damaged pallets. A damaged, palletized load may be lifted if a sound pallet is placed under the damaged pallet or if the load is placed into a cargo net. Otherwise, repalletize the load.

f. Refer to reference C2-4 for additional precautions associated with vertical replenishment.

#### **C0208. CONVEYORS**

a. When using a power conveyor, run the device slowly enough that personnel at the end of the conveyor can handle the packages without rushing.

b. Do not ride a moving conveyor. Signs shall be posted on all conveyors to this effect. Do not walk on idle conveyors, except as required for maintenance.

c. Never leave a powered conveyor unattended while it is in operation. When operating a dual-control conveyor from one control station, use the station affording the best view of the entire conveying operation. For elevated conveyors, this usually means the elevated end. Control stations shall be placarded with operating instructions and precautions.

d. Do not convey materials having an unstable load distribution.

e. Examine all conveyors frequently for sharp edges, dents, worn liners, or any other conditions that could cause injury to personnel or damage to conveyed materials. Inspect power conveyors for loose or broken parts.

f. Do not lubricate, adjust, or repair any part of the conveyor while the machine is in operation. Tag-out and remove conveyor from service before performing maintenance, inspection, or adjustments.

g. Wear steel-toed safety shoes when loading or unloading conveyors. Wear hand protection if the materials have metal bands or sharp edges.

h. To avoid personnel injury from falling cargo, do not go underneath the conveyor or inside the specified safe distance from its sides and ends.

i. Always use the two-man rule when operating conveyors.

j. Always maintain positive communication between the levels of operation.

k. Ensure there is adequate lighting and firm footing (including non-slip) for personnel loading conveyors.

l. Ensure all platform-locking bars, interlocks, and audible alarms are working prior to using the conveyor.

m. Ensure that all conveyor operators and maintenance personnel are PQS qualified.

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## CHAPTER C2

### REFERENCES

C2-1. OPNAVINST 3500.39B

C2-2. Naval Ships' Technical Manual (NSTM) 589, Cranes

C2-3. Naval Ships' Technical Manual (NSTM) 077, Personnel Protection Equipment

OPNAVINST 5100.19E  
30 May 2007

C2-4. Naval Warfare Publication (NWP) 4-01-4, Replenishment  
Underway

## CHAPTER C3

### UNDERWAY REPLENISHMENT

#### C0301. DISCUSSION

a. All precautions listed for handling cargo in chapter C2, must be followed, during underway replenishment (UNREP) operations. However, several operations involved with UNREP are unique and require special attention and safety. Vertical replenishment (VERTREP) operations are covered in chapter C7, Helicopter Operations. Reference C3-1 contains additional procedures, requirements, safety precautions, and warnings associated with underway replenishment planning, ship handling, personnel, rigs, and transfer operations.

b. Fueling-at-sea (FAS) and replenishment-at-sea (RAS) involve the transfer of cargo, personnel, and fuel between two or more ships while underway. This involves not only the dangers normally found with cargo transfers but also adds the problem of heavy weather, motion, streaming operations, and the possibility of collisions. For these extra threats, special precautions and practices must exist.

c. Complete an operational risk management (ORM) assessment before the evolution. C3-2 provides additional guidance on ORM. Mitigate risks as feasible.

#### C0302. PRECAUTIONS TO BE OBSERVED PRIOR TO UNREP OPERATIONS

The senior personnel in charge of UNREP operations shall take the following precautions:

a. Ensure all UNREP equipment and breakaway equipment are in place and properly operational.

b. Ensure all assigned crew members know their duties, are certified where applicable, and are aware of their responsibilities.

c. Test and ensure that proper communications equipment is being used and is operating normally.

d. Ensure that communications (including back-up systems) are established with the UNREP vessel.

e. Ensure UNREP stations have non-slip deck treads or non-skid paint.

f. Ensure all lifelines are in place.

g. Ensure that all UNREP personnel have removed all watches, bracelets, etc., and are wearing life preservers, head protection (hardhats), hand protection (when handling wire rope or banded material), and steel toed safety shoes. Ensure that personnel assigned to work stations are carrying an appropriate knife for routine or emergency use.

h. When fueling, ensure all firefighting stations are properly equipped for any possible cargo fire.

i. Ensure life rings, buoys, and markers are within easy access for UNREP team members, and station lookouts on the fantail for each engaged side.

j. Ensure that all UNREP team members are thoroughly familiar with emergency breakaway procedures. Station-to-station phone talkers and station captains should discuss emergency breakaway procedures as soon as sound powered phone communications are established. Phone talkers should never fasten the phone strap around their necks. Emergency breakaway procedures shall be issued by the delivery ship, but can be initiated by either ship.

k. Ensure that all cargo handling equipment, including padeyes, are not overloaded.

l. Post UNREP warnings at designated personnel transit areas.

m. Only allow essential personnel at UNREP stations.

n. Ensure that all UNREP personnel wear snug fitting clothes.

o. In cold climates, make sure all ice and snow is removed from UNREP station and the UNREP area deck is properly sanded.

p. During night UNREP operations, ensure that all lights are operating.

q. During personnel transfers:

(1) Make sure transferring personnel wear head protection (hardhats) and authorized life preservers according to reference C3-3 and are equipped with whistles and personal marker lights (PMLs).

(2) Ensure that transferring personnel know how to get out of the transfer chair in an emergency.

(3) Inspect transfer rig before using. In particular, inspect the manila/synthetic highline for evidence of rot, broken strands, cuts, or other signs of weakened condition.

(4) Use only manila/synthetic highlines and messenger lines. Hand tend messenger lines and highlines.

r. Ensure that a ready lifeboat is available in case of an emergency.

s. Clear area of dunnage.

t. Ensure padding is in place for ordnance.

u. Assign a PQS qualified safety observer to every UNREP station during the unrep evolution. Ensure that the safety observer's only function is to watch for hazardous conditions. The safety observer should know the locations of all nearby eye wash stations and be familiar with emergency measures in the event of accidental eye splashing.

v. Ensure a safety brief is held for all participants prior to all UNREP evolutions using the principles of operational risk management (ORM).

### **C0303. PRECAUTIONS DURING UNREP OPERATIONS**

All personnel shall comply with the following:

a. Wear head protection (hardhat), hand protection (when handling wire rope or banding material), life preserver, and steel toed safety shoes.

b. Wear snug fitting clothing appropriate for the weather conditions. Remove rings, watches, key rings, cell phone, pager, and other personal gear, which may become entangled in loads or lines.

- c. Know the location of lifesaving and firefighting stations.
- d. Be aware and exercise caution when line throwing gun and/or bolo are in use.
- e. Stand clear of bights.
- f. Transit the UNREP station area in the designated transit area on the side opposite the UNREP operations station.
- g. Never turn your back on incoming cargo.
- h. Stand clear of suspended or incoming cargo.
- i. Do not stand between incoming cargo and a fixed object.
- j. Secure cargo immediately.
- k. Never step into cargo nets.
- l. Know all emergency procedures, especially emergency breakaway.
- m. Do not smoke.
- n. Ensure supervisors are immediately informed of all damaged or broken equipment, including the conditions of lines.
- o. Ensure ship-to-ship phone talkers do not fasten phone straps around the neck.
- p. When passing lines:
  - (1) When possible, use a line-throwing gun for initial line transfer. Ensure that a bolo line is available at each transfer station as a backup.
  - (2) CVs/CVNs, LPDs, LHAs, LHDs, and ships configured for multiple air operations shall provide the shot line.
  - (3) Send the bolo/shot line across only after being advised that the station on the receiving ship is ready.

(4) Do not aim line-throwing guns and bolo lines to areas on the other ship that are under cover or where activities are obscured.

(5) Direct all station personnel to take cover before indicating ready to receive the bolo/shot line.

(6) Specified personnel shall retrieve the bolo/shot line only upon the order of the supervisor in charge of the station.

q. Neatly fake or coil down all lines to avoid a tripping hazard.

r. Stay clear of all lines, especially bights, unless directly engaged in their handling. Line handlers should always be inboard and forward of all lines, space permitting.

s. Space permitting, keep at least six feet from any block or cleat through which lines pass.

t. Use tag lines to control a load during hoisting and lowering.

u. Secure cargo to prevent shifting.

v. Ensure that all transfers of empty hooks are treated as full load transfers with the proper catenary maintained.

w. Keep working areas clear of all dunnage and items that create a tripping hazard.

x. When handling ammunition and guided missiles, use padding on decks, bulkheads, and gun mounts in the vicinity of the station.

y. Raise loads only as high as necessary to clear obstructions.

z. Do not overload hoist rigs.

aa. Keep the bridge informed of any change affecting the readiness of the station to transfer. When reporting all lines clear, ensure that all lines are clear of the receiving ship. When reporting all lines on deck, ensure that no lines are

trailing in the water but are in fact on board and clear of the ship's sides.

ab. Do not step on or in cargo nets attached to a cargo hook.

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**CHAPTER C3**

**REFERENCES**

C3-1. Naval Warfare Publication (NWP) 4-01-4, Underway Replenishment

C3-2. OPNAVINST 3500.39B

C3-3. Naval Ships' Technical Manual (NSTM) 077, Personnel Protection Equipment

30 May 2007

## **CHAPTER C4**

### **SMALL BOATS**

#### **C0401. DISCUSSION**

a. The Navy uses several types of small boats. All can be used for emergency evacuation.

b. The most dangerous operations involving small boats are the launching and retrieval of these boats. It is during these periods that human error and mechanical failure of boat davits and launching/retrieval machinery can occur, and when weather and sea state can have its worst effects.

c. Unsafe contract liberty boats (water taxis) have contributed to the death and injury of Navy personnel. To reduce the hazards associated with these operations, contracts for these services shall specify a minimum level of safety and seaworthiness. In addition, commanding officers shall ensure that a knowledgeable officer inspects water taxis prior to their being placed in service and at least daily thereafter. Section C0405 provides guidance on these safety inspections.

d. Complete an operational risk management (ORM) assessment before the evolution and mitigate risks as feasible. Reference C4-1 provides additional guidance on ORM.

#### **C0402. PRECAUTIONS FOR LAUNCHING AND RETRIEVAL**

Observe the following precautions:

a. NEVER ENGAGE A CRANK WHEN HOISTING MOTOR IS ENERGIZED.

b. Inspect all equipment before use, especially the condition of the boat falls, the machinery, and the boat itself.

c. Conduct an operations and safety briefing. Ensure people riding the boat wear an authorized, securely fastened life preserver and a battle helmet with an unbuckled chinstrap or a safety helmet with the chinstrap fastened under the chin according to section 2 of reference C4-2. Personnel assigned to the boat handling station will dress out the same except they shall always fasten their chinstraps under the chin.

d. Conduct a boat inspection. Inventory equipment; install bilge plug; remove ropes from bags; and check hoisting hook, rings, slings, and bales.

e. Keep non-essential personnel away from the davit area. Do not stand under the boat during lowering or raising.

f. Prepare davit to raise/lower the boat. Post a davit winch watch to monitor the spooling of the wire rope falls.

g. Notify the bridge and raise/lower the boat slowly when cleared. Check that the sea painter is connected.

h. Permit only required personnel to be in the boat during lowering or hoisting operations. These personnel shall hold on to the manropes when provided. Manropes shall be positioned to the outboard side of the boat.

i. Release the stern hook first when launching from a two-point lift.

j. Do not launch a boat when own ship's speed is greater than 5 knots. (Does not apply to rigid inflatable boats.)

k. Do not hoist boats aboard ship or lower with water in the bilge in excess of that which the installed bilge pumps would normally remove.

l. Properly secure lifting hook bails before a boat is raised or lowered.

m. Be alert for any possible malfunctioning and act quickly if it occurs. Do not lower or raise the davit arms into the davit arm stops at full speed. Do not use limit switches as stop switches.

n. When hoisting a motor whaleboat, rigid hull inflatable boat (RHIB), or other ship's boat with survivors embarked, only three crewmembers are required to be aboard: bowhook, sternhook, and coxswain. Other crewmembers should disembark by alternate means in deference to survivors prior to hoisting the boat. Although undesirable, when human life is in jeopardy and depending on operating conditions, the motor whaleboat, RHIB, or other ship's boat's limit on the number of people may be exceeded. The boat and boat davit safety factors are sufficient to permit hoisting the motor whaleboat to the rail or deck edge when

carrying the full capacity (see reference C4-3, section 5 for detailed guidance). However, under no circumstances shall the boat be swung in or out when carrying more than seven people.

o. Before raising or lowering a boat, ensure all slings, bale shackles, and pins are seated and seized.

**C0403. SMALL BOAT FUELING**

a. If possible, fuel a boat in the daytime and while it is in the water with its engine stopped. Fueling a boat at night requires the permission of the officer of the deck.

b. If it is necessary to fuel a boat in its shipboard stowage, provide adequate spill control and fire fighting equipment at the scene. Provide sufficient ventilation (for gasoline fueling, all electrical equipment must be approved for hazardous atmospheres) to ensure that any released vapors are swept overboard and are not allowed to accumulate inside the ship.

c. **DO NOT** fuel boats with passengers on board.

d. Prior to fueling, make a grounding and bonding connection between the fuel delivery pump and the fuel tank for gasoline propelled boats.

e. Always keep gas cap in place when not fueling.

f. Only personnel specifically authorized by the ship's engineer officer shall fuel small boats.

g. Smoking or use of non-explosion-proof lights are not permitted in the vicinity of small boats while fueling operations are in progress.

h. Before starting the engine, inspect compartments and bilges, clean, and ventilate as necessary.

i. Ensure gasoline is stowed only in approved fuel containers, and returned to approved storage location upon completion of the fueling operation.

j. Report, to the officer of the deck (OOD), any fuel or oil spills into navigable waters. Do not rinse, bail, or

discharge anything from the small boat into navigable waters without the OOD's permission.

k. Always use non-vented safety goggles when handling fuels.

l. See reference C4-3 for additional requirements for small boat fueling at the boat stowage location.

**C0404. OPERATIONS**

a. Know and obey the "Rules of the Road." Especially important to boat coxswains is the "Rule of Good Seamanship," which requires that boats give way to ships and seaplanes. Boats should turn away from ships or seaplanes early and radically or show clearly their intentions not to embarrass the larger and less maneuverable vessels.

b. Always post a bow lookout while underway.

c. **DO NOT** cut close to ships anchored or tied up or pass close around the corner of a pier, except when such a procedure cannot be avoided. Coxswains must run slowly until there is no danger of collision with any boat or vessel that may be obscured.

d. Boat Capacity

(1) Be familiar with and never exceed the designated personnel carrying capacity. Be able to calculate the load and regulate the number of personnel accordingly. While carrying stores, the load in pounds, including personnel and stores, shall never exceed the maximum allowable cargo load.

(2) Do not carry passengers, stores, or baggage topside on motorboats. If it is necessary to carry stores or baggage, reduce the maximum number of passengers accordingly. Refer to reference C4-3 for detailed guidance.

(3) Installation of flotation material shall not relieve operating personnel from exercising prudence in the loading of boats or providing of life preservers when conditions warrant.

(4) In choppy seas, reduce capacity. The rated capacity designated on the label plate is the maximum capacity under normal weather conditions in calm waters. Always reduce capacity under extreme weather conditions or on the open sea.

- e. Always display proper lights while underway at night.
- f. **DO NOT** use gasoline to clean the engine or its parts.
- g. Keep bilges and sumps dry.
- h. Prohibit smoking or open flames.
- i. Never start the engine if excessive vapors are present. Check for leaks, damaged piping, and loose connections. Correct deficiencies. If a leak is observed during engine operation, stop the engine and correct the cause of the leak.
- j. Use PQS qualified boat officers in foul weather or reduced visibility or for long duration trips, first boat trips in foreign or unfamiliar ports, and when returning large liberty parties after sunset.
- k. **Do Not** operate the boat with a defective bilge pump.
- l. **NEVER** open the bow ramp of a landing craft while underway.
- m. Ensure boats carry proper fog signaling equipment (refer to reference C4-3, section 6) and two 18-inch life rings, one forward and one aft. Life rings shall be secured in such a manner that they are easily broken out.
- n. For precautions on charging small boat batteries, see paragraph C0904.
- o. Ensure boat crewmembers wear authorized life preservers in accordance with section 2 of reference C4-2, under adverse weather conditions, including reduced visibility.
- p. Run boats dead slow when passing other boats that are alongside ships or landings, in narrow or crowded waters, and when passing deeply laden boats.
- q. Ensure that authorized life preservers according to section 2 of reference C4-2, are readily accessible in boats for all members of the crew and all passengers. Never allow the number of personnel in the boat to exceed the number of life preservers available.

r. **Do Not** operate boats with enclosed engine rooms without the engineer being on board and on station, and then only when proper ventilation is assured.

s. Ensure that boat fire extinguishers are in place and charged.

t. Ensure that life preservers are always kept dry.

u. Inspect the electrical system for loose connections and worn insulation before operating a boat and whenever damage to these systems is suspected. Do not operate the boat until corrective action is completed.

v. Display lights per the "Rules of the Road" when underway between sunset and sunrise or in reduced visibility. (Refer to section 6 of reference C4-3 for guidance.)

w. Ensure shackles and pins are used with anchors. Ensure hoisting slings or bales and steering cables are seized and/or cotter pins are in place.

x. Boat Handling System

(1) Be sure winch and davit safety and operating placards, lubrication charts, and test label plates are posted. Ensure winch controls, brake, clutch, and pawl handles are labeled to show function and direction of movement.

(2) Always check the wire rope on the winch drum before operation to ensure the wire is properly spooled on the drum.

(3) Except in an emergency, check limit switches for operability.

(4) Ensure all turnbuckles used on boat gripes are marked to show the limit of tensioning.

y. Ensure that only qualified (class II or above) swimmers are assigned as boat crew members.

**C0405. CONTRACT LIBERTY BOAT SAFETY**

a. Commanding officers shall ensure that husbanding agents and contractors provide contract liberty boats that are always

manned with a minimum of one operator (coxswain) and two line handlers), operated safely, and secured to the pier or landing with a minimum of two mooring lines during embarkation and debarkation of passengers. Prior to being placed into service, a knowledgeable officer, acting for the commanding officer, shall inspect and approve all contract liberty boats (water taxis) for operational safety.

- (1) Ensure the navigation lights, lighted compass, distress signals, and a fog signal device are present and in working condition, and that the area charts are available and current.
- (2) Ensure that fire extinguishers are present in sufficient number for the size of the boat.
- (3) Verify that there is a working radio aboard, with backup battery, capable of bridge-to-bridge communications.
- (4) Inspect the anchor, anchor chain, and mooring lines for adequacy given the size of the vessel.
- (5) Verify that the weather deck drains are free from obstructions and drain overboard; not into the bilge.
- (6) Check engineering spaces/compartments for fire or flooding hazards.
- (7) Conduct a visual inspection topside for conditions which may be hazardous to passengers.
  - (a) Ensure that the vessel is equipped with a sufficient number of clean and serviceable life preservers for the maximum capacity of the vessel. Life preservers must be stowed in a readily accessible place marked clearly in English.
  - (b) Verify that decks, railings, doors and seats are structurally sound, latched, and tightened as appropriate.
  - (c) Ensure that no bare or exposed electrical wires or connections are located in the passenger area.
  - (d) Validate that a sufficient number of unobstructed exits are present and marked in English.

(e) Verify that no loose gear, potential projectile hazards, or trip hazards exist.

(8) Ensure the operator understands that the boat must be properly secured to the pier or landing with a minimum of two mooring lines before allowing passengers to embark or disembark.

b. It is impractical to establish detailed specifications for each and every inspection item. Inspectors must use their judgment and experience when advising the commanding officer of the overall safety of the contract water taxi.

c. Any item missing that is critical to safety may be provided by the commanding officer for the duration of the contract boat services. Remember to return any such item at the expiration of the contract. In all cases where government furnished property is provided due to contractor's failure to meet the terms of the contract or the contractor's vessel is unsafe for use, the commanding officer shall immediately notify the contracting officer of the circumstances surrounding the deficiency(ies). If the contracting officer is not on site, notification shall be by message.

d. Assign boat officers to the contract water taxis during hours of darkness, or low visibility, and heavy weather. Boat officers shall be PQS qualified by the ship and responsible for maintaining good order and discipline of naval personnel onboard.

e. When boat officers are assigned to contract water taxis, they have the authority to not allow boarding when the water taxi's crew performance and navigation are unsatisfactory. Boat officers must ensure boats are securely moored to the pier or landing with a minimum of two mooring lines before allowing passengers to embark or disembark. When weather conditions are determined to be unsafe, the boat officer has the authority to refuse to get underway.

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## **CHAPTER C4**

### **REFERENCES**

C4-1. OPNAVINST 3500.39B

C4-2. Naval Ships' Technical Manual (NSTM) 077, Personnel Protection Equipment

OPNAVINST 5100.19E  
30 May 2007

C4-3. Naval Ships' Technical Manual (NSTM) 583, Boats and Small  
Craft

30 May 2007

**CHAPTER C5****WIRE AND FIBER ROPE****C0501. DISCUSSION**

Ropes come in a multitude of types, quality, and sizes, each with its own characteristics. In general, there are two types of rope: fiber (natural and synthetic) and wire. When removed from a coil or reel, fiber ropes are generally referred to as lines. Wire is referred to as "wire rope" or "wire", but not "cable". Additionally, there is a fiber/wire hybrid known as "spring lay" rope. Spring lay rope is composed of six main strands laid around a fiber core. Each main strand consists of three preformed wire strands and three fiber strands laid alternatively around a fiber center. Each of these ropes has been developed to satisfy a specific requirement. They can be safely used, but must be properly maintained.

Complete an operational risk management (ORM) review before any line handling evolution, and mitigate risks as feasible. Reference C5-1 contains additional guidance on ORM.

**C0502. GENERAL PRECAUTIONS**

a. Always inspect wires, ropes, and lines before use. Look for deterioration, broken wires or fibers, visible signs of rot, chafing, variations in color, crushing, or the other signs of damage. Refer to reference C5-2 for additional information on use, maintenance, and material requirements for ropes.

b. Wear steel-toed safety shoes with skid-proof soles before handling lines. When handling lines, do not wear rings, watches, cell phones, pagers, key rings, and other items that may become entangled.

c. Check all rollers, capstans, gypsy heads, and windlasses, to ensure they are operating satisfactorily.

d. Avoid getting hands, feet, or clothing caught in bights formed by wires, ropes, or lines.

e. Do not stand directly in line with the point where wires, ropes, or lines change direction (i.e., around a bitt, capstan, or through a block).

- f. Do not straddle or stand on chains, wires, ropes, or lines, whether under tension or not.
- g. Avoid placing wires, ropes, or lines on rough or sharp surfaces that can cause chafing or cutting. Use chafing gear.
- h. Do not place objects on wires, ropes, or lines.
- i. Ensure all kinks are out of wires, ropes, or lines before use.
- j. Check sheaves and blocks being used for proper size and strength. Do not use sheaves or blocks that are too small for the wire, rope, or line used.
- k. Listen to wires, ropes, and lines under tension. Any unusual popping or tearing noises may mean that the wire, rope, or line is in danger of failing.
- l. Always place hands above lines fairled into gypsy heads, capstans, or bitts.
- m. Do not lubricate lines.
- n. Do not apply loads suddenly.
- o. Never leave wires, ropes, or lines under strain on gypsy heads or capstans.
- p. Do not use sheaves or drums with corrugated grooves.
- q. Remove the loose ends of splices.
- r. Seize all bitter ends.
- s. Use the same type of material for stoppers as the hawser being held (e.g., synthetic stopper for synthetic line). Chain shall be used for stoppers on wire rope.
- t. Do not use manila, wire, spring-lay rope, or synthetic line together on the same chock, bitt, or reel.
- u. Do not permit rat guards and sharp edges to wear mooring lines. Use chafing gear and lash well.

v. Change boat falls, highlines, and mooring lines in accordance with planned maintenance system (PMS) procedures. Failure to make such changes can result in serious injury.

w. Make up wires, ropes, and lines not in use and stow clear of walkways and passages.

x. Ensure wires, ropes, lines, and rigging are not subject to overload.

y. Use steadying or frapping lines on boat falls and large lifts to prevent uncontrolled swinging or twisting.

z. Refer to reference C5-2 for additional information on use, maintenance, and material requirements for wires, ropes, and lines.

**C0503. NATURAL LINES**

In addition to the precautions stated in paragraph C0502, also follow these precautions:

a. Do not use natural lines in sheaves and blocks built for wire rope service.

b. Never use manila lines five or more years old.

c. Do not continue to use natural fiber line in which any of the following conditions are present:

(1) Ruptured fibers and powdering between the strands.

(2) Dark red, brown, or black spots between the strands, and a sour, musty or acidic odor.

(3) Thirty percent of the yarns in the cross-section have been worn through.

(4) Long jawed and distorted strand areas.

(5) Salt incrustation and swollen areas.

(6) A harsh, dry, dead feel in manila or sisal lines.

(7) Evidence of gritty material between the strands.

- d. Store lines in cool, dry spaces.
- e. Fake lines down after use to dry out.
- f. Do not use frozen lines.
- g. Do not allow lines to come into contact with chemicals, acid, alkalis, paints, soaps, rust, or vegetable oils.
- h. Do not drag lines over sand, grit areas, or non-skid decks.
- i. Do not let line wear become localized; rotate lines.
- j. Use chafing gear if necessary.
- k. Only use undamaged lines. Always remove damaged lines from use and repair or discard immediately.
- l. Do not use chain or wire stoppers on fiber lines.

**C0504. SYNTHETIC LINES**

In addition to the precautions in paragraph C0502, the following precautions shall be observed:

- a. Do not expose lines unnecessarily to heat, sunlight, excessive cold, or chemicals.
- b. Store nylon and polyester lines under cover or tightly wound on reels or on cleats during excessive cold.
- c. Install tattletale lines to gauge how far lines are stretching.
- d. Payout lines on cleats, bitts, or capstans slowly. Exercise extreme care when easing out synthetic lines under heavy load. Because of their high extendibility under load, their rapid recovery, and their low coefficient of friction, these ropes may slip suddenly on easing out, thereby causing injury to line handlers. For control in easing out or surging, take two round turns on the bitts and then apply one or two figure eight bends. No more than two figure eight bends shall be used. Because these bends tend to lock under surge, use of more than two figure eight bends will cause difficulty in easing out operations.

- e. Double up lines under excessive strain.
- f. Never use wire or chain stoppers on fiber lines.
- g. Stand clear of lines under strain. (The videotape "Synthetic Line Snapback" should be viewed for an appreciation of this phenomenon.)

**C0505. WIRE AND SPRING LAY ROPE**

In addition to paragraph C0502, the following precautions shall be observed:

- a. Always wear heavy-duty hand protection when handling wire and spring lay rope.
- b. Always wear eye protection while splicing.
- c. Seize wire ends to prevent unlaying.
- d. Store wire and spring lay rope away from weather, acid, and chemicals.
- e. Inspect wire and spring lay rope in accordance with PMS procedures.
- f. When using U-bolt clamps to form an eye, always put the U-bolt itself over the bitter end. Tighten clamps only after putting line under stress.
- g. Only operate winches with more than two turns of wire on the drum.
- h. Do not use sheaves or blocks designed for use with fiber rope with wire rope.
- i. Inspect end fittings, such as sockets, connectors, and wire rope clips prior to use to determine if there is an area of break adjacent to the fitting. Tighten clips after the first hour of running and at PMS specified intervals thereafter. Remove clips after long use and examine rope for broken wires. Remove the damaged part, if broken wires are found, and make a new attachment.

j. Inspect the bitter end of a wire on a drum to ensure it is properly attached.

k. Because spring lay is a combination of wire and fiber, rules for the care of both wire and fiber rope apply.

**C0506. Cable Cleaner/Lubricator**

Many ships are now using the pollution prevention (P2) cable cleaner/lubricator to clean and grease wire rope. User instructions are provided with the equipment, and the following precautions shall be observed:

a. Do not exceed the pressure rating of any of the system components.

b. Check the hoses for damage and insure connections/fittings are secure prior to operation.

c. Release all system pressure before any service or disassembly of the unit.

d. Ensure chains or slings used are weight-tested or rated to withstand an initial line pull of 600 pounds.

e. Ensure personnel are clear of the exit end of the lubrication collar during the lubrication process.

f. Ensure that all shackles and fittings are tightened prior to operation.

g. Do not run the system unless the airline lubricator has oil in it.

h. Ensure personnel wear steel-toed shoes, eye and hand protection when handling the wire rope during the cleaning/lubricating.

i. Dispose of any greasy rags or debris in accordance with the ship's local hazmat instructions (e.g., turn in to the ship's HAZMINCEN).

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**CHAPTER C5**

**REFERENCES**

C5-1. OPNAVINST 3500.39B

C5-2. Naval Ships' Technical Manual (NSTM) 613, Wire and Fiber

30 May 2007

## CHAPTER C6

### GROUND TACKLE AND TOWING

#### **C0601. DISCUSSION**

a. Ground tackle is a general term used to refer to the anchor, anchor chain, the anchor windlass, and auxiliary equipment. Although this chapter discusses the gypsy head, additional information is provided under general line handling precautions in chapter C5.

b. Personnel injury may result if any part of the anchor or its handling system fails when under strain. Precautions must be observed to avoid personnel injury or system damage resulting from excessive strain.

c. Towing is an evolution, which is seldom accomplished except in an emergency or for training. Due to the large inertia associated with the ships involved in the evolution, it can be extremely hazardous particularly if excessive strain is placed on the towline and its parts. Refer to ship towing bill and reference C6-1.

d. Complete an operational risk management (ORM) review before anchor handling or towing evolutions, and mitigate risks as feasible. Reference C6-1 contains additional guidance on ORM.

#### **C0602. GROUND TACKLE PRECAUTIONS**

a. All personnel shall wear snug fitting clothing, hand, eye and head protection, and steel toed safety shoes.

b. Check equipment to ensure it is in proper operating condition.

c. Ensure all equipment is lubricated and fluid levels are adequate.

d. Keep hands or feet off of moving anchor chains.

e. Beware of oily areas or ice on decks during cold weather. Clean up oil and spread salt and/or sand for ice. Keep decks clear of obstructions that may impede quick escape.

f. Ensure proper communications to the bridge and the machinery spaces have been established prior to any evolution.

g. Only enter the chain locker when no anchor operations are planned and only with OOD permission. Chain lockers should be entered only when the ship is in port. Space must be certified as gas free before entry (see chapter B8).

h. Check that the chain locker is clear and free for running before using the anchor.

i. Allow only the anchor/line detail in the ground tackle area during operations.

j. Set brake on windlass immediately when yellow painted chain link is visible.

k. Never allow the chain to run free without braking. Excessive payout speed can cause loss of the anchor, or injury to personnel.

l. Ensure anchor chain is securely fastened to the padeye in the chain locker when reinstalling the chain after painting.

m. If using chain stoppers, set and clear the immediate area before strain is put on the chain.

n. Always keep the hawser deck bolster pipe cover in place when not hoisting or letting go the anchor.

o. When first red chain link appears on deck and the brake fails to hold, clear the immediate area.

p. House anchor in hawse pipe shell bolster at the lowest possible speed.

q. Operate windlass at a low speed whenever chain out exceeds 60 fathoms.

r. If the chain tends around the stem, report the situation to the bridge. The chain must be allowed to run free or the sharp bend may damage links. Detachable links are particularly susceptible.

s. Replace anchor chain if corrosion has reduced the mean diameter to less than the criteria in reference C6-2.

t. Provide full body safety harnesses and safety lanyards for personnel assigned to lean over the side of the ship to hose down the anchor after hoisting.

u. Windlasses

(1) When at anchor, nothing shall interfere with the readiness to run, slip, or heave in the chain, or let go the spare anchor.

(2) When using the gypsy head, observe the following safety precautions:

(a) Never make a line fast to the gypsy head, but only to fittings provided for that purpose, such as cleats or bits.

(b) Disengage the wildcat shaft locking head and hold the wildcat by the brake.

(3) When using the capstan, observe the following procedures and safety precautions:

(a) Keep capstan heads free of gouges, paint, and rust.

(b) When using the capstan for heaving, ensure turns are taken in the right direction for heaving.

(c) Never make lines fast to capstans, but only to fittings provided for that purpose, such as cleats or bits.

(d) When handling lines on the capstan; when possible, position line handlers perpendicular to the line of pull.

(4) Ensure operating, safety, and lubrication label placards and test label plates are posted on or in the vicinity of windlasses or capstans.

(5) Ensure controls, brakes, and clutch levers are labeled properly.

(6) Never place any part of the body into moving machinery.

(7) Do not wear jewelry, neckties, cell phone, pagers, or loose fitting clothing while operating equipment.

(8) Wear proper protective clothing, eye and hearing protection, and equipment suited to the operation being performed.

v. Ensure that windlass test label plate, safety and operating placards, lubrication chart, and a ground tackle safety placard are posted near each anchor windlass.

**C0603. TOWING PRECAUTIONS**

Personnel involved in towing operations must be thoroughly trained, disciplined, and equipped not only to perform routine duties, but also to react appropriately to unusual or non-routine situations. The officers and crew of vessels involved in towing operations routinely should conduct safety indoctrination lectures and exercises aimed at reducing unsafe conditions or practices and at reacting appropriately to unusual circumstances through professional knowledge of their duties and towing procedures. Consult reference C6-3 for detailed precautions based on the type of towing evolution.

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**CHAPTER C6**

**REFERENCES**

C6-1. OPNAVINST 3500.39B

C6-2. Naval Ships' Technical Manual (NSTM) 581, Anchors and Anchoring

C6-3. U.S. Navy Towing Manual (SL 740-AA-MAN-010) (NOTAL)

## CHAPTER C7

### HELICOPTER OPERATIONS

#### C0701. DISCUSSION

a. Helicopters are used for varied operations at sea, including anti-submarine warfare (ASW), vertical replenishment (VERTREP) and search and rescue (SAR). Helicopters create special hazards. Catastrophic mishaps can severely damage a ship and cause injury and/or death.

b. Helicopter mishaps can happen at any time and can involve anything from a crash on takeoff or landing or can involve injury to ship's personnel from numerous areas, such as static electricity discharge during hoisting evolutions, inadvertent external cargo release during VERTREP operations, or injury from debris blow about by rotor wash.

c. These standards are written for all ships that are air-capable.

d. Consult references C7-1 and C7-2 for further details concerning specific procedures and related safety procedures.

e. Complete an operational risk management (ORM) review before any flight operations, and mitigate risks as feasible. Reference C7-3 provides additional guidance on ORM.

#### C0702. PRECAUTIONS

a. Avoid approaching within 50 feet of a helicopter when the rotor blades are turning, unless necessary. Whenever required to approach or leave a helicopter that has its blades rotating, remain in full view of the landing signalman, enlisted (LSE) and pilot and keep in a crouched position. Unless authorized, do not work in the area of the cockpit or cabin rearward while blades are rotating. Do not attempt to leave or approach a helicopter that is engaging or disengaging rotors. A crouched position with one side to the helicopter lowers the risk of being blown down or overboard by rotorwash.

b. Always wear complete flight deck uniforms, including cranials with double hearing protection and wind/sun goggles, when required during flight quarters. Long sleeve shirts must be

worn with sleeves rolled down at all times during flight operations. Personnel involved in flight deck operations including maintenance and refueling shall wear approved, non-sparking, safety shoes or boots with non-slip oil and fuel resistant soles.

c. Remove soft hats topside during helicopter landing or take-off.

d. Know the location and use of firefighting and lifesaving equipment.

e. Prohibit garbage dumping during helicopter operations.

f. Prohibit blowing tubes when helicopter is on or in close proximity to the flight deck.

g. FOD is the acronym for "Foreign Object Damage." It defines any article or object which may be disturbed by the wind across the deck or rotor wash and may cause damage to personnel, aircraft, or equipment. Conduct a FOD walkdown on the weather decks and flight deck prior to flight operations. FOD prevention is an all-hands effort. Carry nothing to the flight deck that you do not actually use there, and take inventory of all you have brought before you leave the deck. Report any missing items immediately.

h. Secure all hatches that open into the helicopter operating area. Scuttles and hatches that open into the aircraft operating area will be posted with the following notice:

**CAUTION:  
DO NOT OPEN DURING FLIGHT QUARTERS EXCEPT FOR  
EMERGENCY EXIT. NOISE HAZARD AREA - HEARING PROTECTION  
REQUIRED.**

i. During flight operations, permit only authorized personnel on the flight deck or weather areas adjacent to the flight deck. Personnel shall not stand in or otherwise block entrances to flight deck weather areas.

j. Do not take flash photography during flight operations.

k. Night operations are always most hazardous for both pilots and flight deck crews. Reduce the tempo of flight

operations in both volume and intensity when compared to day operations. Night operations are in effect from 30 minutes prior to sunset to 30 minutes after sunrise.

l. Flight operations and top side motor gasoline (MOGAS) fueling operations shall not be conducted in close proximity.

m. Follow approved hazard of electromagnetic radiation to ordnance (HERO) emission control procedures in accordance with reference C7-4.

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## CHAPTER C7

### REFERENCES

C7-1. Naval Warfare Publication (NWP) 3-04.1M/FMFM5-34, Shipboard Helicopter Operating Procedures

C7-2. Naval Warfare Publication (NWP) 3-50-1, Navy Search and Rescue Manual

C7-3. OPNAVINST 3500.39B

C7-4. NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010, Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel, and Other Flammable Material)

## CHAPTER C8

### WORKING OVER THE SIDE OR ALOFT; VERTICAL TRUNKS, DRY DOCK SAFETY

#### C0801. DISCUSSION

a. Since many areas on the exterior of a ship are inaccessible to the crew from decks or built-in work platforms, it becomes necessary to go "over the side" or "aloft" to reach these areas. "Over the side" shall be defined as anywhere outboard of the lifeline system. "Aloft" shall be defined as any mast, kingpost, or other structure where the potential for a fall exists. Access trunks, escape trunks, elevator trunks, dumbwaiter trunks and vertical pallet and package conveyor trunks are all vertical trunks where the potential for a fall exists.

b. The greatest hazard associated with working over the side or aloft is the danger of a fall. Other hazards include the dropping of objects on (or by) personnel, asphyxiation, electrical shock and radiation burns from transmitting antenna or radar.

c. When a ship is in dry dock, many of the precautions associated with working over the side or aloft must be followed. This chapter will discuss the hazards and precautions associated with this unique evolution.

d. Personnel suspended in a man basket over the side by a crane are subject to electrical shock and burn hazards from voltage induced in the hoist wire from transmitting antenna and radar. When personnel are suspended over the side by a crane, all precautions listed in this chapter shall be taken.

e. As a risk control measure, consider assigning a safety observer, whose only responsibility is safety, during any deck or seamanship evolution that could injure personnel or damage equipment. This safety observer should be knowledgeable in the proper performance of the evolution. Examples of deck evolutions include: operation of boat davits, rigging pilot and accommodation ladders, and handling lines.

#### C0802. GENERAL PRECAUTIONS

a. An appropriate check sheet shall be routed to the officer of the deck (OOD)/command duty officer (CDO) for

permission for working over the side or aloft. OPNAV5100/23, Working Aloft Check Sheet is available at Navy Forms On-line, <http://forms.daps.dla.mil>.

b. Wear a full body safety harness with safety lanyard, and tending line (as required) with double locking snap hooks. The harness shall be inspected in accordance with established planned maintenance system (PMS) prior to use. The lanyard length shall not exceed six feet or the distance from the work to six feet above the deck, whichever is shorter.

c. When performing hot work, replace personal safety and staging/boatswain (bosun) chair fiber lines with wire rope. Personal safety lines shall be corrosion resistant steel (CRES) wire rope.

d. Attach safety lanyards to all tools, if practicable. Never carry tools up and down ladders. Rig a line and raise/lower tools in a bucket.

e. Stop work when the ship begins to roll in excess of 10 degrees, or the ship begins to pitch in excess of five degrees, or wind speed is greater than 30 knots, or in an ice storm or when lightning threatens.

f. Ensure appropriate signal flags are hoisted. (KILO for personnel working aloft; KILO ONE is for personnel working over the side; KILO THREE is for personnel working aloft and over the side.)

g. When underway or when working near stacks or exhausts that are actively discharging gases, the commanding officer's permission is required to work aloft or over the side.

h. An experienced senior person shall check the rigging of the bosun chair or staging prior to use. Never rig lines over sharp edges. Inspect lines for damage, rot, and wear.

i. The petty officer in charge shall mark off an area and keep unnecessary personnel clear. He or she shall also maintain a sharp lookout for anything that would cause an increase in ship's motion or drastic change in direction. Personnel must not work over the side during maneuvers with other ships because of the unpredictable nature of these evolutions.

j. Read any safety placards (e.g., radio-frequency radiation warning signs) posted in the area prior to commencing work.

k. Cranes used to suspend personnel over the side shall be certified and work platforms or man baskets shall be approved by COMNAVSEASYS COM as safe for manned handling. Comply with the caution plates attached to the inside and outside of the man basket gate. Personnel suspended over the side by a crane are subject to radiation burn hazards from voltage induced in the hoist wire from transmitting antenna and precautions must be taken.

**C0803. PROCEDURES FOR WORKING OVER THE SIDE**

Complete OPNAV 5100/24, Working Over the Side Check Sheet, available at Navy Forms On-line, <https://forms.daps.dla.mil>, prior to commencing work over the side.

**C0804. PROCEDURES FOR PERSONNEL WORKING ALOFT**

Complete OPNAV 5100/23, Working Aloft Check Sheet, available at Navy Forms On-line, <https://forms.daps.dla.mil> prior to commencing work aloft.

a. Do not go aloft on masts, macks, stacks, or kingposts or be suspended over the side by a crane without first obtaining written permission from the OOD in the form of a working aloft checklist as described in paragraph C0802.

b. Wear the respiratory protection designated by the respiratory protection manager (RPM) when working near stacks or exhaust that are actively discharging gases.

c. Wear a **full body** safety harness with a safety lanyard, and climber safety device when going aloft where a climber safety rail is installed. If a climber safety rail is not installed, use a double lanyard configuration.

d. Prior to commencement of work and every 15 minutes thereafter, pass a verbal warning over the 1 MC, **"DO NOT ROTATE ANTENNAS, ENERGIZE OR RADIATE ANY ELECTRICAL OR ELECTRONIC EQUIPMENT WHILE PERSONNEL ARE WORKING ALOFT."** If personnel aloft are in the vicinity of the stacks add, **"DO NOT BLOW TUBES OR LIFT SAFETY VALVES WHILE PERSONNEL ARE WORKING ALOFT."**

e. Inform ships in the vicinity that personnel will be working aloft to ensure they take appropriate action on operation of electrical or electronic equipment.

f. Departments concerned shall ensure that all radio transmitters and radars that pose radiation hazards are placed in the STANDBY position and a sign placed on the equipment that reads: "SECURED. PERSONNEL ALOFT. DATE\_\_\_\_\_ TIME\_\_\_\_\_ INITIALS\_\_\_\_\_."

g. Position a safety observer on deck near the work being performed. Outfit the safety observer with a full body safety harness, safety lanyards, and climber safety sleeve to permit rapid emergency assistance aloft if required. The safety observer shall keep the deck area beneath the work aloft free of unnecessary personnel.

**C0805. DRY DOCK SAFETY PRECAUTIONS**

a. Personnel working over the side while in dry dock shall comply with the precautions indicated in this chapter with the exception that life preservers are not required in dry docks without water. Personnel working over the side in drydock will normally be in a man basket with full body safety harness and safety lanyard worn. On scaffolding with guard rails, a safety harness is not required.

b. Ensure all staging is adequately constructed and supported.

c. Only enter the dock with a hard hat, steel-toed safety shoes, and eye protection.

d. Shift no weights within the ship while in dry dock without the permission of the docking officer.

e. Ensure the ship is adequately grounded at all times.

f. Drain all lines subject to freezing, in freezing weather. If frequent service is required, maintain a small flow through the line to prevent freezing.

g. Ensure adequate topside lighting is provided by either installed dock lights or by temporary lighting, particularly in

areas where normal passage is obstructed or disrupted by service lines or work in progress.

h. Ensure that any equipment that projects through the hull is only operated with the permission of the commanding officer and then with a safety observer outside the hull.

i. Do not throw anything over the side into the dock, including debris from cleaning or preservation.

j. When carrying fuel of any kind in drydock, do not allow fuel to drain into the dock. Should it be necessary to remove fuel from tanks or receptacles while in drydock, take precautions that will prevent any of the fuel from reaching the floor of the dock.

k. Safety nets shall be rigged extending a minimum of six feet on both sides under all access brows between the ship and the dock apron.

l. Do not permit horseplay, leaning on lifelines or other negligent practices leading to falling over the side.

**C0806. OPERATING AERIAL LIFTS**

a. Before an aerial lift operation begins, the operator shall:

(1) Be qualified and licensed according to local instructions.

(2) Read and understand the operating instructions and safety rules for the equipment being used.

(3) Understand all decals, warnings, and instructions displayed on the work platform.

(4) Send the OOD and commanding officer OPNAV 5100/23 and OPNAV 5100/24 to request permission to work over the side or aloft. Copies of these check sheets are available at Navy Forms On-line, <https://forms.daps.dla.mil>.

(5) Inspect the lift for defects that would affect its safe operation. Be alert for cracked welds or other structural defects, leaks in the hydraulics, damaged control cables, loose wires, and bad tires.

(6) Test the operating controls to make sure they work, check the operating condition of the brakes, lights and other automotive-operating accessories, such as the horn and warning devices. Test all limit switches.

b. Lift operators observe these rules when working on, around, or over water:

(1) Wear inherently buoyant life preservers. Attach the safety lanyard to a staple or pad-eye inside the man basket. Do not attach safety harnesses or lanyards to the lift. Don't attach lanyards while over water.

(2) Ensure a paint punt is in the water near the lift operations (for rescue purposes).

(3) When using a lift on a barge, secure it to the barge with wire or tie-down.

(4) Do not alter or disable safety devices or interlocks.

(5) Make sure a supervisor watches lift operations from the pier.

(6) When personnel are working on a ship's sides, the supervisor must ensure the deck above the lift is free from hazards, especially falling objects.

(7) Wear hard hats with chin straps.

c. Before each elevation, the operator shall:

(1) Check for overhead obstructions and high-voltage conductors.

(2) Elevate the work platform on only a firm, level surface.

(3) Make sure the load and its distribution on the platform is according to the manufacturer's rated capacity. Never exceed the manufacturer's rated workload.

(4) Use the outriggers or stabilizers, if required, according to the manufacturer's instruction.

(5) Make sure guardrails on the platform are installed correctly and the gates or openings are closed.

(6) Check all occupants' harnesses and lanyards, making sure they are attached properly to a staple or padeye inside the man basket. Don't attach lanyards to objects outside the basket.

d. Before and while driving with the lift elevated, the operator shall:

(1) Look in the direction of, and keep a clear view of the path of travel. Make sure the path is firm and level.

(2) Maintain a safe distance from obstacles (ahead, behind, below, and above), debris, drop-offs, holes, depressions, ramps, and other hazards.

(3) Set the brakes and chock the wheels once stopped.

e. While using the lift, the operator shall not:

(1) Use ladders or makeshift devices on the platform to obtain greater height. Such practices are prohibited.

(2) Climb up or down extendible arms.

(3) Sit on or climb on the edge of the basket.

(4) Delay reporting any defects or malfunctions to the supervisor.

(5) Engage in stunt driving or horseplay.

**C0807. PROCEDURES FOR WORKING IN VERTICAL TRUNKS**

Complete OPNAV 5100/25, Working in Vertical Trunk Check Sheet, prior to commencing work in an elevator, dumbwaiter or conveyor trunk. This check sheet is available at Navy Forms On-line, <https://forms.daps.dla.mil>.

a. Personnel working in vertical trunks shall comply with the precautions indicated in this chapter with the exception that life preservers are not required. On scaffolding with guardrails a safety harness is not required.

b. Ensure all staging is correctly constructed and supported.

c. When replacing access trunk safety nets and staging has not been installed, work from below the net and attach the safety lanyard to a safety net staple.

d. Where elevator or dumbwaiter guardrails are not installed or available, safety lanyards shall be attached to the platform tie down fitting farthest away from the side of the trunk where work is being performed.

e. Personnel are prohibited from riding on the platform of cargo/weapons elevators in motion unless permission is obtained from the commanding officer, or his designee. If movement of an elevator platform cannot be avoided during maintenance, the following precautions shall be taken:

(1) Establish effective communication between all personnel before any platform movement.

(2) The preferred method of moving the platform is with the hoist motor de-energized and tagged out, manually releasing the brake.

(3) If releasing the brake will not allow proper positioning of the platform, jogging the platform in only the down direction is the next preferred alternative.

(4) If jogging down will not permit proper positioning of the platform, only as a last resort, the platform may be jogged in the up direction. This movement puts personnel at the greatest risk and should be avoided if at all possible.

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## CHAPTER C8

### REFERENCES

C8-1. Naval Ships' Technical Manual (NSTM) 772, Cargo and Weapons Elevators

C8-2. Naval Ships' Technical Manual (NSTM) 572, Shipboard Stores and Provision Handling

## CHAPTER C9

### ELECTRICAL AND ELECTRONIC SAFETY AND TAG-OUT PRECAUTIONS

#### C0901. DISCUSSION

Practically every piece of equipment on board ship requires electrical power. Radars, communication equipment, gun mounts, as well as lighting, portable tools, and personal equipment all use power from the ship. With electrical equipment and tools so commonplace, hazards involved with electricity are often taken for granted. Electrical shock is commonplace ashore, where the extra shipboard hazards of high-powered equipment, unstable work spaces, and saltwater are usually non-existent. Compared to other environments, the potential for electrical shock aboard ship is increased. Although ships' electrical/electronic systems are ungrounded, personnel and equipment may easily become a path to ground in cases of faulty wiring, resulting in injury or death or damage to equipment.

#### C0902. DEFINITIONS

a. "Electrical equipment" shall include generators, electrically powered machinery and mechanisms, power cables, controllers, transformers, and associated equipment.

b. "Electronic equipment" shall include radars, sonars, radios, power amplifiers, antennas, electronic warfare equipment, computers, and associated controls and peripherals.

#### C0903. ELECTRICAL PRECAUTIONS

a. General Precautions for Portable Electrical Equipment. Portable electrical equipment is any device that may be plugged into the ship's electrical power. All personnel using portable electrical tools shall:

(1) Wear electrical safety gloves when using electric portable tools in hazardous conditions, such as wet decks or bilge areas.

(2) Wear leather gloves over electrical safety gloves when the work being done could damage the rubber gloves.

(3) Conduct the required PMS on electrical safety gloves before issue/use. Inspect electrical safety gloves prior to storage and store them so they are protected from damage. Do not use electrical safety gloves for cleaning, painting, or any purpose other than electrical work.

(4) Wear required eye protection when working where particles may strike the eyes.

(5) Wear hearing protection (earplugs and/or circumaural muffs) when working with noise hazardous tools or in the area where such work is being conducted.

(6) Not use spliced cables on tool cords or extension cords.

(7) Not use any portable equipment that has a frayed cord or broken/damaged plug.

(8) Make sure that the on/off switch is in the "off" position prior to inserting/removing the plug from the energized receptacle.

(9) Always connect the cord of portable electrical equipment into the extension cord before the extension cord is inserted into an energized receptacle.

(10) Always unplug the extension cord from an energized receptacle before the cord of the portable electrical equipment is unplugged from the extension cord.

(11) Arrange the cords so that they will not create a trip hazard.

(12) Never pick up the tool by the electrical cord.

(13) When drilling/cutting through bulkheads, check the opposite side for cables and pipes.

(14) Only use electric equipment in explosive atmospheres including gasoline hazard areas if the equipment is approved for such use (explosion proof or intrinsically safe).

(15) Not allow cords to run through hatches, chemicals, scuttles, or watertight doors or over sharp objects or hot surfaces.

(16) Not join more than two 25-foot extension cords together.

(17) When it is necessary to run electrical leads through doors or hatches, protect the cord to guard against accidental closing of the door or hatch.

(18) Return portable electrical power tools, drop cords, and extension cords to the proper location at the end of the operation or workday to prevent damage to the equipment.

(19) Visually inspect portable cables for any signs of an unsatisfactory condition, such as tears, chafing, exposed insulated conductors, and damaged plugs and receptacles. Cables shall be of the proper length and cross-sectional area.

(20) Use only COMNAVSEASYSYSCOM-authorized extension or trouble lights for shipboard use to eliminate or drastically reduce the many hazards associated with the use of unauthorized commercial grade lights. The approved lights most frequently used aboard ships are:

(a) A caged, 100-watt incandescent bulb equipped with 50-foot, three conductor cable for use as a general multi-purpose extension light, NSN 9G 6230-00-701-2947.

(b) A small four-watt fluorescent tube for servicing electronic equipment. This light is of all plastic construction with no outside conductive surfaces. It is intended for use in open electronic equipment areas only. It is not explosion-proof and is not acceptable for use in hazardous atmospheres.

b. Do not touch a conductor, until it is properly tagged out of service and tested, to be sure it is de-energized or discharged.

c. Obey all warning signs; read equipment warning labels before use.

d. Never work on live (energized) electrical equipment without the commanding officer's permission and only per paragraph B0705 of this manual.

e. Always de-energize and "tag-out" with red "**DANGER, DO NOT OPERATE**" tags, installed electrical equipment before starting

any maintenance or repair. Test for energized circuits per reference C9-1.

f. Do not energize any electrical equipment that is danger tagged-out. Properly clear the tag first. If a caution tag is installed, ensure compliance with caution prior to energizing equipment.

g. Only use authorized equipment to perform maintenance on electrical equipment. Ground all metal-cased electrical equipment, except power tools verified to be double-insulated on the label and by electrical safety check.

h. Close all fuse boxes, junction boxes, switch boxes, and wiring accessories.

i. Use the one-hand rule when turning on electrical equipment. Never operate a switch with the other hand on a metal surface, which would provide a path to ground through the body.

j. Never use outlets that appear to be burnt or damaged. Do not use equipment with worn or damaged cords, or crushed or damaged plugs. They are not to be patched with electrical tape. Turn in such items immediately to electrical tool issue, informing them of the problem.

k. Ensure that "dead-man" switches work properly when installed.

l. Use an authorized voltage indicator to test whether equipment or circuits are energized.

m. Never remove overload relays except for replacement or preventive maintenance.

n. Never rewire bunk fans or lights or use bunk light wiring to install receptacles or other electrical equipment. Do not use non-government owned, personal, or contractor's electrical equipment, extension cords, tools, or lights without the commanding officer's permission.

o. Only install fuses of the rating specified on a fuse box or panel. Do not over-fuse. Identify fuse panels that are missing fuse-rating labels.

p. Do not connect single-phase 115v mobile equipment, permanently located and energized more than 50 percent of the time (copiers, personal computers and their peripherals, vending machines, and money machines) to the ship's isolated receptacle circuits. Connecting this equipment to the ship's isolated receptacle circuits may overload the circuits, resulting in fire hazards. Connect equipment of this type to a separate single-phase circuit through an isolation transformer supplied by the lighting distribution system. See reference C9-1 for temporary modifications to power such mobile equipment.

q. Do not use aluminum or metal portable ladders when working on electrical equipment.

r. Use only Navy-approved power strips for computer equipment, printers, and peripherals. Never use power strips in series (connected one to another).

s. Wear skin and eye protection when changing out battle lantern batteries.

**C0904. WET CELL BATTERIES**

a. The charging of wet cell batteries will produce hydrogen gas that may be ignited causing fire and explosion. Verify that wet cell battery compartments, which have been sealed, are first opened and well ventilated before entering, turning on any lights, making or breaking any electrical connections, or doing any work in the compartment. Verify that the ventilating apparatus of a wet cell battery compartment is running properly before starting to charge wet cell batteries, and that the exhaust ventilation interlock with the charger is operable. Keep the wet cell battery storage area or compartment well-ventilated during charging. Ensure that battery charging circuit ventilation fans are interlocked so that if power is lost to the fans, the battery charger turns off.

b. While wet cell battery charging is in progress, post a warning placard at the access to the wet cell battery storage area or compartment that reads:

**CAUTION: WET CELL BATTERY CHARGING IN PROGRESS.**

c. Prohibit smoking in the charging area.

- d. Prevent open flames, sparks, or electric arcs in wet cell battery charging areas.
- e. Keep uninsulated tools and other metallic objects away from the top of uncovered wet cell batteries. When using tools around a wet cell battery, do not allow tools to bridge the wet cell battery terminals or short circuit any part of the wet cell battery. Only tools with insulated handles shall be used on the wet cell battery.
- f. During normal use, keep cell service openings closed except when they must be opened to take readings or add water. When charging wet cell batteries, completely unscrew the wet cell battery cap, but leave the cap in place on top of the service opening. This will allow hydrogen gas, which is formed during the charging process, to escape but will minimize the release of acid or alkaline mist into the shop atmosphere. NOTE: This is not applicable to maintenance-free, sealed batteries.
- g. Keep cell tops clean.
- h. Never stow loose gear in the wet cell battery compartment. Gear such as cleaning rags, hydrometer boxes, pieces of wire, and tools must be removed immediately after use.
- i. Charge a wet cell battery only at the rate stated on its nameplate. Never charge a wet cell battery at a higher finishing rate than that stated on its nameplate.
- j. When charging several wet cell batteries at once, ensure the voltage of the charging line exceeds the total voltage of all the wet cell batteries being charged, but that the charging rate in amperes does not exceed the maximum charging rate of the wet cell battery in the line having the lowest ampere-hour capacity.
- k. Do not operate wet cell batteries above 52°C (126°F). When charging wet cell batteries, lower the charging rate immediately if wet cell battery reaches 52°C (126°F) or emits gas.
- l. When charging wet cell batteries, keep compartment temperature below 36°C (97°F), if possible.
- m. While current is flowing in the charging line, do not attempt to repair the connections of any wet cell battery or

connect/disconnect wet cell batteries from the line. Turn current off before attempting any of these procedures.

n. For lead acid batteries (not applicable to maintenance-free or sealed batteries):

(1) Do not add acid of specific gravity greater than 1.350 to a wet cell battery.

(2) Water added to a wet cell battery must be pure distilled water. Never add salt water to a wet cell battery or use salt water to wash out wet cell battery components. Salt water added to a wet cell battery will evolve extremely toxic chlorine gas.

(3) Do not pour water into concentrated sulfuric acid. The heat generated will cause a violent reaction. Sulfuric acid is highly corrosive. Wash up spillage with water and sodium bicarbonate. When handling acid or electrolyte, always wear personal protective equipment (PPE) consisting of a rubber apron, rubber boots, rubber gloves, chemical splash goggles, and a face shield. Store and dispose of battery acid in accordance with local hazardous material procedures.

o. Do not connect or disconnect batteries in compartments that may contain gasoline vapors. In any use of wet cell batteries, verify that all connections are tight to prevent loose connections that may cause sparks.

p. When wet cell batteries are used with one terminal grounded, always disconnect the grounded terminal first when replacing wet cell battery.

**C0905. LITHIUM AND MERCURY BATTERIES:**

a. Lithium batteries shall not be used aboard ship without specific approval of COMNAVSEASYSKOM, and in accordance with reference C9-2.

b. Primary batteries, especially mercury and lithium batteries, shall never be punctured, incinerated or recharged.

c. Dispose of mercury and lithium batteries in accordance with reference C9-3 and local hazardous material disposal procedures.

d. Turn the battery switch off when battery-driven equipment is not in use or battery charge becomes insufficient to operate equipment. Remove batteries from any equipment that is to be stored or shipped. Cover removed battery terminals with insulating material to prevent short circuits. In the case of equipment powered by dry batteries, remove batteries if equipment is to remain idle for 2 weeks or more. These batteries should be scrapped or stored.

e. Store batteries in an adequately ventilated and cool fireproof area.

f. Ensure alkaline batteries and equipment are segregated from lead acid batteries and equipment.

g. The B section of the Navy type 19026 battery can deliver an extremely serious or fatal shock. Avoid contacting the terminals of this high voltage battery.

**C0906. ELECTRICAL FIRES**

a. For electrical firefighting procedures see reference C9-41.

b. Battery Fires:

(1) A battery fire is nearly always preceded by an explosion. Great care is required fighting such a fire to avoid creating another explosion.

(2) The safest and most effective method for fighting a battery compartment fire is through oxygen starvation. Secure the compartment and stop all ventilation within, including agitation air, to deprive flames of oxygen.

**WARNING**

NEVER ATTEMPT TO EXTINGUISH A BATTERY FIRE BY POURING WATER ON THE BATTERY. THE HYDROGEN AND OXYGEN GENERATED BY ELECTROLYSIS COULD PRODUCE A VIOLENT EXPLOSION.

c. Electrical Fire Prevention:

(1) Keep electric motors and generators clean.

- (2) Ensure proper maintenance is performed on electrical equipment (i.e., motors, generators, bearings, and filters).
- (3) Report overheating or arcing electrical equipment.
- (4) Keep air filters clean.
- (5) Do not overfuse.

**C0907. FIRST AID FOR ELECTRICAL SHOCK**

a. Fundamentally, electrical current rather than voltage is the criterion of shock intensity. The passage of even a very small current through a vital part of the human body can cause death. The voltage necessary to produce the fatal current is dependent upon the resistance of the body, contact conditions, the path through the body, etc.

b. It is imperative to recognize that the resistance of the human body cannot be relied upon to prevent a fatal shock from 115 volts or even lower voltage; fatalities from as low as 30 volts have been recorded. Tests have shown that body resistance under unfavorable conditions may be as low as 300 ohms and possibly as low as 100 ohms from temple to temple if the skin is broken. Volt for volt, DC potentials are normally not as dangerous as AC as evidenced from the fact that reasonably safe "let-go currents" for 60 hertz alternating current is 9.0 milliamperes for men and 6.0 milliamperes for women while the corresponding values for direct current are 62.0 milliamperes for men and 41.0 milliamperes for women.

(1) **Electrical Shock Symptoms.** In the event of severe electrical shock, the victim could become very pale or "bluish." His/her pulse is extremely weak or entirely absent, unconsciousness is complete, and burns are usually present. The victim's body may become rigid or stiff in a few minutes. This condition can be caused by muscular reaction to shock, and it should not be considered as rigor mortis. Therefore, artificial respiration shall be administered immediately, regardless of body stiffness, as recovery from such a state has been reported. Consequently, the appearance of rigor mortis shall not be accepted as a positive sign of death.

(2) **Victim Rescue.** The rescue of electrical shock victims is dependent upon prompt administration of first aid.

All electronic and electrically-trained personnel shall be trained annually in cardiopulmonary resuscitation (CPR) procedures by an instructor certified by an authorized agency, such as the American Red Cross or the American Heart Association.

**CAUTION**

Do not attempt to administer first aid or come in physical contact with an electrical shock victim before the power is shut off, or, if the power cannot be shut off immediately, before the victim has been removed from the live conductor.

(3) When attempting to administer first aid to an electrical shock victim, proceed as follows:

(a) Shut off the power.

(b) If the power cannot be deactivated, per step (a), remove the victim immediately, observing the following precautions.

1. Protect yourself with dry insulating material.

2. Use a dry board, belt, dry clothing, or other available non-conductive material to free the victim (by pulling, pushing, or rolling) from the power-carrying object. DO NOT TOUCH the victim.

(c) Immediately after removal of the victim from the power-carrying object, administer CPR.

(d) When providing first aid measures, take into account any possible spinal injuries or fractures.

**C0908. ELECTRONIC PRECAUTIONS**

**a. Definitions**

(1) **Repair.** Removal or replacement, by any method, of any component, subassembly, module, circuit card, or conductor to bring malfunctioning equipment back to an operational status.

(2) **Corrective maintenance.** Alignment, adjustment, tuning, or trouble shooting of malfunctioning equipment per published maintenance or technical manual procedure.

(3) **Preventive maintenance.** Alignment, adjustment, tuning, or testing of operational equipment to ensure performance within published maintenance card or technical manual procedures.

b. Repair of electronic equipment is normally accomplished with the circuit de-energized. Every effort should be made to avoid making repairs to energized equipment. DO NOT repair energized electronic equipment unless you are using approved procedures from technical manuals or other documentation, or an emergency condition exists and the commanding officer has granted permission to perform such repair. In such an emergency, trained personnel shall accomplish the repair of energized circuits and an experienced technician or officer shall supervise. Electronic repair personnel should observe the safety precautions in section 3-4 of reference C9-5.

c. Corrective maintenance on energized electronic equipment is authorized when done according to published maintenance or technical manual procedures. Freelance corrective maintenance (i.e., without a published procedure) on energized electronic equipment shall be performed ONLY with the specific permission of the commanding officer.

d. Preventive maintenance on energized electronic equipment is authorized when it is according to a published maintenance requirement card or technical manual procedures.

e. Perform preventive or corrective maintenance on energized electronic equipment only when duly authorized and trained on that type of equipment.

f. Whenever work on energized electronic equipment exposes the technician to 30 volts or greater the following precautions shall be adhered to:

(1) Study the applicable schematic and wiring diagrams before servicing.

(2) Research into or enter energized electronic equipment enclosure for the purpose of servicing or adjusting only when prescribed by applicable technical manuals, maintenance requirement card, or other approved documentation.

(3) Obtain the commanding officer's permission whenever work on energized electronic equipment deviates from published corrective or preventive maintenance procedures.

(4) Station a safety observer capable of securing power and rendering adequate aid in the event of an emergency.

(5) Provide warning signs and suitable guards to prevent personnel from coming in accidental contact with dangerous voltage.

(6) Obey all warning signs and heed all equipment warning labels.

(7) Insulate the work from ground with approved electrical grade rubber matting. Installation requirements for electrical grade matting are contained in reference C9-6.

(8) Remove or snugly secure any loose clothing. Remove all jewelry.

(9) Insulate all metal tools.

(10) Use only one hand, if practical, in accomplishing the work.

(11) Wear electrical safety gloves on both hands, if possible. If the nature of the work is too cumbersome to wear gloves on both hands, then a glove shall be worn on the non-working hand.

g. Reaching into de-energized equipment also requires special care and precaution.

(1) Study the applicable schematic and wiring diagrams before servicing.

(2) Ensure you are familiar with all circuits that must be de-energized and all voltage storing and high voltage components.

(3) Discharge all voltage storing components with an approved shorting probe.

(4) Do not touch a conductor or electronic component unless you have proven it to be de-energized by using a known good voltage tester.

h. Removal of a unit or part from the normal location within an assembly and the energizing of the unit or part, while it is outside the normal enclosure, removes the protective features such as interlocks, grounded, and enclosures. These safety features may then no longer function as designed. Ground the chassis and frame of all units removed for servicing and ground all circuits normally grounded in operation whenever power is applied to the unit.

i. Do not energize any equipment that is danger tagged-out. Properly clear the tag-out first. If a new caution tag is installed, ensure compliance with the caution before energizing equipment.

j. Never defeat an interlock or built-in safety device. Modify such safeguard circuits only as authorized by the cognizant system command.

k. Refer to references C9-1 and C9-5, Chapter 3, for additional precautions regarding electric systems.

**C0909. ELECTRICALLY AND ELECTRONICALLY SAFE WORK BENCHES**

Electrical and electronic work benches shall be constructed and maintained in accordance with appendix H of reference C9-1.

a. Workbenches used to work on energized electrical and electronic equipment must be insulated on the top working surface and below to reduce shock hazard to personnel.

b. All exposed metal on the work bench, including drawer fronts, shall be insulated per appendix H of reference C9-1. Any adjacent metal, such as filing cabinets or bulkheads which could be contacted by the person working at the workbench shall be insulated.

c. Workbenches shall be grounded to the hull and have equipment grounding leads.

d. The deck in front of the workbench shall be covered with electrical grade matting, MIL-M-15662, type 1, per reference C9-6.

e. A quick disconnect push-button switch (or switches for large spaces) to secure power to the workbench shall be installed in a visible location, readily accessible, and clearly identified,

48 to 54 inches above the deck, and within a red painted target, and labeled with a sign stating "FOR EMERGENCY USE ONLY. WORKBENCH DISCONNECT SWITCH."

f. In large spaces, all disconnect switches shall be interlocked so activation of one secures all power to all benches.

g. Each workbench shall be labeled with a sign indicating if it is or is not electrically safe.

h. Signs on the rescue of personnel in contact with energized circuits, and CPR placards shall be posted near or adjacent to each workbench.

**C0910. TAG-OUT**

Tagging-out of electrical or electronic energy sources shall be conducted in accordance with reference C9-7.

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**CHAPTER C9**

**REFERENCES**

C9-1. Naval Ships' Technical Manual (NSTM) 300, Electrical Plant - General

C9-2. NAVSEA S9310-AQ-SAF-010, Technical Manual for Batteries, Navy Lithium Battery Safety Program Responsibilities and Procedures

C9-3. OPNAVINST 5090.1B

C9-4. Naval Ships' Technical Manual (NSTM) 555, Volume 1, Surface Ship Firefighting

C9-5. NAVSEA SE 000-00-EIM-100, Electronics Installation and Maintenance Book (EIMB), General Handbook

C9-6. Naval Ships' Technical Manual (NSTM) 634, Deck Coverings

C9-7. NAVSEA S0400-AD-URM-010, Tag-Out Users Manual (TUM) (NOTAL)

## CHAPTER C10

### SHIPBOARD FUELS

#### C1001. DISCUSSION

a. Fuels are used to power the ship, emergency auxiliary equipment, aircraft, vehicles, small boats, and a multitude of smaller pieces of machinery. There are several types of fuels in use, each with its own characteristics and traits. It is impossible to cover all the scenarios that can occur with shipboard fuels; however, this chapter will cover the main points.

b. The biggest hazard with shipboard fuels is explosion and fire. Other hazards include asphyxiation, body burns, eye and respiratory difficulties, and environmental hazards. Due to the incredible impact a shipboard explosion and fire would have, the possibility that a catastrophe could occur should constantly be in the minds of all personnel, especially those involved in fuel storage and transfer operations.

c. Complete an operational risk management (ORM) review before refueling operations and mitigate risks, as feasible. Reference C10-1 contains additional guidance on ORM.

#### C1002. DEFINITIONS

a. Hazardous areas are locations where hazardous vapors (whether physical or health hazard) could accumulate.

b. Gasoline hazard areas (GHAs) are those areas where gasoline vapors may be present in quantities sufficient to produce explosive or ignitable mixtures. This includes gasoline stowage, handling, and transfer areas, gasoline pump rooms, spaces connected to GHA by common ventilation, and up to 15 feet away horizontally from an open GHA.

c. Class I flammable liquids are fuels and other liquids with a flashpoint of 100 degrees Fahrenheit (38 degrees centigrade) or less as defined by reference C10-2 and C10-3. Class I flammable liquids in contact with air will release flammable vapors under most typical shipboard conditions.

**C1003. PRECAUTIONS**

- a. Never smoke in fuel storage or transfer areas.
- b. Prohibit any open flames, hot work, or the use of non-explosion-proof fixtures or equipment near fuel storage or transfer areas. Fluorescent fixtures are permitted in areas in which JP-5 or F-76 fuel is handled.
- c. Ensure forced ventilation is in operation during fuel transfers.
- d. When working in motor gasoline (MOGAS) tanks, do not wear, and do not allow others to wear, shoes with steel clips, metal key chains, metal belt buckles, pagers, cell phones, buttons made out of spark producing material, or clothes made of static generating material such as wool, silk, nylon, or Nomex®.
- e. Always ventilate fuel tanks and obtain gas free engineer's certification before entering.
- f. Never enter a tank to aid an unconscious crewmember without proper emergency breathing apparatus, such as a self-contained breathing apparatus (SCBA), and a back-up person standing by. The back-up person shall also be equipped with the proper emergency breathing apparatus.
- g. Detect leaks and make immediate repairs in all fuel systems. Report and clean up pools of leaked or spilled fuel immediately using appropriate hazardous material (HM) or oil spill cleanup equipment and procedures. Dispose of fuel contaminated rags and materials as directed by the ship's hazardous material (HM) coordinator.
- h. Inspect tanks, piping, cargo hoses, pumps, and communication equipment before transferring fuel. Ensure a drip pan is under all transfer hose connections and that gaskets are in place in hose joints and couplings.
- i. Store oily wastes and rags in an approved container and empty it daily in accordance with local hazardous material procedures.
- j. Do not discharge fuel or oily wastes over the side. Do not allow spilled fuel or oily wastes to go over the side. Use

rags or absorbent materials to stop running fuel and report the spill immediately to your supervisor.

k. Avoid excessive contact with fuel(s). Remove fuel soaked clothing and thoroughly wash exposed skin after incidental contact. Personnel who suspect that they have injected or inhaled fuel, or are having a skin reaction to fuel contact, should immediately seek medical attention.

l. Wear eye protection and use respiratory protection if required by the respiratory protection manager (RPM).

m. When in canisters or drums, flammable fuels shall be placed on the weather deck if no flammable storeroom is provided. Gasoline storage shall be in remotely jettisonable racks on the weather decks. Do not store near heat sources or near ventilation intakes.

n. Close hatches, doors, and ports in vicinity of tank vents while transferring fuel.

o. During refueling, close and secure all portholes on the engaged side of the ship. Place oil or fuel absorbent materials at deck edge openings and scuppers to prevent spills from running over the side.

p. Ensure exhaust ventilation and gas detection systems are operational in enclosed spaces used for storage, use or handling of low flashpoint liquids (such as gasoline) prior to entering. Any work in these spaces shall include a dedicated fire watch equipped with a charged potassium bicarbonate dry powder (PKP) portable fire extinguisher or equivalent. See reference C10-4 for ventilation and detection systems details.

q. Ignition sources are prohibited in hazardous areas containing class I flammable liquids and flammable gases. This includes smoking, open flames, spark producing tools, hot work, electrostatic discharges, and non-approved electrical equipment and components (e.g., explosion-proof or intrinsically safe).

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**CHAPTER C10**

**REFERENCES**

C10-1. OPNAVINST 3500.39B

C10-2. 29 CFR 1910.1200, Hazardous Communication Standard

C10-3. National Fire Protection Association (NFPA) Standard 30, Flammable and Combustible Liquids Code

C10-4. Naval Ship's Technical Manual (NSTM) 542, Ventilation and Detection Systems

## CHAPTER C11

### WELDING, CUTTING, BRAZING, AND HOT WORK

#### C1101. DISCUSSION

a. The convenience of metal arc and gas welding and cutting lies largely in the fact that the equipment can be taken to the job. This convenience leads to the performance of construction or repair jobs in locations that have not been designed for such concentrated heat, or mixtures of toxic or explosive gases. The failure to take proper precautions, during welding or cutting operations in such spaces, presents a serious fire, explosion, electric shock, and health hazard.

b. Health hazards common to welding, cutting, and brazing are numerous. In addition to electric shock, burns to the eyes and skin can be caused by sparks, molten metal, and ultraviolet and infrared radiation. Fumes and gases generated by welding can produce ozone and oxides of nitrogen which are poisonous. Lead, zinc, chrome, and cadmium in alloys (strips or wire in coils or rods) produce toxic fumes. Paints and coatings may produce toxic gases when heated by the flames of the welding torch. Additionally, some metal fumes are capable of producing metal-fume fever. Local exhaust ventilation is a must to remove excessive concentrations of air contaminants. Welding in closed, unventilated spaces can result in respiratory irritation or poisoning of personnel.

c. Hot work includes:

(1) Flame heating, welding, torch cutting, brazing, or carbon arc gouging.

(2) Any operation which produces temperatures of 400 degrees Fahrenheit or higher.

#### **NOTE:**

Operations not producing **hot** sparks or flames such as spark-producing or arc producing tools or equipment, static discharge, friction, open flames or embers, impact, and non-explosion-proof equipment such as lights, fixtures, or motors are not considered hot work unless

occurring in the presence of flammable liquids or in a flammable atmosphere.

d. Hot work is divided into two classes where only class alpha materials, such as ordinary combustibles (wood, cloth, paper, rubber, and many plastics) are exposed. These classes are:

(1) **Class I.** These processes produce either high energy sparks or slag that can be thrown or dropped at the work site or produce heat that can be transferred through the deck, overhead, bulkhead, or structure to a location not visible to the hot work operator. This class includes:

- (a) Flame cutting
- (b) Welding
- (c) Plasma cutting
- (d) Arcing and gouging
- (e) Electric arc welding
- (f) Thermal spraying

(g) Other hot spark or flame producing process not included in class II.

(2) **Class II.** These processes produce flames or minimal energy sparks or slag that is generally localized to the immediate work area. This class includes:

- (a) Stud welding with an electric stud gun
- (b) Gas-tungsten-arc welding (GTAW)
- (c) Torch brazing
- (d) Ferrous metal grinding with abrasive disks.

#### **C1102. PRECAUTIONS**

##### a. Clothing and Protective Equipment.

(1) Use the appropriately shaded welder's goggles, welder's helmet, or welding faceshield, as well as

flameproof/leather gloves, jackets, leggings and boots, as required by reference C11-1, the industrial hygiene survey, or other applicable reference. A respirator may be required if indicated by the respiratory protection manager (RPM).

(2) Remove lighters from pockets during hot work.

(3) Do not wear synthetic-fiber clothing.

(4) Do not roll up sleeves, cuffs, or have open pockets.

(5) Always wear a welder's jacket or sleeves and apron while welding. Helmets and face shields shall be fitted with the proper filter and cover lenses.

(6) Always wear electrical safety gloves when removing or replacing electrodes, or handling energized holders, layout tables, or equipment. The gloves shall be dry and in good condition.

(7) Consult with the respiratory protection manager for specific guidance regarding respirator needs or selection. Cartridge respirators, when properly selected (see chapter B6), will protect against metal fumes generated during welding. They do not provide oxygen, which may be necessary when working in a confined space. They also do not protect against hazardous gases that may be generated during welding, if sufficient ventilation is not available, particularly with metal inert gas (MIG) and tungsten inert gas (TIG) welding. Where either condition exists, use a supplied air respirator. Consult the RPM about respirator use and selection.

(8) To protect passers-by from ultraviolet (UV) arc flash and combustible materials from sparks, use NAVSEA-approved welding curtains or panels, as specified in reference C11-1.

b. Space Precautions

(1) Observe the following precautions during the performance of hot work:

(a) Do not perform hot work when flammable liquids or flammable atmospheres are present without specific instructions of the gas free engineer.

(b) Inspect the other side of the bulkhead, deck, overhead, or other structure to ensure that hot work will not damage materials or equipment that may be on the other side of the hot work operation.

(c) Remove explosive materials and flammable liquids or vapors and take suitable precautions against the re-accumulation of such materials. For welding in magazines or adjacent to magazines, refer to reference C11-2.

(d) Where practicable, relocate all combustibles at least 35 feet from the work site. Where relocation is impracticable, protect combustibles with metal guards or curtains constructed of MIL-C-24576 material. Tighten edges of covers at the deck to prevent sparks from going underneath the covers. This precaution is also important at overlaps where several covers are used to protect a large pile of combustibles.

(e) Protect intricate and vulnerable machinery and equipment from falling sparks or other potential sources of fire with metal guards or curtains constructed of military specification (MIL-C-24576) material. Secure the protection in-place before commencing hot work.

(f) For hot work processes that generate slag, weld splatter, or sparks, cover openings in decks, bulkheads, or overheads within 35 feet which can be a path to prevent ignition sources from passing into adjacent compartments, spaces, or decks below. A complete containment system as described in reference C11-1, section 10 meets this requirement. If openings cannot be covered, post a fire watch on the far side.

(g) Blank off ducts and conveyor systems that might carry sparks to distant combustibles or otherwise suitably protect.

(h) When hot work is done near decks, bulkheads, partitions, or overheads of combustible construction, take precautions to prevent ignition.

(i) Do not undertake hot work on pipes or other metal in contact with insulation or combustible decks, bulkheads, partitions, or overheads if the work is close enough to cause ignition by heat conduction.

(j) Do not start hot work in areas other than those specifically designated for hot work, such as welding shops, without approval of the commanding officer or his/her designated representative. Abrasive disk grinding with a small wheel (typically 3-inch diameter or less) does not require notification or approval.

(k) De-energize electrical equipment exposed to the hot work.

(2) Ensure that a gas free engineer's survey has been completed before working in tanks, voids, or other confined spaces, including adjacent spaces (especially if those tanks contained flammable liquids or vapors) if these spaces are identified as a confined space per chapter B8.

(3) Notify the damage control assistant (DCA) or fire marshal before starting hot work.

(4) Conduct hot work in or on fuel tanks, in spaces in which fuel tank vents terminate, or in other confined spaces known to contain flammable fuel, only with the commanding officer's approval.

(5) Set fire watches as follows:

(a) In **confined or enclosed spaces, machinery rooms, catapult rooms, bilges, and other locations proximate to flammable atmospheres** (e.g., near fuel tank vents and sounding tubes), post fire watches at the worksite when hot work is undertaken. After completion of the hot work operation, fire watches shall remain on station for a minimum of 30 minutes, ensure that the area is cool to the touch, and ensure that no smoldering embers remain.

(b) For **class I hot work**, post fire watches when hot work is undertaken. The fire watches shall stand watch for fire for 30 minutes after hot work is completed.

(c) For **class II hot work**, the DCA, fire marshall, or individual designated in writing by the DCA shall determine the need for a fire watch in addition to the hot worker based on his or her assessment of the worksite prior to undertaking hot work. When posted, the fire watch(s) shall stand watch for 30 minutes after hot work is completed.

**NOTE:**

Abrasive disk grinding on a ferrous material with a large wheel (larger than three inches in diameter) typically throws large sparks long distances. A fire watch is recommended for large wheel grinding when class alpha materials (ordinary combustibles) are exposed. The DCA or fire marshall shall determine the need for a fire watch.

(d) When a fire watch is not required for class II hot work, the hot worker shall have the appropriate fire extinguishing equipment available. The hot worker may leave the site after hot work is completed and after he/she has conducted a thorough survey of the area to check for smoldering fires. When grinding a ferrous material with a large abrasive disk wheel (larger than three inches in diameter), the hot worker shall stand watch for 30 minutes after the hot work ends.

(e) When any type of hot work is being performed on bulkheads, decks, or overheads where sparks or heat transfer may ignite combustibles on the opposite, accessible side, set a fire watch on the far side.

(f) The hot worker and the hot worker's supervisor are responsible for ensuring fire watches are in place prior to starting work.

(g) Train fire watches per section 10 of reference C11-3.

(h) Equip fire watches with personal protective equipment (PPE) as required for the operation being conducted and anticipated hazards.

(i) When more than one fire watch is required, establish a communication means between fire watches.

(6) Ensure fire extinguishing equipment is available in immediate area. The types of fire extinguishing equipment fire watches shall use are specified in section 10 of reference C11-3.

(7) Provide ventilation as specified in reference C11-1, industrial hygiene survey, gas free chit, or hot work chit.

(8) Personnel in areas adjacent to welding areas exposed to arc-produced ultraviolet radiation shall be protected by providing screens, appropriate eye protection or other approved means.

(9) Never weld near a source of halocarbons, such as chlorinated solvents (i.e., trichloroethane) or refrigerant gases. Phosgene gas can be produced when halocarbons are exposed to high temperatures.

(10) Do not perform hot work during fueling or ammunition transfer operations. AS-type ships are exempted from this requirement, but shall comply with the requirements of reference C11-4 while performing hot work or ammunition handling.

c. Practices

(1) Never use oxygen to operate pneumatic tools, on oil preheating burners, start internal combustion engines, blow out pipe lines, blow dust from clothing or work areas, create pressure, or for ventilation purposes.

(2) Do not carry oxygen, acetylene, or other fuel gas cylinders into confined spaces. Use leads of an appropriate length to reach the work area while properly securing gas cylinders away from the confined space point of entry.

(3) Always return cylinders to the storage racks when work is completed and ensure cylinders are secured in place by metal retaining collars.

(4) Ground and bond all electrical welding equipment before use.

(5) Stand on a dry surface or insulating material if surface is not completely dry to avoid potential electric shock.

(6) Never permit the metal part of the electrode or the electrode holder to touch the bare skin or any damp clothing, which the operator may be wearing. Do not loop the welding cable over your shoulder or other parts of your body. Operators have been dragged off staging or scaffolds when the welding cables were fouled by other workmen or moving equipment.

(7) When stopping work for a significant time (lunch or overnight), remove the electrode from the electrode holder,

deenergize the equipment and disconnect welding supply cable from the welding machine.

(8) When using portable machines, ensure that the primary supply cables are separately laid out and do not become entangled with welding supply cables.

(9) Inspect work and electrode lead cables regularly for wear and damage. Replace cables with damaged insulation or exposed conductors. Use connecting devices specifically intended for the purpose when joining lengths of supply and electrode cables. Adequately insulate the connecting devices for the proposed service conditions.

(10) Keep welding cables dry and free from grease and oil, wherever practical, to prevent premature breakdown of the insulation which could cause serious short circuits.

(11) Suitably support cables overhead when necessary to run them some distance from the welding machine. If this cannot be done, and cables are laid on deck, protect them in such a manner that they will not be damaged or interfere with safe passage of personnel. Take special care to see that welding supply cables are not close to power supply cables, lighting circuits, or any equipment that utilizes magnetic tapes or depends upon a magnetic principle for operation. Block hatches and doors to prevent damage to welding cables.

(12) Protect welding equipment used in the open from weather conditions (e.g., rain, sleet, snow, spray, etc.) to prevent short circuiting.

(13) Do not smoke cigarettes or use other forms of tobacco while welding or brazing.

d. Cylinder Safety

(1) Store individual cylinders securely fastened in the upright position (valve end up) by metal collars, with each cylinder independently fastened, and ensure that the cylinder valve protection caps are in place.

(2) Store flammable and explosive gases securely on the weather decks protected from direct exposure to the sun or in flammable compressed gas cylinder storerooms.

(3) Never store flammable gases with oxidizing gases. Typical oxidizing gases are oxygen and chlorine. Compressed gases such as helium, carbon dioxide, nitrogen, and argon can be stored with all gases except acetylene, oxidizing or flammable gases. Ensure inert gases are segregated and readily identifiable.

(4) Do not lift cylinders by valve-protection caps. Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen in place or otherwise fixed. Use warm (not boiling) water to defrost.

(5) Close valves of empty cylinders.

(6) Place cylinders a safe distance away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. Use fire-resistant shields.

(7) Do not place cylinders where they might become part of an electric circuit. Contacts with energized equipment shall be avoided. Cylinders shall be kept away from radiators, piping systems, or layout tables that may be used for grounding electric circuits, such as for arc welding machines. Any practice, such as the tapping of an electrode against a cylinder to strike an arc, is prohibited.

(8) Never use cylinders as rollers or supports, whether full or empty.

(9) Do not change or alter the numbers and markings stamped into cylinders.

(10) Never attempt to mix gases in a cylinder. Unauthorized personnel should never refill a cylinder.

(11) Unless connected to a manifold, do not use oxygen from a cylinder without first attaching an oxygen regulator to the cylinder valve. Before connecting the regulator to the cylinder valve, open the valve slightly for an instant and then close valve. Always stand away and to one side of the outlet when opening the cylinder valve.

(12) Do not use hammers or wrenches to open cylinder valves. If valves cannot be opened by hand, the cylinder should be returned to supply.

(13) Do not tamper with, or attempt to repair, cylinder valves. If trouble is experienced, remove from service, tag as defective and notify the supplier, indicating the character of the trouble and the cylinder's serial number. Follow supplier's instructions as to its disposition.

(14) Do not remove the stem from a diaphragm-type cylinder valve.

(15) Always place the fuel-gas cylinders with valve end up. Store and ship liquefied gases with the valve end up. Prior to use, store acetylene cylinders in a vertical position for a minimum of two hours to stabilize the gas.

(16) Handle cylinders carefully. Rough handling, knocks, or falls are liable to damage the cylinder, valve, or safety devices and cause leakage.

(17) Close the cylinder valve and release the gas from the regulator before the regulator is removed from a cylinder valve.

(18) Do not place anything on top of an acetylene cylinder which may damage the safety device or interfere with the quick closing of the valve.

(19) Never use fuel gas from cylinders through torches or other devices equipped with shutoff valves without reducing the pressure through a regulator attached to the cylinder valve or manifold.

(20) Do not use copper tubing with acetylene gas cylinders due to the potential of an explosive chemical reaction to take place.

**C1103. EXTRA PRECAUTIONS FOR WORK IN RESTRICTED ACCESS SPACES**

a. For the purpose of this section, a restricted space shall mean:

(1) A space with only one exit and,

(2) A space where equipment or structural barriers prevent easy exit or entrance.

b. Ensure proper ventilation is available to permit work in restricted access spaces. When sufficient ventilation cannot be

obtained without blocking the means of access, personnel in the confined space shall be protected by supplied air respirators. Ensure space has been certified gas free, if the space is unmanned and ventilation is non-existent or the space is used to store hazardous material.

c. Leave gas cylinders and heavy welding or cutting equipment outside the restricted access space.

d. Station an attendant outside with instructions to observe the welding operator at all times, and in case of emergency, immediately shut off the gas or welding machine and render such help as the occasion warrants.

e. If entering a restricted access space through a manhole or other small opening, provide means for quick personnel removal in case of an emergency. When safety belts and lifelines are used for this purpose, they shall be so attached to the body that the body cannot be jammed in a small exit opening.

f. If the access fitting to a restricted access space is remotely controlled, ensure measures are taken to secure and DANGER tag-out remote-control equipment to avoid accidental closing of doors.

g. If work in a restricted access space is suspended for any substantial period of time, remove electrodes from the holders of arc welding equipment. One of the three following precautions must be taken:

(1) Remove all arc welding equipment from the restricted access spaces.

(2) Disconnect all such equipment from the source of power. This shall always be done if the equipment is to be left overnight.

(3) Positively insulate all such equipment, including the electrode holder, so that no accidental contacts can be made even if the equipment is moved during this period.

h. In the case of gas welding equipment, always close the torch valves and the gas supply to the torch, when not actually in use, to eliminate the possibility of gas escaping through leaks or improperly closed valves. The gas supply to the torch must be able to be positively secured from outside the space.

Torches shall remain in restricted-access spaces only for the period necessary to perform the required hot work. Overnight and at the change of shifts, the torch and hose shall be immediately removed from confined spaces when they are disconnected from the torch or other gas consuming device.

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## CHAPTER C11

### REFERENCES

- C11-1. Naval Ships' Technical Manual (NSTM) 074 (V1), S09086-CH-STM-010, Welding and Allied Processes
- C11-2. NAVSEA OP-4, Ammunition and Explosives Safety Afloat
- C11-3. Naval Ships' Technical Manual (NSTM) 555 (V1), S9086-S3-STM-010/CH-555V1R10 15 July 2003
- C11-4. OPNAVINST 8020.14

## CHAPTER C12

### SHIPBOARD AIRCRAFT SAFETY

#### C1201. DISCUSSION

a. This chapter applies to fixed-wing and/or rotary wing operations on ships that have full flight and hangar decks (CVs, CVNs, LHAs, LHDs, and MCS).

b. Flight decks are hazardous and the danger to personnel goes beyond the possibility of crashes. Air intakes on jet engines can actually suck personnel off the deck and into the engine. Jet engine exhaust can propel personnel into other objects or over the side of the ship. Propellers and rotor blades can maim or kill. Aircraft carry ordnance and fuel that can cause fires and explosions. Moving aircraft can hit personnel. The ship itself is pitching and rolling. For these reasons, personnel whose job requires them to work on the flight deck must be constantly alert to many hazards to avoid injury or death.

#### C1202. GENERAL FIRE PRECAUTIONS

##### a. Smoking

(1) Do not smoke or permit open flames on flight/hangar decks, sponsons, and weather decks.

(2) Only smoke in designated smoking areas.

##### b. Open Flames/Ignition Sources

(1) Do not permit open flames or other ignition source in the vicinity of flammable liquids, gases, or explosive ordnance.

(2) Provide continuous fresh air or properly designed exhaust systems where flammable vapors are present.

##### c. Heating Units

(1) Use caution when using element space heaters in any part of a hangar deck or in any shop where a fire hazard exists.

(2) In no case permit such heaters in locations where ignitable concentrations of flammable gases or vapors are likely to exist, or where flammable or explosive substances in the form of gas, vapor, mist, dust or fibers are present.

d. Shoes. Personnel shall wear approved non-sparking, protective steel toed leather safety shoes with non-slip oil and fuel resistant soles in the vicinity of flammable gases and vapors.

e. Stowage of Combustible Rags. Correctly labeled, metal receptacles with metal covers shall be provided for the holding of oily rags, solvent soaked waste, and other combustible waste materials for disposal. Receptacles shall be emptied daily in accordance with local hazardous material turn-in procedures.

f. Stowage of Combustibles. Approved flammable storage lockers are required for storing combustible materials. See Chapter C23 for details.

**C1203. HOUSEKEEPING**

a. Clean work areas and keep them clean, during and after maintenance evolutions.

b. Keep decks free from oil, grease, and debris.

c. Properly store compressed air tanks, tools, and equipment after use.

d. Spills

(1) Immediately clean up oil, grease, fuels, and other flammable liquids or slippery substances to prevent injury or fire.

(2) Use drip pans during maintenance evolutions to prevent drips and leaks from becoming fire or slip hazards, particularly under aircraft engines.

e. Cords/Hoses. Place hoses, power cords, and similar equipment in their designed stowage areas to alleviate trip hazards. This will also reduce excessive wear and damage to the cords/hoses from traffic and deck abrasion.

**C1204. FOREIGN OBJECT DAMAGE (FOD)**

a. Prohibit dumping of trash and garbage during launch or recovery operations. Only dump trash from the fantail or designated sponsons.

b. Only use approved/required flight deck uniforms, cranial headgear and sound attenuators per appropriate naval air training operating procedures standardizations (NATOPS) during flight operations. Do not wear ball caps, white hats, watch caps, garrison hats, bridge caps, or hard hats on the flight deck, catwalks, or gallery decks during flight operations.

c. Do not put loose objects in shirt pockets while in flight operations area.

d. Aircraft jet engines suck up loose objects from the deck or the area immediately adjacent to the intake, including in some cases, personnel who venture too close. Ingestion of articles into engines can cause costly damage or complete loss of the engine. Aircraft NATOPS manuals depict intake and exhaust danger zones.

**C1205. LIQUID OXYGEN**

a. Liquid oxygen, often abbreviated as LOX, is a pale blue fluid which flows like water. It boils into gaseous oxygen at minus 297 degrees Fahrenheit (-183 degrees centigrade); therefore, it is capable of immediately freezing any object that comes in contact with it. When warmed to ambient temperature, liquid oxygen expands as a gas to about 860 times its liquid volume. Therefore, if a volume of the liquid were confined and allowed to warm, it would exert extremely high pressure (up to 12,000 pounds per square inch (PSI)). Because of these properties, extra safety precautions must be observed when working with liquid oxygen.

b. Fire Protection

(1) Keep the work area and equipment free of oil, grease, or any readily combustible material.

(2) Keep tools and clothing free of oil and grease.

(3) Ensure that the aircraft or the LOX converter when removed from the aircraft and the LOX servicing trailer are

grounded and bonded. The grounding conductor must be connected to the frame of the trailer and all metal parts must be bonded together.

(4) Prohibit smoking, open flames, or sparks within 50 feet of liquid or gaseous oxygen servicing trailers that are transferring or storing oxygen. Any combustion in an oxygen-rich atmosphere may be violent.

(5) Mark oxygen generation and storage spaces with a sign reading:

**OXYGEN - NO SMOKING - NO OPEN FLAMES -DO NOT BLOCK LOX  
JETTISON RAMPS, or an equivalent.**

(6) Ensure that adequate ventilation is present or supplemental ventilation is provided when transferring liquid oxygen to avoid an oxygen-rich atmosphere.

(7) Do not spill liquid oxygen on deck areas. In case of accidental spillage, the area should be thoroughly ventilated.

(8) Ensure a suitable fire extinguisher is immediately available in the LOX handling space.

(9) Ensure that only approved non-sparking tools are used when working on LOX equipment.

c. Freezing Precautions

(1) The extreme cold of LOX will instantly produce burns if LOX comes into direct contact with the skin.

(2) Frostbite or freezing will occur if the skin comes into contact with surfaces that have been cooled by LOX.

d. Protective Clothing. The possibility of exposure from accidental spillage of LOX exists; therefore wear the following protective clothing:

(1) Face and eye protection

(2) White cuff-less coveralls

(3) Hand protection made of leather or cloth for cold protection

(4) Molder's (style, slip on) safety shoes

(5) Ensure that all protective clothing worn is clean and free of oil and grease.

e. Handling Precautions

(1) Wear clean, dry leather gloves offering insulation to cold, when handling parts of equipment that have been cooled by LOX. In the event rubber or neoprene gloves are used, wear a covering glove or an interlining glove in conjunction with the molded glove.

(2) Only handle the tubing or fittings through which the liquid oxygen is flowing when necessary, and then only with insulated gloves or other devices for protection against freezing.

(3) Do not permit LOX to flow onto any part of the body, clothes, pockets, or cuffs where it might be trapped.

(4) In the event the LOX is spilled on clothing, remove the clothing immediately and thoroughly air to allow dilution of the oxygen concentration.

(5) When an un-insulated container of LOX is touched, or when there is any reason to suspect some part of the body has been frozen or chilled through contact with LOX, thoroughly wash the area with clean water and immediately seek medical treatment.

(6) Ensure that at least two persons conduct LOX operations.

(7) Protect storage containers, piping, valves, regulating equipment, and other accessories against physical damage and tampering.

**C1206. ARRESTING GEAR AND BARRICADES**

a. Unauthorized personnel shall remain clear of the walkways, arresting gear machinery, spaces, and equipment.

b. During arresting gear maintenance evolutions, all personnel shall remain clear of the bight of the wire.

**C1207. HAZARDS OF ELECTROMAGNETIC RADIATION TO ORDNANCE (HERO)**

Follow approved HERO omission control procedures per reference C12-1.

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**CHAPTER C12**

**REFERENCES**

C12-1. NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010, Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel, and other Flammable Material)

30 May 2007

**CHAPTER C13****MACHINERY****C1301. DISCUSSION**

a. Machinery is located everywhere in your ship, from the more obvious examples of propulsion equipment in the engine room, to the less than obvious example of galley equipment. The purpose of this chapter is to define precautions for all types of machinery. Chapter C9 covers electrical safety precautions. Galley equipment is described in chapter C19.

b. All machinery has moving parts. The fact that moving parts are present means that the possibility of personnel injury is also present. While personnel injury is one aspect of machinery injury, the fact that a person has interrupted the machinery process can lead to even more disastrous accidents.

c. Except in emergencies, and then only when no qualified operator is present, no person shall operate, repair, adjust, or otherwise tamper with any machinery unless assigned by a competent authority, (for example, officer-of-the-deck (OOD), command-duty-officer (CDO), or engineering-duty-officer (EDO)), to perform a specific function on such machinery. No person shall be assigned to operate or adjust machinery unless he/she has demonstrated a practical knowledge of its operations and repair and all applicable safety precautions, and then, only when qualified by the department head having cognizance over such machinery. Unqualified personnel will operate machinery only under the supervision of qualified personnel.

**C1302. GENERAL PRECAUTIONS**

a. General Precautions. Personnel must observe the safety precautions and adhere to the standard operating procedures for individual machine or ship system operations.

(1) Never place any part of the body into moving machinery.

(2) Never attempt to ride machinery that is not designed for transport, such as vertical package conveyors or weapons elevators.

(3) Do not wear jewelry, including any rings or watches, neckties, pagers, cell phones, or loose fitting clothing while operating machinery.

(4) Wear proper protective clothing and equipment suited to the operation being performed as required by technical manual or baseline industrial hygiene survey.

(5) Do not wear polyester or other synthetic clothing when operating fuel fired equipment (in particular, no engine room or fire room personnel may wear such clothing) or while standing watch or performing maintenance in main propulsion spaces.

(6) Engine room and fire room personnel shall wear fire retardant coveralls, with sleeves rolled down, when on watch or when performing maintenance in machinery spaces where steam is circulating in the piping systems or fuel fired machinery is in operation. In nuclear propulsion aircraft carriers only, engineering and reactor department personnel shall wear long-sleeve navy uniform shirts or navy uniform coveralls with sleeves rolled down when on watch or when performing maintenance in machinery spaces where steam is circulating in piping systems or a diesel engine is in operation.

(7) Observe manufacturer's safety precautions on the Material Safety Data Sheet (MSDS) and warning labels when handling flammable or toxic liquids; in particular, ensure that ventilation is adequate, and wear appropriate personal protective equipment. Wear proper personnel protective equipment such as goggles and respirators, if indicated by the RPM.

(8) Use electrical tools and lights only if inspected and approved. The damage control assistant may require non-sparking and explosion-proof electrical equipment.

(9) Ensure that equipment is de-energized and/or depressurized and properly tagged out of service before attempting to perform repairs or preventive maintenance.

(10) When working near electrical equipment or electrical cables, be alert to the presence of dangerous voltages and avoid striking such equipment with tools of any kind. Should such damage inadvertently occur, report it immediately to the ship's electrical officer.

(11) Do not use compressed air to clean the body, clothing, or to perform general housekeeping. Compressed air may be used to clean machinery parts that have been properly disassembled provided that the supply air pressure does not exceed 30 pounds per square inch (psi) or the nozzle is equipped with a 30-psi limiter. Wear safety goggles when using compressed air for approved cleaning.

(12) Do not store in-use quantities of paints, solvents, acids, or corrosives in unapproved containers or cabinets. Ensure material compatibility and proper labeling. Follow hazardous material policies established for your ship.

(13) Return closed, authorized containers of flammable consumables to approved storage lockers, the ship's hazardous material minimization center (HAZMINCEN), or to the flammable liquid storeroom/paint locker at the end of each working day.

(14) Keep containers of flammable or volatile fluids/adhesives tightly closed when not in use.

(15) Supervisors shall ensure that anyone who incurs any type of injury or who experiences any adverse health effect during or immediately following work activities receives prompt medical attention.

(16) Promptly reinstall shaft guards, coupling guards, deck plates, handrails, flange shields, and other protective devices removed as interference immediately after completion of maintenance on machinery, piping, valves, or other system components.

(17) When working with asbestos-containing material ((Garlock®), spiral wound (flexitallic) gaskets, pipe hangers, clutch plates, brake pads, etc.) comply with Chapter B1 of this manual. Beware of friable asbestos-containing materials. Ensure proper handling/disposal requirements are followed (see chapter B1). Asbestos fireproofing material is still common aboard some ships and asbestos can be found in sheet gaskets and some lagging. Train personnel who routinely handle asbestos containing materials on the hazards, proper precautions, protective equipment requirements and disposal.

(18) Do not use low pressure (LP) air to unclog flammable fluid piping systems unless a specific directive or approved procedure requires its use.

**C1303. MAINTENANCE**

a. Ensure that all installed safety devices, alarms, and sensors are inspected and/or tested in accordance with scheduled Planned Maintenance System (PMS) and other type commander requirements.

(1) Assign the repair of defective safety devices a high priority.

(2) Correct oil leaks at their source. Wipe up spills of any kind immediately and store the wiping rags in fire safe containers. Dispose of oily rags daily in accordance with the ship's hazardous material turn-in procedures.

(3) Avoid trip hazards by maintaining proper stowage.

(4) Open all drains and vents to all drums and headers before loosening manhole or handhold plates. Stand clear of such fittings when initially opening them after service.

b. When maintenance exceeds boundaries of PMS, appropriate supervisors shall ensure the quality assurance (QA) documentation and procedures are followed per volume 5 of reference C13-1.

**C1304. INDUSTRIAL EQUIPMENT**

a. General Industrial Equipment Operation and Repair Safety

(1) Read manufacturer's instruction books for essential details of readying machines and equipment for operation, cleaning, lubricating, and general care and maintenance. These instruction books, supplemented by technical handbooks, provide comprehensive instructions on all phases of shop practice.

(2) Inspect before operating industrial equipment (fixed or portable) to ensure that the equipment is in good working condition and that all installed or attached safety features (such as guards, limit switches, interlocks, and speed limiting controls) are in place and in good working order.

(3) Unplug or disconnect from power source and affix a red tag (DANGER - DO NOT OPERATE) on all fixed or portable industrial equipment requiring repairs.

(4) Shut off the power when changing industrial equipment parts such as faceplates or chucks on lathes, drill bits in electric drills, or saw blades.

(5) Block up ram where applicable and open the switches and red tag (DANGER - DO NOT OPERATE) on power shears, drills, punches, and presses when it becomes necessary to place any part of the body underneath or within the equipment.

(6) Replace machine guards and safety devices after repairing, oiling or greasing, or after inspections or PMS have been completed before the machine is started or operated.

(7) Remove all industrial tools or test equipment used in making repairs, adjustments to machinery, or other shipboard equipment/systems so that all working parts of the machinery, equipment, or system will be free to operate without damage.

(8) Take care that no one is in a position to be injured when the machinery/equipment/system is again set in operation.

(9) Be sure all personnel are clear before starting any industrial tools or equipment.

(10) Do not permit anyone to operate electrical or mechanical equipment or machines in any space when alone.

(11) Make sure there is plenty of light to work by before operating a machine. Incandescent lights must be used for machines with visible rotating shafts or chucks to avoid the stroboscopic effect from fluorescent lights.

(12) See that tools and work are properly clamped before starting a machine.

(13) Only place/mount a saw, cutter head, grinding wheel, or tool collar on a machine arbor when the tool is the proper size to fit the arbor.

(14) Ensure each powered machine has a means of cutting off power which can be safely reached and operated from the operator's normal position, without reaching through the point of operation or other hazardous areas.

(15) On machines where injury to personnel might result if motors were to restart after power failures, check that provisions have been made to prevent machines from automatically restarting upon restoration of power.

(16) Make sure that operating controls, including treadles, are protected by recessing, guarding, location, or other effective means against unexpected or accidental activation of the machine.

(17) The point-of-operation is the area of a machine where the work is actually performed upon the material being processed. Check that the point-of-operation is guarded so that personnel cannot be injured by contact with the machine or by flying objects propelled from the machine. Methods of point-of-operation guarding include barriers, shields, interlocks, automatic feed and removal, and two-hand activation devices. The best guarding device is usually one designed and attached by the manufacturer as an integral part of the machine. The selection and design of guards other than those provided by the manufacturer must be adequate to protect personnel and not present a hazard in themselves.

(18) Power transmission devices include belts, chains, pulleys, shafting, fly wheels, gears, sprockets, and any other moving parts of a machine other than the point-of-operation. Ensure that power transmission devices are enclosed within the machine or otherwise guarded or so located that it is not possible for personnel to contact the moving parts. Power transmission devices over seven feet above the deck or other standing/walking surface need not be guarded.

(19) Ensure all warning and caution signs, for eye hazards, noise hazards, pinch points, etc., and machine safety precautions are posted within sight of the machine operator. Machine safety precautions may be posted using standard stock placards or excerpts from technical manuals. Ensure caution areas and eye hazard areas around the machine are marked as defined in Chapter C1.

b. Housekeeping

(1) Keep areas around machines clear of obstructions and in a non-slippery condition. Clean up all spilled oil or grease immediately.

(2) Keep machines clean.

(3) Do not clean chips from the surface of machines with compressed air or with hands; use a brush or hook and wear leather gloves.

(4) Do not use compressed air to clean clothing or to blow dust off the body or to assist in the clean up of dust, debris, or other particulate matter.

(5) Do not place hand tools on lathes or other machines. Keep them in their assigned location.

(6) Turn off all power to the equipment before removing chips and other debris.

(7) Ensure that all portable tools (electrical or pneumatic) have been tested prior to initial use and periodically, as prescribed by PMS or other data.

(8) Ensure that all machine guards and other safety devices are in place prior to equipment operation.

c. Portable Power Tools

(1) Ensure all portable electric power tools have a current safety inspection by the electrical tool issue room prior to use.

(2) Ensure that portable circular saws, electric or pneumatic chain saws, and percussion tools without positive accessory holding (i.e., equipped with a constant pressure switch that will shut off the power when the pressure is released) are equipped with an operable "dead-man" switch.

(3) Keep portable power tools clean, lubricated, and in good repair.

(4) Keep all electrical cords clear of moving parts when using portable electrical equipment around machine tools.

(5) Wear and use the required personal protective equipment (PPE), such as hearing or sight protection, for those tools and equipment requiring PPE.

d. Operating Precautions - General

(1) Remove chuck keys, wrenches, or other devices used to attach accessories to industrial machines before operating.

(2) Do not attempt to adjust a tool or feel the edge to be cut while the equipment or tool is in motion.

(3) Never attempt to stop or grab by hand or apply a wrench or tool to moving work or to moving industrial-equipment parts.

(4) Do not use hangers to knock cutters into positions.

(5) Never lean against a machine that is running.

(6) Never leave moving machinery unattended.

(7) Do not distract the attention of a machine operator.

(8) Remove cutting tools from machines when not in use.

(9) Avoid excessive cutting speeds, feeds, and depth of cut. Keep hands clear of moving parts. Use a separate block to feed stock into cutting blades.

e. Securing for Sea. When securing for sea, take all precautions to ensure that components of industrial equipment or tools, including accessories, will not sway or shift with the motion of the ship. These precautions should include, but are not limited to, the following:

(1) Lower the arm of top-heavy equipment, such as a radial drill press, to rest on the table or base of the machine and then clamp and block securely.

(2) Secure chain falls, trolleys, overhead cranes, and other suspended equipment, such as counterweights on boring mills and drill presses.

(3) Secure tailstocks of lathes.

(4) Secure spindles of horizontal boring mills.

(5) Protect and secure tools stowed in cabinets or drawers. Secure drawers and cabinet doors. Where possible, install metal bands or fixtures vice using line to temporarily secure equipment. Secure all bar and sheet-metal stock and do not handle or move while underway.

(6) Inspect foundation bolts of heavy equipment in accordance with PMS to ensure tightness.

(7) While underway or while at anchor in high sea states, do not operate shop machines whose components are subject to shifting or swaying with the motion of the ship, so as to present a hazard to operators, without permission of the commanding officer.

(8) Do not perform operations such as the melting and pouring of metal or similarly dangerous evolutions while the ship is underway.

f. Posted Safety Precautions and Deck Markings

(1) Post operating instructions and safety precautions tailored to the specific equipment at each piece of industrial plant equipment. Install warning plates, located to ensure visibility, wherever necessary to minimize possible injury. Also, include instructions to never allow machines to run unattended and not to distract the operator while the machine is in operation. Posting may be accomplished using standard stock placards or excerpts from technical manuals.

(2) Clearly establish and mark equipment hazard areas or zones per Chapter C1, ship's plans and specifications, and industrial hygiene survey.

g. Safety Precautions for Specific Types of Equipment

(1) **Pneumatic Tools - General.**

(a) Wear and use necessary personnel protective devices, especially eye and hearing protection.

(b) Do not connect or drive pneumatic tools by air pressure in excess of that for which the tools are designed.

(c) Only authorized and trained personnel shall operate pneumatic tools.

(d) Lay pneumatic tools down in such a manner that no harm can be done if the switch is accidentally tripped. Do not leave idle tools in a standing position.

(e) Keep pneumatic tools in good operating condition and thoroughly inspect them at regular intervals with particular attention given to on-off control valve trigger guard (if installed), hose connections, guide clips on hammers, and the chucks of reamers and drills.

(f) Pneumatic tools and air lines may be fitted with quick disconnect fittings which incorporate automatic excess flow shut-off valves, which shuts off the air at the air lines before changing grinding wheels, needles, chisels, or other cutting or drilling bits.

(g) Only use air hoses suitable to withstand the pressure required for the tool. Remove leaking or defective hoses from service.

(h) Do not lay hoses over ladders, steps, scaffolds, or walkways in such a manner as to create a trip hazard. Where a hose is run through doorways, protect the hose against damage by the door edge. Preferably, elevate air hose over walkways or working surfaces in a manner to permit clear passage and prevent damage to the hose.

(i) Connect a tool retainer on each piece of equipment that, without such a retainer, may eject the tool.

(j) Ensure that all portable pneumatic grinders and reciprocating saws are equipped with a safety lock-off device. The lock-off device must automatically and positively lock the throttle in the off position when the throttle is released.

(k) Pneumatic tool air hose fittings shall not be interchangeable with the hose fittings designated for airline respirators.

(1) Ensure that air hoses are equipped with "quick disconnect" fittings at all hatches, doors, or scuttles.

(2) **Pneumatic Hammers**

(a) Do not point any pneumatic hammer at other personnel. Operate hammers in a careful and safe manner at all times.

(b) Ensure that all hammers are equipped with a device for holding the tool bit in the hammer. Inspect safety tool holders at frequent intervals per PMS.

(c) Do not restrict the air exhaust in any fashion.

(d) Ensure that all pneumatic hammers are equipped with a hand-whip safety switch (dead-man switch).

(e) Use pneumatic hammers only for those purposes for which designed.

(f) When operating a power hammer, wear necessary eye, face, ear, and body protection, including gloves.

(3) **Power Saws.** In addition to the general precautions for portable electric and pneumatic tools contained in this manual, observe the following precautions for electric and pneumatic saws:

(a) Provide all circular power saws with guards that fully encompass the unused portion of the blades.

(b) Ensure that qualified personnel install circular saw blades.

(c) Only use portable electric or pneumatic saws that have handgrip "dead-man" switches installed.

(d) Grasp portable power saws with both hands and hold firmly against the work. Take care that the saw does not break away, thereby causing injury.

(e) Disconnect the power supply and inspect the blade at frequent intervals or immediately after it has locked, pinched, or burned.

(f) Inspect and remove potential obstacles from the material to be cut before using a saw.

(g) Immediately remove dull, badly set, improperly filed, or improperly tensioned saws from service before they can begin to cause the material to stick, jam, or kickback when it is fed to the saw at normal speed.

(h) Immediately clean saws when gum or pitch has adhered to the sides. Disconnect power before cleaning.

(i) Keep bearings well lubricated.

(j) Keep arbors of all circular saws free from play.

(k) Only designated personnel with certified skill shall sharpen or tension saw blades or cutters.

(l) Maintain cleanliness around woodworking machinery, particularly as regards the effective functioning of guards and the prevention of fire hazards in switch enclosures, bearings, and motors.

(m) Remove all cracked saws from service.

(n) Do not permit the practice of inserting wedges between the saw disk and the collar to form what is commonly known as a "wobble saw."

(o) Provide push sticks or push blocks at the work place in the several sizes and types suitable for the work to be done. Push sticks, blocks, or other special hand tools are not substitutes for guards. Keep all required guards in place and operable when push sticks or blocks are used

(p) On band saws, ensure all portions of the blade are enclosed or guarded, except for the working portion of the blade between the bottom of the guide rolls and the table. The portion of the guard between the upper-saw-wheel guard and the guide rolls must guard the front and outer side of the blade and must be adjustable to move with the guide as it is raised and lowered. When the band saw is in use, position the adjustable guard to maintain the minimum clearance between the guide rolls and the material consistent with free movement of the material being cut.

(q) To avoid vibration, welded joints in band saws shall be the same thickness as the saw blade.

(r) Ensure that each circular table saw is guarded by a hood that completely encloses the portion of the saw above the table and above the material being cut. Mount the hood so that it will automatically adjust itself to the thickness of, and remain in contact with, the material being cut. An approved clear plastic guard cantilevered over the saw table may be used as an alternative to the enclosing hood. The plastic guard must be large enough and set low enough to prevent the hands of personnel from contacting the blade.

(s) Make sure that each hand-fed rip saw has a spreader mounted in a position one-half inch from the back of the largest saw which may be mounted on the machine. The spreader prevents material from squeezing the saw and being thrown back on the operator. The spreader shall be thinner than the saw kerf and rigid enough to resist side thrust and bending. The spreader is not required for grooving, dadoing, or rabbeting but must be replaced immediately upon completion of such operations.

(t) Check that each rip saw, including hand-fed rip saws with spreaders, are provided with non-kickback fingers or dogs to prevent material from being thrown toward the operator.

(u) Ensure that self-feed circular saws have a hood or guard that will prevent the operator's hands from contacting the nip point of the feed rolls.

(v) Verify that radial saws are guarded, as required by the following subparagraphs:

1. The upper portion of the blade, including the arbor, must be completely enclosed by a hood. The sides of the lower portion of the blade must be guarded to the full diameter of the blade by a guard that will automatically adjust to the thickness of the material being cut.

2. The work surface must be wide enough, or a stop shall be provided, to prevent the cutting head from traveling to a point where the blade extends beyond the outer edge of the table.

3. The unit shall be tilted back or counterweights shall be provided so that the cutting head will return to the starting position when released.

4. Ripping and ploughing with a radial saw must be against the direction that the saw rotates. The direction of rotation must be conspicuously marked on the hood. A label shall be affixed to the rear of the hood reading "**DANGER: Do not rip or plough from this end.**" Non-kickback fingers must be provided for ripping and ploughing operations.

(w) Inspect saw blades by non-destructive, PMS test methods for surface cracks and defects.

(x) Ensure sawdust collectors are properly attached prior to use of wood saws and are in serviceable condition. Empty sawdust from collector bags per the manufacturer's instructions.

#### (4) **Sanding Machines**

(a) Carefully inspect all sanders before use. Do not use sanding discs or belts if they are frayed or cracked.

(b) Use eye protection during sanding operations and while cleaning up. Consult the respiratory protection manager about the need for particulate respirators while sanding or cleaning dust collectors. Operate dust-collecting systems for sanders, if installed, when sanding is in progress.

(c) Keep hands or other parts of the body from coming into contact with the abrasive surface of the sander.

(d) Grasp portable hand-held sanders with both hands and hold firmly against the work. Take care that the sander does not break away, thereby causing injury or damage.

(e) When permanently mounted sanders are used, grasp the work firmly and hold it to the sanding surface carefully to avoid finger contact with the sanding belt or disc. Sand small pieces of work that would bring the fingers within 1 inch of the belt or disc surface by hand, rather than on powered sanders.

(f) For portable sanders and fixed sanders having electric plugs, pull the electric plug before sanding belts or

discs are changed or before repairs or adjustments are made to the sander. Open and DANGER tag the power source circuit breaker of fixed sanders that are "hard wired" before making repairs or adjustments or changing belts or discs.

(g) Ensure each belt sanding machine has both belt pulleys enclosed in such manner as to guard the points where the sanding belt runs onto the pulleys. Enclose the unused run of the sanding belt. Adjust belt type sanders to the proper tension.

(h) Ensure coast down brakes, where installed by the manufacturer, are in good working condition before commencement of sanding and use them to stop belt or disc motion after the power is secured.

**(5) Buffers, Grinders, and Cut-Off Wheels - General**

(a) Check the spindle speed of the machine before mounting of the wheel to be certain that it does not exceed the maximum operating speed marked on the wheel.

(b) Gently tap wheels with a light non-metallic implement, such as the handle of a screwdriver for light wheels, or a wooden mallet for heavier wheels, immediately before mounting. Do not use if they sound cracked (dead). This is known as the "ring test." It should also be noted that organic bonded wheels do not emit the same clear metallic ring as do vitrified and silicate wheels.

(c) Wheels must be dry and free from sawdust when applying the "ring test," otherwise the sound will be deadened.

(d) Dress or replace wheels that are chipped, have imbedded non-ferrous material, are rounded, or worn out of round prior to using the grinder.

(e) Replace fabric buffer wheels that are frayed or worn out of round.

(f) Replace wire buffer wheels that are badly worn or loose at the hub.

(g) Permanently mounted buffers and grinders shall have a shatterproof safety shield in place between the operator's eyes and the work at all times while buffing and grinding. Wear eye and hearing protection (if posted as noise hazardous) when

operating either portable or permanently mounted buffers or grinders.

(h) Clean the flange surface of grinding and buffing wheels, normally placed between washers and the spindle hole, before mounting the wheel so that clamping pressure will be evenly distributed.

(i) Ensure that the hole in the buffer or grinding wheel is of the proper size for spindle (neither too small nor too large).

(j) Use compression washers as large as the flanges in diameter for buffer and grinding wheels.

(k) Tighten spindle nuts just enough to keep the buffer or grinding wheel from moving out of position between the washers.

(l) Mount tool or work rests on firm supports and space not more than one-eighth of an inch from the surface of grinding wheel. Ensure any dust collection bags, of non-flammable material, are in place and emptied regularly.

(m) Ensure that the hood around grinding wheels is constructed so its periphery can be adjusted to the constantly decreasing diameter of the wheel by means of an adjustable tongue or equivalent. Maintain the distance between the wheel periphery and the tongue or end of the periphery band at approximately one-fourth of an inch.

(n) Ensure that the upper point of opening in the grinding wheel hood facing the operator is not less than 25 degrees and not more than 65 degrees from a vertical line drawn through the spindle center.

(o) Ensure that the maximum exposure of a grinding or cut-off wheel periphery or circumference for hoods on a swing frame machine does not exceed 180 degrees and the top half of the wheel is protected at all times.

(p) Ensure that the maximum exposure of the wheel periphery or circumference on bench or floor stands does not exceed 90 degrees.

(q) Protect cup type wheels used for external grinding by either a movable cup guard or a band type guard. Provide all other portable abrasive wheels used for external grinding with safety guards (protection hoods), except as follows:

1. When the work location makes it impractical, use a wheel equipped with safety flanges.

2. When using wheels two-inches or less in diameter, securely mount the wheel on the end of a steel mandrel.

(r) When safety flanges are required, use them only with wheels designed to fit the flanges. Use only safety flanges of a type and design and properly assembled as to ensure that the pieces of the wheel will be retained in case of accidental breakage.

(s) Ensure portable abrasive wheels used for internal grinding are provided with safety flanges (protection flanges), except as follows:

1. When wheels are two inches or less in diameter, securely mount on the end of a steel mandrel.

2. If the wheel is entirely within the work area being ground.

(t) Ensure that all deck or bench mounted abrasive wheels have a work rest. Keep the work rest adjusted to within one-eighth inch of the wheel periphery to prevent the work from being jammed between the rest and the wheel.

**(6) Operating Grinding, Buffing, and Cut-Off Wheels.**

(a) Stand to one side of the wheel when first applying power.

(b) Take care that the hands are not drawn into contact with buffing, grinding, and cut-off wheels.

(c) Never operate stationary grinding wheels unless protective eye guards and hooks are in their place and the tool rest is correctly adjusted.

(d) Never operate portable pneumatic or electric grinding machines using wheels and wire brushes without a hood.

(e) Before the power is turned on, check to ascertain that the wheel runs true, is not out of balance, and does not strike or rub against housing, hood, safety shield, or tool rest. Dress wheels as necessary.

(f) Never use a grinding wheel on nonferrous materials. Nonferrous materials could build up on the wheel causing an imbalance condition, over-heating, or possible debris hazard. Dress grinding wheels that have excessive imbedded non-ferrous material.

(7) **Spray Paint and Flame Spray Booths.** A paint spray booth is a ventilated structure provided to enclose a spraying operation, to confine and limit the escape of spray, vapor, and residue and direct them safely to an exhaust system. Paint spray booths are installed in AS, CV, CVN, LHD, and LHA type ships. They are typically found in carpenter shops, optical shops, and AIMDs. Spray booths use filters to collect paint overspray. Flame spray booths have a similar function and capture molten metal particle overspray as they are applied to coat items.

(a) If spray paint and metal particles are not filtered out, they will collect in the exhaust fan and ducting, creating a potential fire hazard. Ensure maintenance and filter change-out is conducted in accordance with manufacturer's procedures.

(b) Consult the respiratory protection manager to see if supplemental respirators are required.

(c) Ensure that only qualified personnel are authorized to use the spray booth.

(8) **Industrial Slot Hoods.** Parts washers, ultrasonic cleaners, dip tanks, and varnish tanks may be equipped with local exhaust ventilation, usually in the form of a slot hood. A slot hood removes vapors or gases at the point of generation before the contaminant reaches the user's breathing zone.

(a) Ensure that local exhaust ventilation is operational prior to using. Know where the controllers are for

local exhaust systems. If the system is not working properly, notify your supervisor.

(b) Ensure the slots on the hood area are not obstructed.

(c) Follow the posted operating instructions and safety precautions for the dip tank or washer and never put other than approved chemicals or cleaners into the tank.

(9) **Drill Presses.** Stationary, mounted drill presses must be equipped with guards to prevent injury from shattering drill bits or chips of material. Telescoping drill bit guards, which cover the drill bit as it is lowered and raised during use, are required for all drill presses.

(10) **Parts Washers and Pollution Prevention Equipment.** Enclosed parts washers, ultrasonic cleaners, degreasers, and other pollution prevention devices used in workshops will be provided with local exhaust ventilation and must have posted safety precautions.

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## CHAPTER C13

### REFERENCES

C1-1. COMFLTFORCOMINST 4790.3, Joint Fleet Maintenance Manual

30 May 2007

**CHAPTER C14****ORDNANCE****C1401. DISCUSSION**

a. By mission definition most naval ships carry some type of ordnance for offensive or defensive operations. Ordnance can take the traditional form of shells for large and small caliber guns, or it can be in the form of missile warheads, torpedoes, and nuclear weapons. Generally, every Navy ship has some sort of ordnance on board, ordnance that has the inherent power to destroy a ship, and if alongside a dock, to seriously damage other ships and facilities.

b. The greatest danger from ordnance is explosion. Due to built-in safety devices, ordnance requires outside intervention to set it off unintentionally. Improper handling, fire, excessive heat, or simple misjudgment or mistakes can cause a weapon discharge. The major safety factor in preventing an ordnance catastrophe is a well experienced and knowledgeable person-in-charge that can identify and correct potential safety hazards. A crew who knows and understands the basics of ordnance safety and has a real respect for ordnance hazards is better prepared to assist this supervisor.

**C1402. GENERAL ORDNANCE PRECAUTIONS**

a. Do not smoke or allow open flames near ordnance.

b. If ordnance leaks any material, stop operations immediately; remove leaky ordnance and clean up spill as required for the specific explosive. References C14-1 and C14-2 prescribe the minimum safety requirements and regulations for handling and storing conventional ammunition by units afloat.

c. Get immediate first aid if splashed with rocket fuel or oxidizer.

d. Never enter a space where rocket propellant leaks are suspected without having a gas free survey conducted.

e. Use only authorized equipment on ordnance to perform any operation. Do not use improvised equipment.

30 May 2007

f. Do not engage in operations involving ordnance which are within a five mile radius of thunderstorms or high winds.

g. Use approved standard operating procedures (SOPs) for all hazardous operations. Discuss such procedures with all personnel concerned and post in the shop spaces specifically designated as ordnance shops, handling rooms or checkout areas. Do not post SOPs in areas where they will present a potential safety hazard, such as the flight deck and hangar deck of carriers and amphibious ships, the main deck of combatants, and the handling areas of ammunition supply ships.

h. Do not leave exposed ordnance unattended. Do not leave open magazines or lockers unattended.

i. Ensure the appropriate hazards of electromagnetic radiation to ordnance (HERO) emission controls are set prior to any ordnance operation. Follow the general HERO requirements of reference C14-2 volume 2 when conducting ordnance operations involving electrically initiated ordnance.

**C1403. ORDNANCE HANDLING PRECAUTIONS**

a. Keep ordnance handling to a minimum and conduct handling with utmost care using certified/qualified personnel, approved equipment, and established procedures. Ensure a safety brief is held prior to ordnance handling operations. This brief shall cover all the duties and responsibilities of personnel involved and details of the operation.

b. Ensure that "BRAVO" flag is flying during ordnance cargo handling operations or a red task light is displayed at night.

c. Thoroughly wash hands after handling ordnance.

d. Do not allow any other cargo handling operations to take place in the area where ordnance handling is taking place.

**CHAPTER C14**

**REFERENCES**

C14-1. NAVSEA OP 4, Ammunition and Explosives Safety Afloat

C14-2. NAVSEA OP 3565/NAVAIR 16-1/NAVELEX 0967-LP-624-6010,  
Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel,  
and other Flammable Material)

## CHAPTER C15

### MARINE SANITATION DEVICES (SEWAGE SYSTEMS)

#### C1501. DISCUSSION

a. All naval ships have marine sanitation device (MSDs) designed and operated to prevent the overboard discharge of untreated or inadequately treated sewage into navigable waters of the United States or other countries.

b. MSDs either hold raw sewage until it can be discharged overboard or to a pier connection, or treat sewage in certified treatment-based MSDs.

c. All naval ship MSDs must be certified by NAVSEA in accordance with references C15-1, C15-2 and C15-3 to ensure the MSDs meets performance and safety/health requirements. Navy certification of shipboard MSDs is a one-time requirement - there is no time-based recertification requirement for shipboard MSDs. The need to recertify an existing MSD based on modifications by a ship change is determined by NAVSEA and the appropriate ship program manager or type commander.

#### C1502. SANITARY, HYGIENIC, AND SAFETY PROCEDURES

a. Hygienic Procedures. The following hygienic procedures are applicable to all MSDs (e.g., collection, holding, and transfer (CHT) systems; vacuum CHT (VCHT) systems; and treatment based MSDs such as fixed activated sludge treatment (FAST) and waste grinding treatment called ORCA):

(1) Wear appropriate personal protective equipment (e.g., rubber gloves, rubber boots, chemical splash goggles, faceshield, and disposable coveralls), while connecting or disconnecting sewage hoses.

(2) After handling sewage transfer hoses or working in MSD spaces, personnel shall thoroughly wash hands, lower arms, and face (in that order) with hot water and soap, especially prior to handling potable water hoses.

(3) Make certain that removable drip pans or coamings are installed in health sensitive spaces, such as food storerooms, food preparation or messing areas, sculleries,

30 May 2007

medical and dental spaces, or berthing spaces, to catch, contain and detect possible leakage from MSD valves or takedown joints.

(4) Ensure that removable drip pans are installed beneath transfer pumps, diverter valves, and comminutors to detect leakage or prevent leakage from causing an unsanitary condition.

(5) Verify that health-warning placards are posted in appropriate locations, identifying procedures to be followed in those areas.

(6) Ensure that personnel exposed to sewage or who work on MSDs or graywater systems are placed in medical surveillance and maintain their basic immunizations as required by reference C15-4.

b. Leak or Spill Clean-up Procedures

(1) In the event spaces become contaminated with sewage as a result of leaks, spills, or sewage system backflow, evacuate the space immediately and notify the officer of the deck (OOD), damage control assistant, and medical department of the spill.

(2) Secure the spill area from traffic.

(3) The ship's gas free engineer (GFE) shall test the area to ensure that the atmosphere is within acceptable limits to eliminate risk of fire, explosion, exposure to toxic substances, suffocation or asphyxiation.

(4) Use a full facepiece, self-contained breathing apparatus (SCBA) operated in the pressure-demand mode. If the atmosphere is not within acceptable limits, refer to reference C15-5 for further guidance.

(5) Post a safety watch with respiratory protection at the compartment access during clean-up (two-man rule).

(6) Remove or wash down spilled sewage.

(7) Keep respiratory protective equipment, (supplied air respirator/self-contained breathing apparatus (SAR/SCBA)) available even if the atmosphere is within acceptable limits. Emergency escape breathing devices (EEBD) are to be mounted in all MSD pump rooms and equipment spaces, and kept available in

30 May 2007

MSD work areas for emergency exiting. A minimum of two EEBDs shall be mounted in each pump room and equipment space.

(8) Ensure proper ventilation is provided, maintained and the area is recertified as gas free at least every two hours, (every one hour for ambient temperatures above 90°F), or more frequently if deemed necessary, until the clean-up is complete.

(9) Accomplish a final wash down with water, providone/iodine solution and detergent.

(10) Treat food service spaces, berthing areas, and medical spaces with an approved disinfectant.

(11) The medical department representative (MDR) must certify the space as clean.

**C1503. GAS FREE ENGINEERING FOR MSD SYSTEMS**

**WARNING**

Ship's force shall not open the manhole or enter a MSD tank at any time unless this is done at a suitable industrial facility and all tank cleaning and gas free requirements are met. If problems develop preventing MSD operations that require such tank access for correction, divert all drains overboard and secure the system until proper facilities are available or use redundant/backup sewage systems, if installed, reference C15-2.

a. MSD tanks and sewage collection and transfer piping systems (piping, valves, pumps, etc.) are considered immediately dangerous to life or health (IDLH). Do not open or enter a MSD tank, pump or pipe/valve/pump or remove a component which will leave an opening to the tank unless approval is granted by the commanding officer and the system is inspected and certified by a gas free engineer (GFE) or National Fire Protection Association (NFPA) marine chemist. Toxic and explosive gases may exist in the tank or piping system.

b. Observe a no smoking regulation. Do not allow open flame, ordinary electric lights, flashlights, regular tools, or sparking electrical apparatus in or near an open MSD tank.

30 May 2007

c. Recertify (gas free) open sewage tanks at least every four hours. Personnel must recognize that even though a tank may be certified gas free, toxic gases can remain in the sludge blanket and could be released when the blanket is disturbed.

d. Before opening a tank in any manner, or removing any valves or components below the highest level of the tank overflow, wear proper respiratory protective equipment (see chapter B6 of this manual for respiratory protection requirements or consult the respiratory protection manager (RPM)).

e. Utilize continuous net exhaust ventilation (IAW reference C15-5) after opening tank. Ventilation should be sufficient to provide a change of air in the tank every three minutes. Avoid contamination of the air compressor or ventilation intakes.

f. Do not weld or perform hot work inside or outside the tank without a GFE determining that the tank is safe for hot work. After welding is complete, inspect the coating for heat damage and repair as necessary.

g. See section 4 of reference C15-6 for additional information and precautions.

#### **C1504. CONTROL OF TOXIC GAS HAZARDS IN SEWAGE MSD SYSTEMS**

To minimize the potential hazards resulting from the release of toxic gases from the MSD system, observe the following precautions:

a. Always assume that the MSD tank and piping system contains sewage and toxic gases, and has an oxygen deficient atmosphere. Of particular concern is hydrogen sulfide ( $H_2S$ ), a gas with a rotten egg smell at low concentrations. This odor is not reliable as a warning signal because  $H_2S$  deadens the sense of smell. As  $H_2S$  concentration increases, the degree of danger increases.

b. Never enter the tank or open the manhole access at any time unless at a suitable industrial facility, and only after certification by a GFE, industrial hygienist (certified GFE) or National Fire Protection Association (NFPA) certified marine chemist.

30 May 2007

c. If hydrogen sulfide is detected by smell when working in the MSD pump room, MSD space, comminutor space, or any space containing sewage piping, evacuate the space immediately. If the space is equipped with a hydrogen sulfide alarm, evacuate the space immediately when the alarm sounds.

d. Contact a GFE immediately. A space in which the hydrogen sulfide odor has been detected should only be re-entered by personnel who have been properly trained and are wearing the proper IDLH respiratory protection equipment.

e. In any space where a sewage spill has occurred, do not conduct any work or maintenance other than work required to clean up the spill, until gas levels are below acceptable limits, as determined by a GFE, and all sewage wastes, including solids, have been removed from the space and the space washed down.

f. Ensure all hydrogen sulfide alarms and ventilation low flow indicators are properly maintained and operable at all times. In spaces where the ventilation low flow indicator reads zero and/or the low flow alarm has sounded, ensure the atmosphere is tested prior to entry.

**C1505. GRAYWATER COLLECTION/TRANSFER SYSTEMS AND GRAYWATER HOLDING TANKS**

The sanitary, hygienic, and safety procedures, gas free engineering requirements, and requirements related to the control of toxic gas hazards provided herein also apply to dedicated graywater collection/transfer systems and graywater holding tanks where installed. See reference C15-6 for additional information.

**C1506. DISCHARGE REQUIREMENTS AND ADDITIONAL GUIDANCE**

a. Refer to reference C15-2 prior to any discharge of sewage overboard.

b. See reference C15-6 for additional guidance and information related to surface ship MSDs.

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**CHAPTER C15**

**REFERENCES**

C15-1. DoD Instruction 4715.6-R1, Regulations on Vessels Owned or Operated by the Department of Defense

C15-2. OPNAVINST 5090.1B

C15-3. NAVSEAINST 9593.1C, Certification Program for Marine Sanitation Devices (MSDs) Installed on Surface Ships, Craft and Boats in the U.S. Navy

C15-4. BUMEDINST 6230.15, Immunizations and Chemoprophylaxis

C15-5. Naval Ships' Technical Manual (NSTM) 074, NAVSEA S9086-CH-STM-030/CH-074-VOL3

C15-6. Naval Ships' Technical Manual (NSTM) 593, NAVSEA S9086-T8-STM-000/CW 593R, Pollution Control

## CHAPTER C16

### HEAVY WEATHER

#### C1601. DISCUSSION

a. Heavy weather is any weather condition that results in high winds, extreme sea states, and heavy rain, snow and/or hail.

b. There are multitudes of hazards present in heavy weather. Objects can slide or fall on personnel causing injury. Personnel can fall into machinery or equipment. Heavy weather is as dangerous now as it was during the days of sail, and all personnel must be aware of potential hazards and safety requirements.

#### C1602. LIFELINES

a. Keep lifelines or rails rigged at all times along all boundaries. Keep permanent lifelines in good repair.

b. Keep unguarded openings adjacent liferail or lifeline sections or an end section and adjacent structures to a minimum and in no case greater than 5 inches.

#### C1603. TIE-DOWNS

a. Use approved tie-downs or lashing to secure moveable shipboard items, such as aircraft, vehicles and cargo, against the motion of the ship and exposed areas against the forces of wind and waves.

b. Seize or tie-down shackles, hooks, turnbuckles, release devices to prevent working loose. Check them for security more frequently in heavy weather.

#### C1604. SAFETY PRECAUTIONS UNDER HEAVY WEATHER CONDITIONS

a. Be aware of stowage locations of all equipment necessary for rigging heavy weather lifelines.

b. Inspect tie-down equipment such as cables, turnbuckles, deck pads and bolts, at frequent intervals to ensure their security.

30 May 2007

c. Only use the fittings provided on the aircraft, vehicle, and equipment to be transported to secure the item to the ship.

d. Do not use excessive force to place a tie-down onto a fitting.

e. Ensure that the arrangement of individual tie-down assemblies is in strict conformance with design requirements.

f. Ensure that when lashing and tie-down equipment is not in use, it is stowed in its proper location.

g. Take special precautions in dealing with equipment which may have broken loose during heavy weather conditions. Conduct an operational risk management (ORM) assessment to evaluate the hazards to personnel and to the ship and identify and implement controls prior to attempting to secure equipment, vehicles, or aircraft.

h. Refrain from use of machinery, tools, moving heavy stores, or other non-essential evolutions that may have an increased risk due to the ship's movement during heavy weather.

i. Supervisors must take into account the physical condition (sea sickness) of crew members during heavy ship movement before assigning critical or hazardous tasks.

j. In cold weather situations where crew members are assigned to remove snow or ice from topside areas ensure personnel are properly outfitted with cold weather gear and gloves.

k. Avoid any mast or topside work, and secure personnel from exterior areas when thunderstorms threaten, whether or not lightning is sighted.

30 May 2007

## CHAPTER C17

### ABANDONING SHIP

#### C1701. SAFETY PRECAUTIONS DURING ABANDONING SHIP

a. Wear a full set of clothing including shoes and a soft cap or head covering as protection from exposure.

b. Do not wear a helmet (e.g., Kevlar®) or plastic hard hat when going over the side.

c. Life preservers authorized by reference C17-1 shall be securely fastened. When distance to the water is over 30 feet and/or there is burning oil on the water, throw the life preserver over the side. Inflatable life preservers shall not be inflated until the wearer is in the water. The life preserver shall be inflated as soon as wearer is in the water and/or clear of flames.

d. Go over the sides by means of a line, ladder, or debarkation net if time permits.

e. Look first to be sure that water below is clear of personnel or floating gear or wreckage, if it is necessary to jump.

f. Do not dive, always jump feet first, with feet and legs together, and arms crossed over the chest holding onto the life preserver.

g. Always abandon ship as far away from the damage as possible.

h. Know direction of the wind and go to windward side of ship, if possible, to avoid flames, oil, and drift of ship.

i. When in the water, concentrate on staying calm and avoiding panic. Obey the following rules:

(1) Conserve energy by moving as little as possible.

(2) Keep clear of oil slicks, if possible. If possible, protect eyes and breathing passages by keeping head high or swimming underwater. If swimming underwater, prior to

30 May 2007

coming to the surface, put hands above head and splash the water surface to disperse oil, debris, or flames.

(3) If there is danger of underwater explosion, float or swim on the back as near the surface of the water as possible.

(4) Stay with other persons in the water to reduce danger of sharks and make rescue easier. In cold water, forming close circles with others will preserve heat.

(5) If ship is sinking rapidly, swim clear promptly, and tow injured persons clear, to avoid suction effect.

j. Follow all other procedures/precautions as delineated in the ship's Abandon Ship Bill.

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## CHAPTER C17

### REFERENCES

C17-1. Naval Ships' Technical Manual (NSTM) 077, Personnel Protection Equipment

30 May 2007

## CHAPTER C18

### PAINTING AND PRESERVATION

#### C1801. DISCUSSION

a. For precautions for application and removal procedures of lead-based containing paint, see chapter B10. This chapter deals exclusively with the application and removal of non-lead containing based paint.

b. Many paints, varnishes, lacquers, cleaners, solvents, and other finishing materials contain flammable solvents and, therefore, present a fire hazard. In addition, these same products may give off toxic vapors which can be harmful to health and the environment. It is therefore necessary that personnel take proper precautions in handling and using these products. See reference C18-1 for detailed procedures and precautions.

c. Paint removal operations can produce extremely high personnel exposures to toxic substances found in paints, depending on the method of removal. Follow administrative and protective measures to reduce the amount of dust from sanding, grinding, and chipping paints and from fumes generated during hot work on painted surfaces.

#### C1802. SAFETY PRECAUTIONS FOR PAINT REMOVAL

a. Ship's force shall not perform routine shipboard paint removal for cosmetic reasons or due to excessive coating thickness. Ship's force should only remove paint when required to accomplish preservation of corroded surfaces, incidental to hot work, welding, or when bare metal is necessary for an inspection.

b. Wear eye protection, and a long sleeve shirt or coveralls with sleeves rolled down. Consult the respiratory protection manager (RPM) about any respirator requirements for the operation.

c. For paint removal, keep mechanical grinding and sanding to the absolute minimum with primary reliance on manual removal methods, impact tools and authorized chemical paint strippers.

30 May 2007

d. Use only pneumatic, not electric powered, wire brushes and chipping tools over the side.

e. When working over the side or aloft, see chapter C8 for additional precautions.

f. Wear protective gloves when handling cleaning compounds or chemical removers.

g. Wear electrical safety gloves when using portable, electric-powered tools. See chapter C9 for additional precautions when using electrical power tools.

h. Many paint removal tools are noise hazardous equipment. If equipment is labeled as noise hazardous, ensure that proper hearing protective equipment is worn. See chapter B4 for additional information.

i. Assume all paint contains substances, such as lead and chromate, which are hazardous to health if ingested or inhaled in small amounts, unless proven otherwise by sample analysis (see Chapter B10 for paint sample analysis procedures).

j. Treat all paint debris as environmentally hazardous material and control and dispose of accordingly. When working topside, set up barriers to prevent paint debris from entering surrounding waters.

k. Secure and cover all deck drains and installed ventilation systems and openings in the paint removal work area to control dust. Isolate the work area to the maximum extent possible with drop cloths and/or plastic.

l. Personnel shall minimize the use of water as dust control or clean-up in the paint removal process, since any used in the operation must be treated as hazardous material (HM).

m. Tools and surfaces in at the work area shall be wiped down with a damp cloth or tack cloth after completion of the task to remove dust.

n. Ensure that paint debris, wipe down rags, and other disposable materials are separated from reusable coveralls, gloves, and boots. Place disposable materials into plastic bags and turn them in to the ship's hazardous material minimization center (HAZMINCEN) or HM coordinator.

30 May 2007

**C1803. SAFETY PRECAUTIONS FOR SURFACE PREPARATION AND PAINTING OPERATIONS**

- a. Wear eye protection when painting.
- b. Do not paint in any area where welding or other hot work is being performed.
- c. Wear respirators for painting operations if directed by the RPM.
- d. Return paint in closed, authorized containers, to the paint locker or ship's HAZMINCEN at the end of each day.
- e. Store paint, brushes, and stirring sticks in closed metal containers. Do not place or store paint and paint wastes on the pier for extended periods of time. Turn in all paint waste to the ship's HAZMINCEN or designated area for disposal.
- f. Ensure exhaust ventilation system is switched on and operational in closed areas when painting.
- g. Wear protective gloves when handling cleaning compounds, thinners, paints, removers, or other irritants. Do not use electrical safety gloves for paint work.
- h. De-energize all equipment in areas being painted if using highly flammable paints.
- i. Use a spray booth when spray painting, if available and practical.
- j. Use explosion-proof lighting during spray painting operations if using highly flammable paints.
- k. All paints, paint cleaners, solvents and brush cleaners are HM. Return all containers of paints and thinners to the paint locker or ship's HAZMINCEN upon completion of the job, at the end of the workday, or when taking a lengthy break.
- l. Only perform paint mixing in the paint locker or ship's HAZMINCEN if adequately ventilated. If not adequately ventilated, only mix paints on the weather decks. Provide posted barricades to ensure smoking, open flames, or hot work does not occur in the vicinity of the paint mixing area.

30 May 2007

m. Avoid prolonged skin contact with paints and thinners and do not use paint thinners or mineral spirits to clean paint off of skin. Use an approved industrial skin cleaner to remove paint from skin. Never use bare hands to mix paints.

n. Use approved painting pollution prevention equipment according to the safety precautions provided.

(1) Wear eye and skin protection when dispensing paint, maintaining dispensers and brush holders, and cleaning paint brushes.

(2) Paint dispensing systems and paint brush holders are to be operated and maintained only by authorized personnel.

(3) Approved paint brush holders, provided for storage of paint brushes in mineral sprits, will be kept closed to avoid evaporation and release of vapors into the air.

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## CHAPTER C18

### REFERENCES

C18-1. Naval Ships' Technical Manual, Chapter 631, Painting and Preservation of Ships

30 May 2007

**CHAPTER C19****FOOD SERVICE AND TRASH AND GARBAGE DISPOSAL EQUIPMENT****C1901. DISCUSSION**

A basic necessity for any ship is a galley. The crew must be fed and personnel must prepare food for consumption. The food preparation required to feed a large body of people means that machinery and equipment must be used. The use of this machinery introduces hazards unique to the galley and food preparation areas. Additional precautions may be found in reference C19-1. Personnel assigned to permanent and temporary work in food service areas shall be given a copy of these precautions prior to beginning their assignment.

Every Navy ship and submarine is equipped with trash and garbage processing machinery, frequently under the purview of the Supply Department. This equipment includes pulpers, trash compactors, incinerators, plastic waste processors, and garbage disposals. Use of this machinery has unique hazards as well as environmental pollution ramifications.

**C1902. GENERAL PRECAUTIONS**

Before attempting to operate machinery, observe the following general precautions:

a. Check for and determine the location of emergency equipment, such as fire extinguishers, cut-off switches, and first aid boxes, to ensure their availability should an accident occur. Ensure machinery, hand tools and electrical equipment are properly grounded prior to operation. Report any deficiencies or malfunctioning equipment to your supervisor.

b. Make sure that the work area around the equipment is clear of obstructions and thoroughly dry. Clean up all spills immediately to ensure a clean, dry, non-slippery walking surface.

c. Ensure the installed lighting in the work area is operating properly and provides sufficient light.

d. Read, observe and follow posted operating instructions and safety precautions.

30 May 2007

e. If there is any doubt about operating procedures or safety precautions, ask your supervisor.

f. Only authorized personnel shall attempt to operate equipment.

g. Be certain no loose gear is in the vicinity of moving parts of machines. Make sure all safety guards, screens, and devices are in place before turning on machinery.

h. Never use your hands or body to stop moving blades and parts or to clear food in mixers or meat slicers.

i. If ship movement is severe, exercise caution in operating machines; if severe movement continues, discontinue nonessential machine operation and turn off equipment.

j. Utilize eye and hand protection, and safety equipment such as dip baskets while handling chemicals or hot water. Personnel at the deep sink shall wear protective gloves with elbow-length or longer sleeves to prevent hot water burns.

k. Keep your hands, body, and clothing away from operating machine parts.

l. Never leave operating machinery unattended.

m. Do not attempt to clean or service machinery while it is in operation. Before cleaning, adjusting, oiling or greasing equipment, be sure power is turned off and equipment is DANGER tagged. Follow tag-out procedure when servicing or cleaning equipment. If in doubt about the requirement to tag-out any equipment, consult your supervisor.

n. Ensure only authorized personnel make all repairs and service machines.

o. Make sure safety devices such as safety interlocks on galley equipment, such as the covers of vegetable peelers and bread slicer, are maintained in proper working condition at all times. If removed for any reason, replace such devices before the machine is returned to operation.

p. Remove rings and watches, pagers, cell phones, and eliminate any loose clothing such as rolled-up sleeve cuffs, oversized gloves, and ill-fitting coats and jackets.

30 May 2007

q. Ensure that permanently-mounted equipment is hardwired (extension cords are not permitted). Know where the cut-off switches for hard-wired equipment are located. Obey all tag-out tags on switches.

r. When cleaning, look before reaching into enclosed spaces or under grills or griddles for loose wires or sharp obstructions.

s. Avoid touching sharp metal edges of opened cans and lids.

t. Report any injuries, such as burns, cuts or open wounds, to your supervisor.

**C1903. COOKING UTENSILS**

a. Make certain that all heavy items, knives, and other sharp tools are securely fastened and stowed in racks to prevent injury to personnel.

b. Secure all coffee pots and urns to prevent dislodging and splashing.

c. Exercise extreme caution and care when handling hot oils, water, and other liquids or when operating steam valves and equipment. In heavy or moderate sea states, do not transfer hot liquids.

d. Never leave operating hot plates, pots, griddles, or fryers unattended.

e. Be careful not to place meat, vegetables, or other foods on a knife or other sharp instrument. The food may conceal the cutting edge.

f. Do not place knives in the wash water until ready to wash them. Lay them in plain view beside the sink.

g. When using a cleaver, keep your free hand as far from the path of the cleaver as is necessary to assure safety.

h. Use a protective glove (e.g., metal fiber or Kevlar®) when boning meat.

30 May 2007

- i. Keep the surfaces of meat blocks level.
- j. Do not allow pot/pan handles to extend beyond the edge of the range. They can be bumped and serious burns to personnel result from spilled food or liquid.
- k. Before removing foods from hot ranges and ovens, be sure there is a clear place on which to set them and clear the path to that place.
- l. Use only the proper implements for opening cans and other containers.
- m. Keep knives in a rack designated for this purpose only.
- n. Magnetic knife racks are prohibited due to knife magnetism picking up foreign material.
- o. Keep knives sharp at all times.
- p. Ensure hot pads are clean and dry.
- q. Keep all tools clean and dry.

**C1904. FOOD PREPARATION**

- a. Practice good personal hygiene at all times, and report all illnesses and injuries to your supervisor.
- b. Keep your hands clean and thoroughly wash hands with soap and water after using the head, touching your mouth or nose, or handling raw meat or fish.
- c. Keep fingernails short.
- d. Wear appropriate hair covering at all times in food-handling areas.
- e. Do not touch food with your bare hands. Use appropriate implements for handling food or wear plastic food handling gloves.
- f. Never handle food when you have an open wound or infection of any kind on your hands or arms. If you develop a sore throat, cold, intestinal disturbance, or symptoms of other general disease, report to the corpsman at once.

30 May 2007

g. Clean up spilled food immediately.

h. Do not use leftovers held over 36 hours. Ensure all leftovers are marked with the date and time they were placed in storage.

i. Ensure that distant-reading dial thermometers and, when required, electronic temperature-monitoring units are installed and operating. Verify thermometer accuracy monthly. Ensure the emergency door-release mechanism required in "walk-in" refrigerators and freezers is installed and properly operating.

j. Discard protein foods that have remained at temperature between 40 degrees Fahrenheit and 140 degrees Fahrenheit longer than three hours.

k. Observe safety precautions around all electrical equipment to avoid injury from shock. Do not reach into areas for cleaning around griddles and ovens that have exposed wiring unless the equipment has been tagged out.

l. Notify your supervisor immediately if the heat stress dry bulb thermometers read 100 degrees Fahrenheit or greater, or if you experience dizziness, nausea, or other heat stress related symptoms.

m. Wear eye and hand protection when using oven cleaners or other strong cleaning materials. Do not dispense bulk cleaners into spray bottles without properly labeling the spray bottle with the new contents. See chapter C23 for details on handling of hazardous materials and atmosphere contaminants.

**C1905. SAFE OPERATION OF FOOD SERVICE EQUIPMENT**

a. General precautions. Observe all posted operating procedures for each piece of food service equipment. Additionally, inspect all electrical equipment (range, griddle hotplate, and disposals) for exposed, chafed or frayed wiring.

(1) Ensure all power switches are functional.

(2) Ensure all required guards are in place.

(3) Ensure rubber boots over switches in wet areas are in good condition.

30 May 2007

(4) Ensure all personnel operating equipment or performing food service functions are trained and properly supervised.

(5) Ensure meat slicers are de-energized at the power source, not just turned off with a local switch, prior to dismantling/reassembling for cleaning. Ensure any switches on meat slicers are guarded to prevent them being turned on unintentionally.

b. Deep Fat Fryer

(1) Beware, this is high voltage equipment.

(2) Extinguish a fire in the deep fat fryer per reference C19-2.

(3) Never leave fryer unattended when in use.

(4) If solid fat is used, do not allow large pieces to drop on heating units or thermostat bulb.

(5) Whenever possible, melt solid cooking oil or fat prior to putting into deep fat fryer.

(6) Ensure heating coils are completely covered with fat before turning on the equipment.

(7) Never exceed the maximum temperature noted by manufacturer.

(8) Monitor cooking oil temperature with a proper thermometer whenever the deep fat fryer is in use. Ensure back up safety thermostat is installed and operational.

(9) Install cover when fryer is not in use.

(10) Secure deep fat fryer following posted instructions when not in use.

(11) Ensure that grease spills are cleaned up promptly.

30 May 2007

(12) Wash and change grease filters in range hoods as often as necessary per PMS, but not less than weekly, to avoid the danger of fire.

c. Dough Mixing Machine

(1) Never attempt to cut dough while the agitator is revolving.

(2) Never attempt to knead or feel consistency of dough product while machine is in operation.

(3) Never attempt to clean out a bowl in the tilt position by reaching in unit while the agitator is revolving.

(4) Check safety switch to lid cover for proper functioning in accordance with PMS.

d. Food Mixing Machine

(1) Use proper machine speed for the specific operation.

(2) Never place hands into the bowl while machine is in operation.

e. Vegetable Cutting and Slicing Machine

(1) Always use plunger when applying pressure on vegetables being fed into the hopper.

(2) Do not use loose-fitting gloves when operating the machine.

f. Meat Slicing Machine

(1) Never operate the machine unless the blade guard is secured in place.

(2) Do not use hands to press down food.

(3) Never touch the blade when it is running or exposed for slicing.

(4) Set index at zero and secure power at the distribution box or by pulling the plug when cleaning blade.

30 May 2007

(5) Ensure slicing machines are provided with a toggle switch finger guard that is oriented in the proper direction for protection.

(6) Always disconnect power cord prior to cleaning and reconnect only when ready to use.

(7) Once de-energized, clean the blade with a clean, detergent-soaked cloth wrapped around a cook's fork or other extension utensil. Rinse the blades following a similar procedure and sanitize them with an approved disinfectant.

(8) Reassemble machine after cleaning.

g. Steam Kettle

(1) Each day this equipment is used, test the safety relief-valve while under operating pressure by pulling the chain attached to the safety relief valve arm.

(2) Do not tamper with the safety-valve or tie it closed. It is there to prevent the kettle from exploding.

(3) Do not apply steam to an empty kettle; never put water into a hot, dry kettle.

(4) Ensure safety relief-valve levers are equipped with an 18-inch chain to allow activation from a safe distance. Chains must be mounted in such a way that the need to reach over or between/behind hot kettles is eliminated.

(5) Ensure steam-jacketed kettles are hydrostatically tested as required by the equipment maintenance requirement card (MRC).

(6) Piping from relief valves shall extend to just inside the deck coaming.

(7) Lagging under steam kettle shall be removed and replaced with perforated steel or aluminum with approximately 1/2-inch stand off.

h. Electric Griddle

(1) Keep griddle turned off when not in use.

30 May 2007

(2) Keep cooking surface and grease gutter scraped and wiped clean at all times.

(3) Remove, empty, and clean grease drawer after each use. Do not reach into the drawer area for cleaning unless the griddle is tagged out.

(4) Use griddle guards to keep food from sliding off the cooking surface.

(5) Never use water to clean a griddle surface. Wipe the surface with clean, dry paper towels when the griddle is cold. Use pumice stone block to clean hard-to-remove burn spots.

i. Coffee Urn

(1) Do not introduce water too quickly into the boiler.

(2) Do not overfill boiler. Be sure water has stopped rising in the gauge glass after the water-inlet valve is closed. Do not turn on activating switch until water-level gauge reads full or the pressure control dial reads 36 ounces.

(3) Do not open urn cover while siphon valve is open. Do not agitate coffee while cover is open. Do not remove leacher from the urn body until it is completely drained.

(4) Do not obstruct safety-valve outlet. Keep equipment clean. Clean the urn immediately after use to prevent development of rancid taste.

j. Ranges and Ovens

(1) Do not allow grease to collect in oven.

(2) Do not clean oven while it is hot.

(3) Clean oven thoroughly once a week in addition to normal daily cleaning.

(4) Turn off surface units when not in use.

(5) Keep range drip-pan and grease trough clean. Never allow grease to accumulate since it is a serious fire hazard.

30 May 2007

(6) Observe the electrical wiring under the range griddle/hot plate to see if wiring is secured in place and not chafed or in contact with the grease drip-pan. Tag-out the power source prior to cleaning under the range, griddle, or hot plate. DO NOT attempt to correct faulty wiring yourself. Report electrical hazards to your supervisor.

k. Proofer

(1) Only authorized personnel are permitted to operate this equipment.

(2) Clean the proofer after each use.

l. Dishwashing Machine. Observe operating instructions and safety precautions.

(1) Ensure rubber protectors over switches are in good condition (no cracks or tears).

(2) Wear protective equipment when changing out cleaner dispensers.

(3) General ventilation in the space and local exhaust ventilation to remove steam from the machine must be operational.

(4) Do not reach into the dishwashing machine while operating - secure power before trying to clear the conveyor.

m. Steam Table

(1) Use the proper implements, such as pot holders and tongs, for handling the containers.

(2) Tilt containers away from you when inserting them into the wells.

(3) Carry hot liquids in covered containers with the covers securely in place and use heat protective hand protection.

(4) Promptly mop up grease which is spilled on the deck.

30 May 2007

n. Gaylord Exhaust Hoods.

(1) The fire extinguisher control box contains a live electrical circuit. Prevent water or other cleaning fluids from entering this box.

(2) The baffle blades and interior of hood should be cleaned at least once a day to prevent fires from accumulation of grease.

(3) Keep the access doors closed during the wash and rinse cycles to prevent hot water from splashing personnel.

(4) Keep hood drains clear at all times.

o. Meat Chopping Machine

(1) Never feed this equipment by hand. Use a pestle (stomper).

(2) Never attempt to remove anything from these machines while they are operating.

(3) Always disconnect the machines before cleaning them.

p. Meat Tenderizing Machine

(1) Never place your hands near the feed slot when feeding material into this machine.

(2) Avoid wearing loose fitting gloves.

q. Potato Peeler

(1) Make sure water is running before operating this equipment.

(2) Never put your hand in this machine while it is operating.

**C1906. TRASH AND GARBAGE PREPROCESSING EQUIPMENT**

a. Garbage Grinder

(1) Do not put hands into grinder when in operation.

30 May 2007

(2) Start grinder and turn on water before feeding waste.

(3) Feed food waste gradually.

(4) Do not feed metal, wood, cloth, rubber, plastics, or corn husks into the garbage grinder. If such material is fed accidentally, stop grinder immediately and remove object after disconnecting power. Do not feed bones larger than 1/4 inch in diameter for the 400-pound/hour model or larger than 1 inch in diameter for the 1,600-pound/hour model into the grinder.

b. Trash Compactor. Refer to chapter C13 for precautions on the operation of the trash compactor.

c. Plastic Waste Processor (PWP)

(1) Only authorized personnel may operate the PWP.

(2) Hazards with the PWP include hot surfaces, electrical hazards when cleaning, and slippery decks.

(3) Follow operating instructions provided with the PWP.

(4) Wear the proper personal protective equipment including heavy-duty gloves, safety glasses, and leather apron while operating the plastic waste processor.

d. Incinerator

(1) Only authorized personnel may operate the incinerator.

(2) Hazards with the incinerator include hot surfaces.

(3) Follow operating instructions provided with the incinerator.

(4) Wear the proper personnel protective equipment including heavy-duty gloves, face shield, and apron while operating the incinerator.

e. Pulper

- (1) Do not put hands into pulper when in operation.
- (2) Only authorized personnel may operate the pulper.
- (3) Hazards with the pulper include electrical hazards when cleaning and slippery decks.
- (4) Follow operating instructions provided with the pulper.
- (5) Wear the proper personnel protective equipment including rubber gloves, face shield, and apron while operating the pulper.

f. Solid Waste Shredder

- (1) Do not put hands into shredder when in operation.
- (2) Only authorized personnel may operate the solid waste shredder.
- (3) Hazards with the shredder include electrical hazards when cleaning and slippery decks.
- (4) Follow operating instructions provided with the shredder.
- (5) Wear the proper personnel protective equipment including heavy-duty gloves, safety glasses, and leather apron while operating the shredder.

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**CHAPTER C19**

**REFERENCES**

- C19-1. NAVMED P-5010, Manual of Preventive Medicine
- C19-2. Naval Ships' Technical Manual (NSTM) 555, Surface Ship Fire Fighting

## CHAPTER C20

### LAUNDRIES AND PHOTOGRAPHY LABS AND DARKROOMS

#### C2001. DISCUSSION

Hazards in laundries, dry cleaning plants, and photographic laboratories include mechanical equipment, toxic chemicals, electric power, and heat stress. Safety precautions contained in this chapter are basic and general. Ships shall provide personnel assigned to work with laundry equipment with a copy of these precautions prior to beginning their assignment.

#### C2002. LAUNDRY PRECAUTIONS

##### a. General Precautions

(1) See chapters B3 and C23 for handling and stowage requirements for hazardous materials used in laundries and dry cleaning plants.

(2) Personnel shall use protective equipment listed in the material safety data sheet (MSDS) or current industrial hygiene survey when required.

(3) Ensure a readily accessible emergency eye wash station is installed in the laundry area.

(4) Do not disable two-hand safety switches on any of the presses, and ensure personnel using presses are trained in their safety precautions.

(5) Ensure ventilation systems and spot coolers are functioning in laundry and press areas, and presses and dry cleaning machines are provided with local exhaust ventilation.

(6) Ensure automated detergent dispensers are properly maintained and electrically grounded.

##### b. Washer Extractor

(1) Thoroughly examine all clothing before cleaning; remove all foreign materials such as matches, lighters, ink pens, and metallic objects.

30 May 2007

(2) Make certain that the cylinder door is firmly latched before operating the machine.

(3) Do not exceed the prescribed loading capacity of the cylinder; doing so may damage the machine or prove hazardous to personnel.

(4) Ensure the machine is entirely disconnected from the circuit before cleaning or servicing. Use safety tag-out procedures as required by reference C20-1 and preventive maintenance system (PMS) requirements.

(5) Ensure safety devices, such as the safety interlock on cover, are maintained in proper working condition at all times. If removed or out of order for any reason, replace safety devices before the machine is put into operation.

(6) Do not exceed the recommended detergent amount for load size being washed. Excessive soap may cause skin irritation.

(7) Ensure safety precautions and operating procedures are posted.

c. Tumbler Dryer

(1) Turn off power prior to loading and unloading machine.

(2) Never overload the machine.

(3) Never open the door while the tumbler is in motion.

(4) Before servicing or cleaning, be sure the power to the tumbler dryer is entirely disconnected. Use safety tag-out procedures as required by reference C20-1 and PMS.

(5) Maintain safety devices in proper working order at all times. If removed for any reason, replace safety devices before machine is put into motion.

(6) Ensure that the primary lint screen is checked and cleaned as required prior to use and after every drying cycle. Ensure the secondary lint filter is cleaned after every four hours of operation (eight hours for self-serve laundry).

(7) Ensure someone is watching the machine while it is running. It is a fire hazard.

(8) Ensure safety and fire prevention precautions and operating procedures are posted.

(9) Never allow the dryer temperature to exceed 160°F (71 degrees Centigrade).

d. Self-Service Laundries

(1) Ensure self-service laundry equipment is installed only in authorized areas, where dryer ventilation, drainage, and electrical service are provided.

(2) Post safety precautions and operating instructions at each unit.

(3) Clean dryer lint filters after each use.

(4) Dryer vents must be directed into an approved overboard exhaust, never to water filter units within the space.

(5) Self-service units may only be plugged into approved receptacles and not hard wired into the ship's electrical system.

**C2003. PRECAUTIONS FOR LITHOGRAPHIC, PHOTOGRAPHIC AND RADIOGRAPHIC DARKROOMS AND LABORATORIES**

a. Ensure each chemical mixing and developing area is equipped with an emergency eye wash station if it is determined that corrosive liquid hazards exist.

b. Avoid skin contact with chemicals. Personnel shall use protective equipment listed in the industrial hygiene survey when required.

c. Clean protective equipment after each use.

d. Take care when entering or leaving darkroom areas because of the rapid change of lighting.

e. Inspect all electrical connections frequently for damage and fraying. Ensure that all electrical equipment is properly grounded, has been safety checked, and approved electrical plugs are used.

30 May 2007

f. Never touch an electrical plug, switch, or any part of an electrically operated machine with wet hands or while standing on a wet deck.

g. Use rubber mats with appropriate electrical ratings around equipment that could cause electrical shock.

h. Ensure chemicals are stored in accordance with ship's hazardous material (HM) or hazardous material minimization center (HAZMINCEN) requirements.

i. Ensure chemicals are properly collected for disposal as directed by the ship's HAZMINCEN, and that overboard deck drains are secured when a potential for chemical spillage exists.

j. Use the following precautions with **flash equipment**:

(1) Severe electrical shock is the hazard to guard against when using electronic flash equipment. Stored energy in photographic electronic flash units can be lethal (some units operate from voltages as high as 4,000 volts). Use caution whenever operating this equipment.

(2) Only those thoroughly familiar with the equipment shall repair electronic flash equipment. The storage capacitors may have a large charge at high voltage and can be discharged at high amperage which may be lethal.

(3) Use extreme caution when utilizing flash equipment on the flight deck during launch, recovery, or taxi evolutions especially at night. At no time use flash equipment without the expressed approval of the flight deck officer.

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## CHAPTER C20

### REFERENCES

C20-1. NAVSEA S0400-AD-URM-010, Tag-Out Users Manual (TUM)

30 May 2007

**CHAPTER C21****MEDICAL AND DENTAL FACILITIES****C2101. DISCUSSION**

This chapter contains basic safety precautions that medical and dental personnel must observe to protect themselves and their patients from harm. Consult operating manuals and Planned Maintenance System (PMS) maintenance requirement cards (MRCs) for complete safety precautions related to specific items of equipment.

**C2102. SAFETY PRECAUTIONS FOR MEDICAL AND DENTAL FACILITIES****a. Special Precautions**

(1) Dispose of disposable needles and syringes in "sharps" containers as an entire unit.

(2) Keep all liquid pesticides under lock and key. Keep bulk amounts in a flammable liquid storeroom.

(3) Ensure that only medical department personnel who are instructed in the proper use and toxicity of the pesticides use them.

(4) Keep all poisons and bulk compounding materials under lock and key.

(5) Double lock the pharmacy when not in use, with keys made available only to authorized personnel.

(6) Do not stow, use, or dispense methyl alcohol in the pharmacy.

(7) Account for methyl alcohol in same manner as ethyl alcohol and narcotics. Attach a prominent label to each container of methyl alcohol with clear warning of its dangerous qualities.

(8) Maintain a poison antidote locker. Secure the locker with a seal and ensure a complete inventory is made whenever the locker seal is broken.

30 May 2007

(9) Stow inorganic medical acids such as hydrochloric, sulfuric, nitric and phosphoric in lead-lined or acid-resistant containers in the medical storeroom (see chapter C23). Stow organic acids such as glacial acetic, oxalic, carbolic, cresylic, and picric acids in a locker lined in acid resistant material (not lead) in the flammable liquids storeroom (see chapter C23).

(10) Only keep a minimum working stock of flammable materials (e.g., alcohol and acetone) on hand in medical department spaces. Keep stocks of a bulk nature in a separate locked cabinet in the flammable liquid storeroom.

(11) Ensure only medical department personnel handle bacteriological specimens.

(12) Due to a large number of extremely hazardous shipboard jobs requiring full attention at all times, label all medications affecting awareness.

(13) When handling and disposing of medical waste follow the guidelines in reference C21-1.

b. General Safety Precautions

(1) Do not permit any smoking in areas where oxygen is being administered.

(2) Secure all medical equipment having wheels when not in use. Use wheel blocks or securing straps for this purpose.

c. Sitz Bath and Whirlpool Tank. Safety check electrical cords to ensure that all cords are in good repair (e.g., without frayed insulation or exposed wires), prior to such treatments to preclude the potential for electrical shock.

**CAUTION:**

Do not use electrical appliances including radios, other than authorized equipment in the physical therapy spaces at any time.

**CHAPTER C21**

**REFERENCES**

C20-1. OPNAV P-45-113-3-99, Afloat Medical Waste Management Guide (NSN: 0420-LP-022-6620)

30 May 2007

**CHAPTER C22****CO<sub>2</sub> FIXED FLOODING SYSTEM SAFETY PRECAUTIONS AND PROCEDURES****C2201. DISCUSSION**

a. This chapter contains basic safety precautions that personnel must observe to protect themselves from harm from carbon dioxide (CO<sub>2</sub>) fixed flooding systems. Consult operating manuals and Planned Maintenance System (PMS) Maintenance Requirement Cards (MRCs) for complete safety precautions related to specific items of equipment.

b. Follow the procedures and precautions in this chapter whenever performing corrective or preventive maintenance work inside or outside a space protected by a CO<sub>2</sub> fixed flooding system. This includes work on the CO<sub>2</sub> fixed flooding system and in the immediate area of manual or electrical controls for the system.

c. This chapter discusses the health hazards of CO<sub>2</sub>, general safety precautions, and procedures for disabling CO<sub>2</sub> fixed flooding systems, for general maintenance and for rescue personnel.

d. Carbon dioxide (CO<sub>2</sub>) is a colorless, odorless gas that is naturally present in the atmosphere at an average concentration of 0.03 percent. It extinguishes fires at high concentrations by reducing the concentration of oxygen to the point that combustion stops. Concentrations of CO<sub>2</sub> in the range of 30 to 70 percent are needed to extinguish fires.

e. Carbon dioxide for firefighting is stored as a liquid at high pressures. Upon discharge into a protected space, most of the liquid flashes to vapor and the rest forms fine, dry ice particles.

**C2202. HEALTH HAZARDS OF CARBON DIOXIDE**

a. Carbon dioxide is 1.5 times heavier than air, and will collect at low points. Unless forced ventilation is provided CO<sub>2</sub> will remain in the protected space and may migrate to adjacent spaces, especially if they are lower than the protected space. Ship's personnel should be aware of this whenever they approach a room in which the CO<sub>2</sub> has discharged.

30 May 2007

b. If CO<sub>2</sub> concentrations are greater than 30 percent, loss of consciousness will occur within half a minute. As the concentration increases further, cardiac arrest, brain damage due to lack of oxygen, and even death might occur. The body reacts to concentrations less than 10 percent by rapid and deeper breathing, headaches, and vomiting.

c. Tests have shown that within two seconds of actuation of a CO<sub>2</sub> fixed flooding system within a protected space, visibility is obstructed and within three seconds enough pressure has built up to prevent opening inward swinging doors.

### **C2203. SAFETY PRECAUTIONS**

a. Personnel performing work inside CO<sub>2</sub>-protected spaces without a CO<sub>2</sub> system time delay, shall ensure that inward swinging access doors are blocked open by a positive means, such as a C-clamp rigidly attached to the frame or door, to provide a minimum opening of six inches.

b. Ensure that the following safety precautions are followed when working on the CO<sub>2</sub> system **INSIDE** a CO<sub>2</sub>-protected space with the CO<sub>2</sub> system functional:

(1) Do not begin work on a CO<sub>2</sub> fixed-flooding system until a safety briefing has been given to all personnel involved in the maintenance work, the assigned rescue personnel, and persons in areas susceptible to CO<sub>2</sub> leakage.

(2) Verify that CO<sub>2</sub>-protected space ventilation is in operation.

(3) Evacuate all personnel from the CO<sub>2</sub>-protected space except those directly associated with the maintenance work. Evacuate all non-essential personnel from areas susceptible to CO<sub>2</sub> leakage.

(4) Identify and be familiar with an escape path from the protected space and areas susceptible to leakage of CO<sub>2</sub> to a safe haven not susceptible to CO<sub>2</sub> leakage.

(5) Verify that doors or hatches to the CO<sub>2</sub>-protected space and from areas susceptible to CO<sub>2</sub> leakage are blocked open and hatches or doors on the way to a well-ventilated space or to the weather are blocked open.

30 May 2007

(6) Post temporary danger signs to warn personnel of the hazard and temporary warning signs to limit access to the CO<sub>2</sub>-protected space and spaces susceptible to leakage of CO<sub>2</sub>. These signs should have lettering of at least one inch high. Danger signs shall include the words, "**DANGER - CARBON DIOXIDE GAS - WHEN ALARM SOUNDS - VACATE IMMEDIATELY.**" Post signs at the accesses to CO<sub>2</sub>-protected spaces, inside the protected space, and inside all spaces susceptible to CO<sub>2</sub> leakage.

(7) Ensure all personnel inside CO<sub>2</sub>-protected spaces wear operating oxygen breathing apparatus (OBAs).

(8) Verify that all personnel in spaces susceptible to leakage of CO<sub>2</sub> have emergency escape breathing devices (EEBDs) immediately available.

(9) Ensure rescue personnel are assigned, equipped, and located per paragraph C2206. Rescue personnel shall maintain a count of personnel inside the CO<sub>2</sub>-protected space.

c. Ensure that the following safety precautions are followed when working on the CO<sub>2</sub> system **OUTSIDE** a CO<sub>2</sub>-protected space with the CO<sub>2</sub> system functional:

Follow the procedures listed in paragraph C2203b for work done inside the CO<sub>2</sub>-protected space with the exception of the following escape path procedures.

(1) Verify that the doors and hatches to the CO<sub>2</sub>-protected space are closed.

(2) Verify that the doors or hatches in the escape path are blocked open.

d. Test the alarm systems within the guidelines provided by the PMS cards.

e. Be aware that any movement of the cylinder or the pull cable can actuate the pull-cable actuation systems.

f. Be aware that the seawater sprinkling system controls look similar to components of the CO<sub>2</sub> fixed-flooding systems.

g. Be aware that CO<sub>2</sub> can be discharged from CO<sub>2</sub> bottles if they are dropped and their discharge heads become damaged.

30 May 2007

h. Take precautions to not accidentally rotate the CO<sub>2</sub> cylinder in its brackets, thereby putting tension on the actuation cable.

i. Follow PMS procedures carefully during the process of removing and installing discharge and control heads to avoid accidental discharge of CO<sub>2</sub>.

**C2204. GENERAL PROCEDURES DURING MAINTENANCE WORK**

a. Ensure that the damage control assistant (DCA), the engineering officer of the watch (EOOW), cognizant department head, and the officer of the deck (OOD), when underway; or, the command duty officer (CDO), engineering department duty officer, cognizant department head, the OOD, and damage control (DC) central, when in-port, are notified and requested to be ready to respond immediately in case of an emergency before the work starts.

b. Ensure that all personnel directly involved follow tag-out procedures, including tag-out of all locations from which CO<sub>2</sub> discharge can be actuated.

c. The cognizant division officer shall verify that all ship maintenance personnel involved in maintenance on CO<sub>2</sub> fixed-flooding systems meet the applicable Personnel Qualification Standards and that knowledgeable, qualified supervision is assigned.

d. Ensure that any actuation of a CO<sub>2</sub> discharge alarm, either audible or visual, is investigated. An alarm that continues longer than one minute is abnormal and should be immediately investigated.

e. When corrective or preventive maintenance work is being done on the CO<sub>2</sub> system, do not permit normal space functions and other maintenance work in the CO<sub>2</sub>-protected space.

**C2205. DISABLING PROCEDURES**

a. Always disable CO<sub>2</sub> fixed-flooding systems by removal of the discharge heads and removal of the CO<sub>2</sub> cylinder control head, when installed.

30 May 2007

b. Ensure that the period of time that a CO<sub>2</sub> fixed-flooding system is disabled is limited whenever flammable material is in the CO<sub>2</sub> protected space.

c. Establish backup flammable liquid fire fighting capabilities (such as an aqueous film forming foam (AFFF) hose or a seawater hose with a five gallon can of AFFF concentrate and a portable educator) during the period the CO<sub>2</sub> system is disabled.

d. Establish fire watches during the period that the CO<sub>2</sub> system is disabled.

**C2206. RESCUE PERSONNEL PROCEDURES**

a. Ensure that a minimum of two rescue personnel are assigned. Assign additional personnel when more than four maintenance personnel are present using a ratio of one rescue person for each two maintenance personnel.

b. Locate rescue personnel at or near the access to the CO<sub>2</sub>-protected space in which the maintenance work is being performed or in the area in which the work is being done outside the CO<sub>2</sub>-protected space. Position rescue personnel so that they can monitor maintenance personnel and space/area conditions.

c. One rescue person shall have communications, such as a sound-powered phone, with a manned location such as damage control central, main control, the quarterdeck, or the bridge.

d. Equip assigned, qualified rescue personnel with SCBA or OBAs and ensure they are capable of providing cardio-pulmonary resuscitation (CPR).

e. Once accidental discharge of CO<sub>2</sub> has occurred, rescue personnel should do the following:

(1) Inform DC central, main control, and the quarterdeck (when in port) or the bridge (when underway) of the emergency and request assistance, including medical assistance.

(2) Help maintenance personnel escape.

(3) Count personnel leaving area to assure all personnel have departed.

30 May 2007

(4) Search for personnel who have not departed and assist them to escape.

(5) Verify that space in which CO<sub>2</sub> is dumped is free of personnel and then close the access door or hatch to reduce spread of CO<sub>2</sub> to other areas of the ship or space.

(6) Proceed to a safe haven.

(7) Perform CPR on any personnel that require help until assistance arrives.

(8) Report status of escape to operating station.

(9) Start ventilation to space.

f. Rescue personnel shall wear personal protective equipment (SCBA or OBA) appropriate for entry into immediately dangerous to life and health (IDLH) atmospheres (refer to paragraphs B0610(a) and (d)).

30 May 2007

**CHAPTER C23****HAZARDOUS MATERIAL CONTROL AND MANAGEMENT STANDARDS****C2301. DISCUSSION**

a. Hazardous material control and management (HMC&M) standards address policy requirements for the requisitioning, receiving, storage, use, and disposal of all hazardous material (HM). The information in this chapter provides the policy guidance that ships need to properly manage and control HM. It implements the requirements contained in Chapter B3 and considerations cited in the other references listed at the end of this chapter.

b. Special precautions are required for the stowage, handling, and use of HM aboard ship. Significant hazards include fire, poisoning by inhalation of toxic substances in unventilated spaces, dermatitis, asphyxiation, and burns of the skin and eyes. This chapter contains specific management guidance and precautions for stowage and use of all HM, and specific precautions for selected materials. Chapter B3 of this manual describes HMC&M emergency response and training requirements.

c. In order to comply with Chief of Naval Operations (CNO) direction, all U.S. Navy ships are required to implement the Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP). This program is a HM control and management plan calling for all HM to be centrally controlled onboard ships. CHRIMP requires the establishment/installation of Hazardous Material Minimization Centers (HAZMINCENS) on each ship for the centralized management of all shipboard HM, used and excess HM and empty HM containers. The HAZMINCEN is an issue/reuse site with HM inventory tracking by the Hazardous Inventory Control System for Windows (HICSWIN) software for surface ships and the Submarine Hazardous Material Inventory and Management System (SHIMS) for submarines.

d. Execution of CHRIMP through the establishment of a HAZMINCEN should reduce on board quantities of HM through inventory control and management. However, sufficient material should be available on board after these efforts to conduct HAZMINCEN operations and perform the preventive, corrective, and facilities maintenance needed to support ship operations.

e. Refer to chapter B3 to obtain Navy HMC&M definitions.

30 May 2007

f. The HMC&M Program shall be evaluated for compliance and effectiveness, in accordance with chapter B3. The checklists of appendices B3-C (Surface ships) and C23-B (Surface), may be used for this purpose. Additional supporting information and checks can be found in references C23-7 and C23-10. During HM coordinator spot checks and other inspections, all or portions of the checklists of appendices B3-C and C23-B may be used. The HM coordinator shall ensure the appropriate supervisor is included in inspections of work-centers and HM storage areas.

### **C2302. HMC&M - HAZMINCEN STANDARDS**

a. HMC&M - HAZMINCEN Program Element Overview. The following elements (from B0302) are essential for effective surface ship HMC&M. The requirements associated with these elements are described in the paragraphs that follow.

(1) **Centralized Inventory Management/Tracking.** Record and control HM using the Navy-developed, HICSWIN software. This software enables the user the ability to control the HM inventory. The HICSWIN Users Guide provides the user the information needed to utilize the system.

(2) **Requisitioning and Receiving Authorized HM.** Afloat units shall centrally manage authorized HM (new, used and excess) through the operation of a HAZMINCEN. The HAZMINCEN shall requisition, receive, store and centrally control the issue of all HM with a SHML MMI of "Y" and collection of all HM for disposal for the ship. The material management indicator (MMI) code identifies items which the HAZMINCEN controls.

(3) **HM Container Labeling.** Ensure HM container labeling complies with this chapter and applicable references.

(4) **Storage of HM.** The HAZMINCEN shall store incompatible HM separately to prevent the occurrence of an adverse reaction. HM and HAZMINCEN facilities shall be designed and operated to prevent risks to personnel or to the space in which they are stored.

(5) **Controlling HM Issue/Re-issue/Return.** Afloat units shall make HM available to work-centers 24 hours a day, and collect previously issued HM for reuse, alternate use, or offload. Record issue/return/re-issue in HICSWIN. Restrict the amount of HM in use to the lowest level necessary for the work performance of ship work-centers.

30 May 2007

(6) **HM Container Compatibility.** Store HM in containers reserved and configured exclusively for HM.

(7) **Consolidation/Offload/Disposal of Used or Excess HM.** Afloat units shall process HM for safe offload/disposal in accordance with this chapter and other applicable documentation. Provide optimal procedures and facilities for the turn-in of used HM, empty HM containers, and HM-contaminated items.

(8) **HM use and Handling Requirements.** Afloat units shall use personnel protective equipment when using and handling HM. Afloat units shall transport HM safely throughout the ship. HM and HAZMINCEN facilities shall be designed and operated to prevent risks to personnel.

(9) **Training.** The HM Coordinator shall normally receive en route training at the Navy Supply Corps School's basic and department head courses. The HM Supervisor, and other assigned personnel as required by the activity manpower document, shall be a graduate of the HMC&M Technician (SNEC 9595) course (A-322-2600 or A-322-2601). At a minimum the HM supervisor shall also be a graduate of the CHRIMP/HICS Technician course. (see paragraph chapter B3)

b. Centralized Inventory Management/Tracking of HM. Record and control HM using the Navy-developed, HICSWIN software. This software enables the user the ability to control the HM inventory. The HICSWIN Users Guide provides the user the information needed to utilize the system.

c. Requisitioning and Receiving Authorized HM

(1) **HM Stock Number Purchase.** Before ordering any HM, ships shall determine that a valid requirement exists (PMS, technical manual) and determine if the HM is authorized on the Type-Ships Hazardous Material List (T-SHML). If there is a valid requirement for HM not listed on the T-SHML, a SHML Feedback Report (SFR) including justification for that material shall be submitted. The SHML Feedback Report, when completed and signed by the commanding officer (or a designated officer O-5 or above) and attached to the purchase request, shall be used as the required certification. The ship shall obtain an MSDS from the manufacturer or supplier prior to approval of a new product for purchase or use and retain the material safety data sheets (MSDS) aboard. An SHML Feedback Report with the hazardous material information resource system (HMIRS) MSDS number shall be

30 May 2007

submitted via Standard Automated Logistics Tool Set (SALTS) Software to naval inventory control point (NAVICP) Code 0772, notifying the appropriate type commander and procurement department. Submittal of an SFR for a material which is not currently identified in HMIRS should be accompanied by an electronic version of the manufacturer's MSDS. Submittals of SFRs can be accomplished utilizing a number of methods such as SALTS, email, facsimile, and letter. NAVICP-M will provide an SFR tracking number and/or technical response within 48 hours of receipt of the SFR and appropriate supporting documentation. If SALTS is unavailable, reference C23-6 provides a hard copy SFR format.

**NOTE:**

The ship's hazardous material list (SHML) is a record of the HM authorized aboard U.S. Navy surface ships. The SHML provides surface ships with the ability to determine HM authorized and preclude stocking of dangerous material for which the ship has no use. Each SHML item is marked with a HM use category in the Allowed Onboard data field. Type-SHMLs or T-SHMLs shall be used by ships for which they are available. Ships of a type not covered under the existing T-SHMLs shall use the master SHML as their authorized use list. The Naval Supply Systems Command working with the technical systems commands assigns these use categories based on a technical and safety and health assessment of the product. These use categories are:

(a) Allowed (A). No restriction on use of this HM on surface ships.

(b) Prohibited (P). HM not allowed aboard surface ships and cannot be requisitioned.

(c) Restricted (R). HM not allowed aboard surface ships except with specific restrictions.

(d) Obsolete (O). HM that is obsolete and in most cases no longer procurable. Materials may become obsolete due to lack of purchase history.

(e) Not Determined (N). HM that is under review and is not allowed aboard surface ships.

30 May 2007

(2) **HM Open Purchase.** Navy policy is that, to the maximum extent feasible, ships shall only procure and use standard stock HM. If ships or other commands are approached by commercial vendors offering HM not listed in the SHML for shipboard use or for substitution for stock-numbered HM, they shall refer vendors to the shore side HAZMINCEN or NAVICP, Code 0772.

(3) **HM Receipt**

(a) The supply department shall check all containers of HM upon receipt to ensure that they contain a manufacturer's label as described in paragraph C2302d. They shall refuse a container not so marked.

(b) When authorized HM containers are accepted and brought aboard, they shall be immediately placed in a stowage location based on the hazard characteristic code (HCC) associated with the product. The HCC can be found on HMIRS MSDS. If the HCC is not on the HMIRS MSDS, contact NAVICP, Code 0772.

(c) The HAZMINCEN shall be the receiving point for HM that was requisitioned by, and will be issued from, the HAZMINCEN. This will allow HM data to be entered into the HICSWIN software.

d. HM Container Labeling

(1) All HM containers shall be labeled at all times. Labeling shall be in accordance with the following paragraphs.

(2) Labels for shipboard identification of HM containers must clearly identify the material name, the manufacturer's name and address, stock number, HCC, and the nature of the hazard presented by the HM including the target organ potentially affected by the material. A label may be a tag, sign, placard, or gummed sticker. For more information on container labeling, refer to reference C23-7.

**NOTE:**

If necessary, consult shipboard safety officer/industrial hygiene officer for assistance when identifying HCC assignments and/or target organs.

(1) When dispensing HM from one container to another unlabeled container, HAZMINCEN personnel shall annotate the

30 May 2007

receiving container to indicate the material name, manufacturer name and address, and the nature of the hazard (including target organ) as specified by the manufacturer to preserve the continuity of information.

(2) If the material is used and not in its original container, the HAZMINCEN shall ensure that the material is labeled as required above. In addition, a label identifying the material as used HM (refer to reference C23-7) shall be completed and attached to the container. This label shall contain information on the process in which the material was used (e.g., used spring bearing lube oil, circuit board cleaning solvent, dried out epoxy paint, etc.). It will also identify any known impurities that the material might contain based on routine PMS analysis (e.g., Naval Oil Analysis Program (NOAP) test results) and any special storage requirements. This information is necessary to assist the shore activity in properly storing the used HM and filling out disposal documents if the material is processed as waste.

**NOTE:**

If the material is transferred into a small container, such as a dropper bottle for boiler water chemistry, and insufficient room exists to place the required information on the label, the label shall at a minimum contain the material name, manufacturer's name, and stock number. The HAZMINCEN shall provide the remaining information on a card in a location known to users that is in close proximity to the container, so that it can be readily referenced. In addition, supplemental label information shall be cross-referenced to the smaller container, using numbers or letters (e.g., MSDS serial number).

e. Storage of HM

(1) **General Storage Requirements:**

(a) The HAZMINCEN shall store and centrally control the issue of all HM with a SHML MMI of "Y" and collection of all HM for disposal for the ship.

(b) Store HM in containers or compartments reserved and configured exclusively for HM. Bulk and infrequently used HM shall be stored in compliant storage spaces and only moved to the HAZMINCEN when necessary for replenishment and use. Do not stow

30 May 2007

HM in spaces or locations that are not specifically authorized for HM stowage.

(c) Stow incompatible materials in separate compartments to prevent mixing in the event of a spill. See section C2304 for information on stowage requirements based on the HCC.

(d) Post HM stowage locations with a CAUTION sign that states (obtain these signs through the supply system using national stock number (NSN) 9905-01-342-4851 (10" X 7") or 9905-01-342-4859 (3" X 5")):

#### **HAZARDOUS MATERIAL STORAGE AREA**

(e) Ensure that HM stowage locations other than lockers are equipped with supply and exhaust ventilation. Keep ventilation system in good operating condition. Any area to be used for HM stowage must first be evaluated by an industrial hygienist. For additional information refer to reference C23-24.

(f) Mark stowage compartments to identify type of HM stored by HCC and keep the compartment/materials clean and dry at all times.

(g) Stow HM only in containers that are compatible with the material (e.g., do not place corrosive materials in metal drums).

(h) Stack containers so that they will not crush lower containers, become imbalanced, or be difficult to access.

(i) Use material on a first-in, first-out basis, considering shelf life.

(j) Prohibit smoking, eating, or drinking in stowage areas.

(k) Never permit open flames or spark producing items in HM stowage areas.

(l) The gas free engineer shall monitor stowage compartments for oxygen depletion, suspect explosive atmospheres, the presence of potentially toxic vapors, and CO<sub>2</sub> accumulation any time the question arises as to the safety of a stowage area.

30 May 2007

(m) Operate only explosion-proof electrical equipment in a potentially explosive environment. Maintain explosion-proof electrical fixtures in proper condition in applicable HM stowage areas.

(n) Seal and protect all containers against physical damage and secure for heavy seas.

(o) Ensure containers are secured with metal banding or other tie-downs vice nylon, polypropylene or manila line.

**(2) Flammable Storage Requirements:**

(a) Store flammable and combustible materials separately from oxidizing materials.

(b) Use in-use flammable liquid cabinets within or near the workspace to stow a limited (seven-day) quantity of flammable liquids used routinely on a daily basis. Longer storage to address special needs must be authorized, in writing, by the Executive Officer after review of by the requesting department head, HM coordinator, DCA, and safety officer. Maximum total storage capacity of in-use flammable liquid cabinets shall be limited to 30 gallons per work-center. Permanently mount a label on lockers used for in-use flammable liquids worded as follows:

**FLAMMABLE LIQUIDS**

DURING STRIP SHIP CONDITION, THE CONTENTS OF THIS CABINET SHALL BE RELOCATED TO A FLAMMABLE LIQUIDS STOREROOM, ISSUE ROOM, OR READY SERVICE STOREROOM. Restrict access to HM stowage locations to personnel authorized by the responsible division officer. Entry to confined locations shall occur only after obtaining the gas free engineer's approval as specified in chapter B8 of this manual.

(c) No in-use storage of flammable and combustible materials is allowed in machinery spaces.

(d) Stow all lubricating oils and petroleum products with a flash point greater than or equal to 200 degrees Fahrenheit but less than 1,500 degrees Fahrenheit under fixed HALON or CO<sub>2</sub> gas flooding or sprinkler protection or on the weather deck under protection from the elements.

30 May 2007

(e) Ensure ordinary combustible materials such as rags, paper and wood are not stowed in flammable stowage areas.

(f) Pack oily rags in approved containers, in accordance with reference C23-7, and stow containers in flammable storage areas.

**(3) Toxic Storage Requirements:**

Store all toxic material in cool, dry, well ventilated spaces separated from all sources of ignition, acids and acid vapors, caustics, and oxidizers.

**(4) Corrosive Storage Requirements:**

(a) Ensure that acids and alkalis are stowed separately from each other.

(b) Ensure corrosive materials are not stored near oxidizers or other incompatible materials.

(c) Stow acids in a locker lined with acid-resistant material in the flammable liquids storeroom separated by a partition, or by at least three feet, from all other material.

**(5) Oxidizer Storage Requirements:**

Ensure oxidizers are stored in a separate compartment/storeroom. Oxidizers violently react (heat, combustion) with organic materials at room temperatures. Oxidizers cannot be stored in the same compartment with flammable or combustible materials such as fuels, oils, solvents, grease, paints, or cellulose products.

**(6) Aerosol Storage Requirements:**

(a) Stow ship's stores aerosol stock items in the flammable liquid storeroom.

(b) Do not stow aerosol containers in areas with temperatures above 120 degrees Fahrenheit or adjacent to steam lines, hot zones, or heat sources.

f. Controlling HM Issue/Re-issue/Return

(1) Make HM available to work-centers 24 hours a day. The ship can accomplish this by establishing normal hours of store

30 May 2007

operation during ship's working hours and on-call service during other periods.

(2) Issue/re-issue only limited quantities of HM essential for immediate needs during a work shift from the HAZMINCEN issue room or flammable liquid storerooms. Generally, less than a seven day supply of each routinely-used item shall be in or near the user compartment for HM issued from the HAZMINCEN (SHML MMI of "Y"). Longer storage to address special needs must be authorized, in writing, by the executive officer after review by the requesting department head, DCA, HM coordinator, and safety officer.

The HAZMINCEN shall provide work-center personnel with the amount of HM necessary to accomplish the job. If a worker needs only a pint of a solvent, only a pint should be issued; not a quart. The HAZMINCEN should, where possible, break down the volume issued using smaller containers. The HAZMINCEN shall mark these containers per paragraph C2302e prior to issue. Re-pour operations may not be an option for all HAZMINCENS due to space and safety limitations. Consult with the safety officer (or supporting industrial hygiene officer) to determine advisability of re-pour operations.

(3) Provide procedures and facilities for the turn-in of used HM, empty HM containers, and HM-contaminated items. At the completion of a maintenance action, the end of the workday, or the end of a seven day use period, work-centers shall return unused HM that was issued from the HAZMINCEN and its container as well as any residue from the maintenance action to the HAZMINCEN. Longer storage to address special needs must be authorized, in writing, by the executive officer after review of by the requesting department head, HM coordinator, DCA, and safety officer. Unused HM shall be consolidated with like material and appropriate inventory adjustments made in HICSWIN. Used HM shall also be consolidated with like material for offload per section C2302h. Empty containers free from contaminants shall be retained for future use with the same HM. Empty containers that are contaminated or cannot be reused shall be disposed of per the requirements of reference C23-3. Rags or other residual materials used with HM shall be processed aboard (if capable) or containerized for shore processing.

(4) Upon HM return to HAZMINCEN, consolidate previously issued HM for reuse.

30 May 2007

g. HM Container Compatibility

(1) HM containers shall be compatible with the substances they are to contain. Refer to reference C23-7 to obtain compatibility data for common shipboard materials.

h. Consolidation/Offload/Disposal of Used or Excess Hazardous Material

(1) Ship's force shall comply with transfer and disposal policy guidance provided in reference C23-1, appendix L.

**NOTE:**

The requirements detailed herein shall not preclude the overboard discharge of HM during an emergency where failure to discharge would clearly endanger the health or safety of shipboard personnel or would risk severe damage to the ship.

(2) The HAZMINCEN shall consolidate used and excess HM for offload. Additional offload guidance can be found in reference C23-8, section 5, and reference C23-6.

(3) Ship's force shall use HICSWIN to generate the offload forms (DD 1348-1 or DD 1348-1A).

(4) Used HM not in original containers shall be labeled per section C2303(c).

(5) All hands must control and offload rags, protective clothing, empty containers, and items used in spill response contaminated by hazardous substances with the same precautions as applied to all other HM.

(6) Ships shall exhaust all beneficial uses from a HM prior to transfer or disposal. This action includes increasing the useful life of the material by extending the shelf life per approved procedures outlined in reference C23-2 or redistribution within the ship for reutilization.

(7) Ships shall **segregate** collected used HM. They shall normally fill a container with one type of HM (i.e., all the used HM in a container shall normally be of only one stock number). The container shall be labeled and stowed in accordance with this chapter.

30 May 2007

(8) When ready for offload, contact the local shore-side HAZMINCEN, normally the local fleet and industrial supply center (FISC), for assistance to request a pick-up and ascertain local requirements. If the contents of a HM container are unknown, the label must state so, and the fleet must pay the costs of chemical analysis to determine specific content. The work-center originating the HM for offload shall provide any useful information in identifying the origin or composition of the material in the container. If the contents are unknown and the originating work-center can determine by experience that the material is flammable or combustible (the most common type of HM aboard ship), reactive, toxic, or corrosive, they shall supply that information on the container to allow proper stowage aboard ship and at the receiving shore activity.

**NOTE:**

When transferring HM ashore to a Navy activity, an MSDS must be provided upon request. If any additional requirements (e.g., waste profile sheets) are placed on the shore activity by Federal or State laws and regulations or by the supporting Defense reutilization and marketing office (DRMO), the receiving shore activity **shall** ensure that these requirements are met using information supplied by the ship on the DD 1348-1 or DD 1348-1A and container label.

(9) In situations where compatible materials are inadvertently mixed, the ship shall include the MSDSs of each material in the mixture with the used HM.

(10) Specific procedures for oil pollution abatement, including requirements for segregation of oily wastes, used oil, and waste oil are found in reference C23-8. Ships shall collect used lube oils separately and store and label for eventual shore recycling. They shall also collect synthetic lube oils and hydraulic oils separately from other used/waste oils.

(11) Except where used/excess HM is transferred from a tended unit to a tender, ships shall only transfer used HM to another ship during operations that preclude the ship entering a port in which normal offload may occur.

i. HM Use and Handling Requirements

(1) Ship's force shall comply with HM use and handling

30 May 2007

requirements as directed by maintenance requirement card, hazardous materials user's guide (HMUG), Naval Ship's Technical Manual (NSTM), industrial hygiene survey, or manufacturer's instructions. Refer to section C2305 for general HM use and handling requirements.

(2) Ship's force shall use personal protective equipment (PPE) as directed by maintenance requirement card, HMUG, NSTM, industrial hygiene survey, or manufacturer's instructions.

(3) Ship's force shall transfer contents of a damaged container to a new properly labeled container, and handle the emptied container as HM.

(4) The original HM container shall be used for storing the corresponding used/excess HM. If the original container cannot be used, comply with procedures in references C23-7 and C23-8.

### **C2303. HM STORAGE SEGREGATION STANDARDS**

HAZMINCEN personnel shall segregate incompatible hazardous materials. This section summarizes segregation requirements. Hazardous materials have characteristics that require special storage or handling in order to prevent risks to personnel or to the space in which they are stored. Contact between incompatible materials can produce a reaction such as fire, explosion, boiling, spattering, severe heat, or the release of toxic or hazardous gases. Identification of incompatible materials can be difficult. These chemicals, while appearing to be identical, may have different segregation/storage requirements. In order to uniformly identify compatibility information for HM, a HCC system was developed. The HCC is a two digit alpha-numeric code that is used to provide a means of categorizing the reactivity of HM. Trained scientific or engineering personnel assign HCCs using the data provided on the MSDS, thereby uniformly identifying HM managed by all Government activities. HCCs are captured on the MSDSs in the Department of Defense (DoD) HMIRS. If the HCC is not on the HMIRS MSDS, contact NAVICP, Code 0772. The HCC serves as the basis for determining compatible storage requirements.

HAZMINCEN shall segregate hazardous materials in accordance with the primary and secondary segregation requirements detailed in the HM storage segregation matrix found in appendix C23-A. The table was compiled using existing NAVSUP publications. Definitions for each HCC are provided in reference C23-11. All HCCs fall into one of the primary segregation (storage) codes

30 May 2007

listed below. HM may only be stored with items that have the same primary segregation letter. For example, store Fs with other Fs (flammables with flammables) and Cs with other Cs (corrosives with corrosives). Each of these primary segregation codes must be thought of as a separate storage space onboard ship.

**PRIMARY SEGREGATION CODE**

- |               |                                |
|---------------|--------------------------------|
| A Radioactive | G Gas, Compressed              |
| C Corrosive   | L Low Hazard (General Purpose) |
| D Oxidizer    | P Peroxide, Organic            |
| E Explosive   | R Reactive                     |
| F Flammable   | T Toxic / Poison               |

Within a primary segregation code, there are often subcategories of material. The table below is a portion of the HM storage segregation matrix that lists all HCCs with a primary segregation code of "F" (flammable). The last column in the table provides the secondary segregation requirements via a series of notes. The notes explain that even within a (primary) storage space, (secondary) segregation of materials is required. For example, a HM with a HCC of F6 (a flammable, corrosive alkali) and a HM with an HCC of F7 (a flammable, corrosive acid) can be stored in the same storeroom because their primary segregation is flammable. However, they must be separated from each other by at least 3 feet, according to Note L of the table below. The black rows in the table represent secondary segregation within the flammable primary segregation storage.

HM Storage Segregation Matrix - Primary/Secondary Segregation (Flammables)

HCC	HAZARD CHARACTERISTICS GROUP*	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
F1	Flammable Liquid DOT PG I, OSHA IA					*							Note J
F2	Flammable Liquid DOT PG II, OSHA IB					*							Note J

HCC	HAZARD CHARACTERISTICS GROUP*	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
F3	Flammable Liquid DOT PG III, OSHA IC					*						Note J
F4	Flammable Liquid DOT PG III, Combustible Liquid OSHA II					*						Note J
V4	DOT Combustible Liquid, OSHA IIIA					*						None
F5	Flammable Liquid and Poison					*						Note L
F6	Flammable Liquid & Corrosive, Acidic					*						Note L
F7	Flammable Liquid & Corrosive, Alkali					*						Note L
F8	Flammable Solid					*						Note K
V2	Aerosol, Nonflammable					*						Note EE
V3	Aerosol, Flammable					*						Note EE

NOTE J - Segregate into flammable liquid storage separate from flammable solids by at least one 3 ft aisle width.

NOTE K - Segregate into flammable solid storage separate from flammable liquids by at least one 3 ft aisle width.

NOTE L - Separate from other flammables and flammables with secondary hazards by at least one 3 ft aisle width.

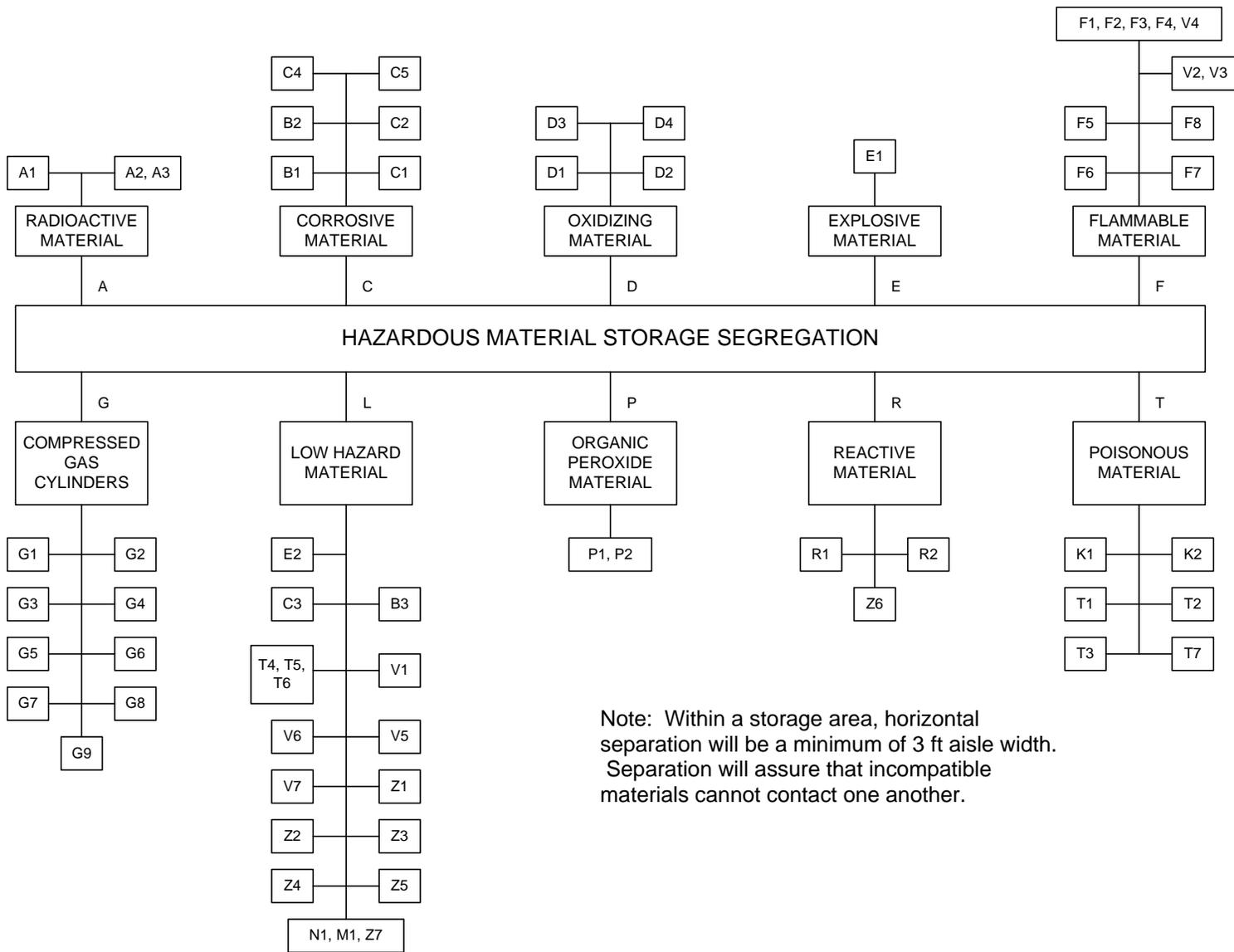
NOTE EE - Store aerosols from flammables by placing in separate room or barrier such as floor to ceiling wire mesh, chain link fence, etc. to protect personnel from aerosols that can become self-propelled projectiles.

\*Note: A complete set of HCC definitions can be found in reference C23-11. OSHA Class definitions, which NAVSEA adopts, are provided in appendix C23-A.

Primary and secondary segregation requirements provide a means for directing hazardous materials to the storage area most

30 May 2007

appropriate for the item being stored. The Figure below is a schematic that represents HM storage (primary and secondary) segregation requirements. Each of the 10 primary storage locations is shown in the figure within blocks (ie. "Radioactive Material", "Flammable Material"). Connected to each primary storage block (location), there are blocks that contain HCC designations. These blocks represent secondary segregation requirements. For example, for flammables, it can be seen from Figure 3-1 that within the flammable storeroom, HCCs F1, F2, F3, F4 and V4 may be stored together. HCCs V2 and V3 may be stored together, but they must be segregated from the other flammables. HCCs F5, F6, F7, and F8 must be segregated from each other and segregated from all the other flammables. This Figure was adapted from reference C23-11.



**Figure: HM Storage Segregation Chart**

30 May 2007

**C2304. GENERAL HANDLING AND USE REQUIREMENTS**

Observe the following general requirements when handling HM:

a. Handle and use hazardous materials as directed by maintenance requirement card, HMUG, NSTM, industrial hygiene survey, or manufacturer's instructions.

b. Use personal protective equipment (PPE) when using HM. Refer to reference C23-5 for additional PPE guidance.

(1) Work-center supervisors shall ensure that, prior to using any HM, personnel under their supervision are trained on the hazards associated with that material, and that they have been provided with necessary protective clothing and equipment (i.e., eye protection, respirators, and gloves). When in doubt, consult the safety officer for specific guidance in this regard or for a determination of the need for more stringent respiratory protection requirements.

(2) Ensure PPE (eye protection, respirators, gloves appropriate to the HM in use, etc.) is in good operating condition and is readily available.

(3) When mixing or pouring HM, eye protection shall consist of chemical goggles and full face shields which have been cleaned and disinfected before being issued to another wearer.

(4) Use a respirator when potentially exposed to harmful levels of particulate matter, hazardous gases, or vapors.

(5) Use gloves and protective clothing when handling sensitizers or potential skin irritants such as epoxy and polyester resins and hardeners where significant skin contact is likely.

(6) At a minimum, wear chemical goggles, full face shields, and rubber gloves when handling acids or other corrosive materials.

(7) If additional assistance is needed, contact the ship's safety department.

c. Avoid contact with the eyes or prolonged contact with skin when using HM.

30 May 2007

d. Work-center supervisors shall ensure that adequate supply and exhaust ventilation is maintained in all spaces where HM is used, that such systems are in good operating condition, and that they have been evaluated as adequate by an industrial hygiene survey team. Keep ventilation intakes clear of HM at all times. Consult GFE as required.

e. Never store excess supplies of HM in work areas. Return surplus material to the appropriate storage area or HAZMINCEN when not being used.

f. Handle incompatible materials (identified by HCC) in separate compartments to prevent mixing in case of a spill.

g. Never mix incompatible materials in the same collection containers.

h. Ensure that containers of partially used hazardous materials are returned to proper stowage facilities, are tightly closed, and are properly labeled.

i. Prohibit smoking, drinking, or eating in areas where HM is used. Post spaces in which HM are used as **NO SMOKING areas**.

j. When transferring HM to second containers, ensure that the second container is compatible. Place labels on the second container.

k. Do not remove or obliterate warning labels from containers.

l. Before entering spaces that have been closed for significant periods, have a gas free engineer determine that atmosphere is safe for entry.

m. Keep suitable fire extinguishing equipment and materials ready at all times for instant use.

n. Never use HM near a heat source or a spark-producing device.

o. Keep scrapings and cleaning rags soaked with flammable or combustible liquids in a covered metal container. Do not leave scrapings and cleaning rags in a soaked state even in a covered metal container for longer than one work shift. Avoid accumulation of wetted rags or clothing that may be subject to

30 May 2007

spontaneous heating or ignition. Ignition may be initiated by the temperature of low-pressure steam pipes, the surfaces of incandescent light bulbs, sunlight, or any other heat source. Treat such materials as used HM, containerize to prevent leakage, and properly label and store.

p. Keep aerosol containers away from steam lines, electronic equipment, hot water, and other heat sources such as prolonged exposure to sunlight. Avoid prolonged or repeated inhalation of aerosol or flammable concentrations of aerosol spray vapors in the air.

q. Do not disperse aerosol spray near flames, hot surfaces or ignition sources due to potential hazards from thermal decomposition products and back flash.

r. Use aerosols containing material with a flash point less than 73 degrees Fahrenheit on board ship only when required for a specific use and authorized by the cognizant division officer.

s. Prior to handling or transporting any instrument or equipment containing mercury, seal, cap, plug, or double-bag the item in plastic to prevent spillage.

t. Do not allow calcium hypochlorite to come into contact with paints, oils, greases, wetting agents, detergents, acids, antifreeze, alkalis, or combustible materials.

u. Dispense calcium hypochlorite with clean, dry utensils and only in amounts required for immediate use.

v. For external contact with calcium hypochlorite, or if taken internally, follow the instructions printed on the container label or in the MSDS.

w. Do not mix calcium hypochlorite with ammonia.

#### **C2305. SPECIALITY MATERIAL**

a. Halocarbons (Refrigerants). Liquid or gaseous halocarbons have multiple applications in the Navy. They are used as refrigerants, aerosol propellants, solvents, and dielectric fluids and as fire extinguishing and degreasing agents. Due to changes in the Clean Air Act, the use of halocarbons is being phased out; however, they are still used in the Navy. With common names of refrigerant R-11, R-12, R-22, R-113, R-114, and R-116, these

30 May 2007

products may be better known by names such as FREON, ISOTRON, FRIGEN, FLUORANE, FREON MF, FREON TF, GENSOLV D, BLACO-TRON TF, and ARKLONE P-113. Ship's force shall refer to reference C23-7 for specific storage, handling, and disposal guidance.

b. Mercury represents a potential personnel health hazard if ingested, absorbed through the skin, or inhaled. Inorganic or elemental mercury can vaporize at room temperature in amounts hazardous to the health. In addition to health hazards, mercury may be damaging to materials and equipment. Mercury and its compounds are especially corrosive to certain non-ferrous metals and their alloys, such as aluminum, copper, and silver. Mercury must be controlled onboard ships. Reference C23-25 lists requirements for the controlled use of mercury and prevention of mercury contamination. Ship's force shall refer to reference C23-7 for specific storage, handling, and disposal guidance.

c. Polychlorinated Biphenyls (PCB's). PCB's are chlorinated hydrocarbons used primarily as insulation in electrical equipment. They are usually white solids or colorless to pale yellow liquids, and are typically used with a solvent such as trichlorobenzene or kerosene. Refer to reference C23-8, and C23-4 for additional shipboard PCB's management requirements. Ship's Force shall refer to reference C23-7 for specific storage, handling, and disposal guidance.

d. Inorganic Acids. Specific requirements for inorganic acids are as follows:

(1) Stow liquid inorganic acids, such as hydrochloric, sulfuric, nitric and phosphoric acids bottled in glass or plastic in such a manner that they are cushioned against shock. They should be kept in their original shipping carton inside suitable acid-resistant corrosive lockers located in storerooms below the full-load waterline. Except where stowed in chests or lockers, the lower part of the bulkheads where acids are stored shall be provided with a watertight acid-resistant rubber lining.

(2) Maintain hydrofluoric acid in acid-proof polyethylene or ceresin-lined bottles at all times and never allow them to come in contact with skin or eyes.

(3) Stow medical acids in corrosive lockers located in the medical storeroom.

30 May 2007

e. Organic Acids. Do not permit liquid and solid organic acids, such as glacial acetic, oxalic, carbolic, cresylic, and picric acids to come in contact with the eyes or skin. These acids are corrosive to aluminum and its alloys, to zinc, and to lead. Keep these acids, usually packaged in glass bottles, from freezing and physical damage.

f. Alkalis. Stow alkalis (bases), such as sodium hydroxide, trisodium phosphate, sodium carbonate, potassium hydroxide, lithium hydroxide, and ammonium hydroxide (ammonia water) in designated lockers, cabinets, or chests. Ship's Force shall refer to reference C23-7 for additional storage, handling, and disposal guidance.

g. Calcium hypochlorite is a very strong oxidizer used to provide the sanitizing and bleaching property of chlorine without requiring the handling of gaseous chlorine. Ship's Force shall refer to reference C23-7 for specific storage, handling, and disposal guidance.

h. Organic Chlorine Laundry Bleach. This bleach contains an organic chlorine-liberating compound and was selected as a less hazardous material to replace calcium hypochlorite as laundry bleach. However, under conditions of high heat and humidity, organic chlorine laundry bleach emits vapors that can be hazardous to personnel. Stow this bleach in a cool, dry place as far from conditions of high heat and humidity as possible. Do not mix with materials containing ammonia.

i. Compressed Gases. Aboard Navy ships, numerous cylinders of compressed gases will be found. Compressed gases are used for welding operations (oxygen and acetylene), in refrigeration and air conditioning systems, and for purging various systems (nitrogen). Cylinders of compressed gases are potential explosion, fire, and health hazards if strict compliance with existing requirements is not met. Ship's Force shall refer to reference C23-26 for additional storage, handling, and recharging guidance.

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**CHAPTER C23**

**REFERENCES**

- C23-1. OPNAVINST 5090.1B
- C23-2. NAVSUPINST 4410.52B, Shelf-Life Item Identification, Management, and Control (NOTAL)
- C23-3. OPNAV P-45-114-95, CNO Policy Guide for Shipboard Hazardous Material Container Disposal (NOTAL)
- C23-4. NAVSEA S9593-A1-MAN-010, *Shipboard Management Guide to PCBs* and associated NAVSEA issued PCB Advisories (NOTAL)
- C23-5. OPNAVINST 5100.28
- C23-6. NAVSUP Publication P-722, Consolidated Hazardous Material Reutilization And Inventory Management Program (CHRIMP) Manual (NOTAL)
- C23-7. Naval Ships' Technical Manual Chapter 670, S9086-WK-STM-010/CH-670R6, Stowage, Handling, And Disposal Of Hazardous General Use Consumables (NOTAL)
- C23-8. Naval Ships' Technical Manual Chapter 593, S9086-T8-STM-010/CH-593R4, Pollution Control (NOTAL)
- C23-9. Hazardous Inventory Control System Windows (HICSWIN) Afloat Desk Guide (NOTAL)
- C23-10. NAVSUP Publication P-485, Naval Supply Procedures (NOTAL)
- C23-11. NAVSUP Publication P-573, Storage and Handling Of Hazardous Materials
- C23-12. NAVSEA Manual S9510-AB-ATM-010(U), Nuclear Submarine Atmosphere Control Manual (NOTAL)
- C23-13. Submarine Supply Procedures Manual, COMSUBLANT/COMSUBPACINST 4406.1E.

30 May 2007

C23-14. NAVSEA S9593-CT-MAN-010, Instruction Manual for the HM Spill Response Kit

C23-15 NAVSEA S9593-DV-HBK-010, Instruction Manual for the Oil Spill Response Kit

C23-16. OPNAVINST 5102.1D/MCO P5102.1B, Navy and Marine Corps Mishap and Safety Investigation, Reporting, and Record Keeping Manual

C23-17. OHS Spill Contingency Plan Guide -  
<http://navyseic.dt.navy.mil/>

C23-18. Shipboard Safety Equipment Shopping Guide (NAVSAFECEN Publication)  
<http://safetycenter.navy.mil/osh/afloat/shoppingguide.htm>

C23-19. Naval Warfare Publication 62-1, Surface Ship Survivability

C23-20. NSTM 555, Volume I, Surface Ship Firefighting

C23-21. NSTM 079, Volume II, Practical Damage Control

C23-22. NSTM 077, Personal Protection Equipment

C23-23. NAVAIR 00-80-R-14, US Navy Aircraft Firefighting and Rescue Manual

C23-24. NAVSEA S9593-DS-GYD-010, Preliminary Technical Manual Design and Installation Guidance for Hazardous Material Minimization Center (HAZMINCEN) Areas on Surface Ships

C23-25. NAVSEA Instruction 5100.3D, Control of Mercury, Mercury Compounds, and Components Containing Mercury or Mercury Compounds

C23-26. NSTM 550, Industrial Gases-Generating, Handling and Storing

APPENDIX C23-A

HAZARDOUS MATERIAL STORAGE SEGREGATION MATRIX

HM Storage Segregation Matrix: CORROSIVES												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
B1	Alkali, Corrosive Inorganic		*									NOTE B - Inorganic Alkali Storage - store away from acids by at least one 4 ft aisle width and away from organic alkalis by at least one 4 ft aisle width
B2	Alkali, Corrosive Organic		*									Note C - Organic Alkali Storage - store away from acids by at least one 4 ft aisle width and away from inorganic alkalis by at least one 4 ft aisle width.
C1	Acid, Corrosive Inorganic		*									NOTE D - Inorganic Acid Storage - store away from alkalis (caustics) by at least one 4 ft aisle width and away from organic acids by at least one 4 ft aisle width. Separate from other acids with subsidiary risk labels by at least one 4 ft aisle width.

HM Storage Segregation Matrix: CORROSIVES												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
C2	Acid, Corrosive Organic		*									NOTE E - Organic Acid Storage - store away from alkalis (caustics) by at least one 4 ft aisle width and away from inorganic acids by at least one 4 ft aisle width. Separate from other acids with subsidiary risk labels by at least one 4 ft aisle width. Organic Acids may be stored in a locker lined with acid-resistant material in the flammable liquids storeroom separated by a partition, or by at least 4 feet, from all other material.
C4	Acid, Corrosive and Oxidizer, Inorganic		*									NOTE D - Inorganic Acid Storage - store away from alkalis (caustics) by at least one 4 ft aisle width and away from organic acids by at least one 4 ft aisle width. Separate from other acids with subsidiary risk labels by at least one 4 ft aisle width.

HM Storage Segregation Matrix: CORROSIVES														
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION		
		A	C	D	E	F	G	L	P	R	T			
C5	Acid, Corrosive and Oxidizer, Organic		*											NOTE E - Organic Acid Storage - store away from alkalis (caustics) by at least one 4 ft aisle width and away from inorganic acids by at least one 4 ft aisle width. Separate from other acids with subsidiary risk labels by at least one 4 ft aisle width. Organic Acids may be stored in a locker lined with acid-resistant material in the flammable liquids storeroom separated by a partition, or by at least 4 feet, from all other material.

HM Storage Segregation Matrix: Low Risk														
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION		
		A	C	D	E	F	G	L	P	R	T			
B3	Alkali, Low Risk							*						NOTE F - Further separate into Acid and Alkali Storage within the low hazard storage area to keep potentially incompatible products from mixing.

HM Storage Segregation Matrix: Low Risk													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
C3	Acid, Low Risk							*					NOTE F - Further separate into Acid and Alkali Storage within the low hazard storage area to keep potentially incompatible products from mixing.
E2	Explosive, Low Risk							*					NOTE A - Security Storage - must be well ventilated with limited access.
M1	Magnetized Material							*					None
N1	Not Regulated as Hazardous							*					None
T4	UN Poison, Packing Group III							*					NOTE BB - Store away from food.
T5	Pesticide, Low Risk							*					None
T6	Health Hazard							*					None
V1	Miscellaneous Hazardous Materials - Class 9							*					None
V5	Hi-Flash Point Liquids, OSHA IIIIB							*					None

HM Storage Segregation Matrix: Low Risk													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
V6	Petroleum Products							*					None
V7	Environmental Hazard							*					None
Z1	Article Containing Asbestos							*					None
Z2	Article Containing Mercury							*					None
Z3	Article Containing Polychlorinated Biphenyls (PCB)							*					None
Z4	Article, Battery, Lead Acid, Nonspillable							*					None
Z5	Article, Battery, Nickel Cadmium, Nonspillable							*					None
Z7	Article, Battery, Dry Cell							*					None

HM Storage Segregation Matrix: Oxidizer													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
D1	Oxidizer			*									None
D2	Oxidizer and Poison			*									NOTE G - Separate from other oxidizers and oxidizers with secondary hazards by at least one 4 ft aisle width.
D3	Oxidizer and Corrosive Acidic			*									NOTE G - Separate from other oxidizers and oxidizers with secondary hazards by at least one 4 ft aisle width.
D4	Oxidizer and Corrosive Alkali			*									NOTE G - Separate from other oxidizers and oxidizers with secondary hazards by at least one 4 ft aisle width.

HM Storage Segregation Matrix: Explosive													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
E1	Explosive, Military				*								NOTE H - Magazine Storage.

HM Storage Segregation Matrix: Flammable												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
F1	Flammable Liquid DOT PG I, OSHA IA					*						NOTE J - Segregate into flammable liquid storage separate from flammable solids by at least one 4 ft aisle width.
F2	Flammable Liquid DOT PG II, OSHA IB					*						NOTE J - Segregate into flammable liquid storage separate from flammable solids by at least one 4 ft aisle width.
F3	Flammable Liquid DOT PG III, OSHA IC					*						NOTE J - Segregate into flammable liquid storage separate from flammable solids by at least one 4 ft aisle width.
F4	Flammable Liquid DOT PG III, OSHA II					*						NOTE J - Segregate into flammable liquid storage separate from flammable solids by at least one 4 ft aisle width.
F5	Flammable Liquid and Poison					*						NOTE L - Separate from other flammables and flammables with secondary hazards by at least one 4 ft aisle width.
F6	Flammable Liquid & Corrosive, Acidic					*						NOTE L - Separate from other flammables and flammables with secondary hazards by at least one 4 ft aisle width.

HM Storage Segregation Matrix: Flammable													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
F7	Flammable Liquid & Corrosive, Alkali					*							NOTE L - Separate from other flammables and flammables with secondary hazards by at least one 4 ft aisle width.
F8	Flammable Solid					*							NOTE K - Segregate into flammable solid storage separate from flammable liquids by at least one 4 ft aisle width.
V2	Aerosol, Nonflammable					*							NOTE EE - Store aerosols from flammables by placing in separate room or barrier such as floor to ceiling wire mesh, chain link fence, etc. to protect personnel from aerosols that can become self-propelled projectiles.
V3	Aerosol, Flammable					*							NOTE EE - Store aerosols from flammables by placing in separate room or barrier such as floor to ceiling wire mesh, chain link fence, etc. to protect personnel from aerosols that can become self-propelled projectiles.
V4	DOT Combustible Liquid, OSHA IIIA					*							None

HM Storage Segregation Matrix: Gases												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
G1	Gas, Poison (Nonflammable)						*					NOTE M - Further segregate into Poison Gas storage within compressed gas area.
G2	Gas, Flammable						*					NOTE N - Further segregate into Flammable Gas storage within compressed gas area.
G3	Gas, Nonflammable						*					NOTE P - Further segregate into Nonflammable Gas storage within compressed gas area.
G4	Gas, Nonflammable, Oxidizer						*					NOTE R - Further segregate into Oxidizer Gas within the Nonflammable Gas storage that is within the compressed gas area.
G5	Gas, Nonflammable, Corrosive						*					NOTE S - Further segregate into Corrosive Gas within the Nonflammable Gas storage that is within the compressed gas area.
G6	Gas, Poison, Corrosive (Nonflammable)						*					NOTE T - Further segregate into Corrosive Gas within the Poison Gas storage that is within the compressed gas area.
G7	Gas, poison, Oxidizer (Nonflammable)						*					NOTE U - Further segregate into Oxidizer Gas within the Poison Gas storage that is within the compressed gas area.

HM Storage Segregation Matrix: Gases												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
G8	Gas, Poison, Flammable						*					NOTE V - Further segregate into Flammable Gas within the Poison Gas storage that is within the compressed gas area.
G9	Gas, poison, Corrosive, Oxidizer (Nonflammable)						*					NOTE W - Further segregate into Corrosive and Oxidizer Gas within the Poison Gas storage that is within the compressed gas area.

HM Storage Segregation Matrix: Toxic Poison													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		
K1	Infectious Substance											*	NOTE X - Further segregate into Biomedical storage within the Poison Storage area.
K2	Cytotoxic Drugs											*	NOTE Y - Further segregate into a Medical Security storage within the Poison Storage area.
T1	DOT Poison - Inhalation Hazard											*	None
T2	UN Poison, Packing Group I											*	None
T3	UN Poison, Packing Group II											*	None
T7	Carcinogen (OSHA, NTP, IARC)											*	NOTE CC - Further segregation within Poison Storage area may be necessary if secondary hazards exist (i.e. flammable, corrosive, etc.)

HM Storage Segregation Matrix: Peroxide, Organic													
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION	
		A	C	D	E	F	G	L	P	R	T		

HM Storage Segregation Matrix: Peroxide, Organic												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
P1	Peroxide, Organic, DOT Regulated								*			None
P2	Peroxide, Organic (Low Risk)								*			None

HM Storage Segregation Matrix: Reactive												
HCC	HAZARD CHARACTERISTICS GROUP	PRIMARY SEGREGATION CODE										SECONDARY SEGREGATION
		A	C	D	E	F	G	L	P	R	T	
R1	Reactive Chemical, Flammable									*		NOTE Z - Further segregate into a spontaneously combustible storage within the Reactive Storage area.
R2	Water Reactive Chemical									*		NOTE AA - Shall not store in areas protected with water sprinkler system. Fire protection shall be non-water based.
Z6	Article, Battery, Lithium									*		NOTE DD - Separate from other products within the Reactive Storage area.

**Definitions:**

Flammable and Combustible Liquids. The Code of Federal Regulations, 29 CFR 1910.106 and National Fire Protection Association (NFPA) -30 "Flammable and Combustible Liquids Code" generally define flammable and combustible liquids

as follows:

Flammable Liquid. Any liquid that has a closed cup flash point below 100°F (37.8°C), as determined by the test procedures and apparatus set forth in NFPA-30 1.7.4. Flammable liquids are classified as OSHA Class I liquids as follows:

OSHA class I Liquid. Any liquid that has a closed-cup flash point below 100°F (37.8°C) and a Reid vapor pressure not exceeding 40 psia (2068.6 mmHG) at 100°F (37.8°C), as determined by ASTM D323, Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method). OSHA Class I liquids are further classified as follows:

OSHA class IA Liquid. Liquid that has a flash point below 73°F (22.8°C) and boiling point below 100°F (37.8°C).

OSHA class IB Liquid. Liquid that has a flash point below 73°F (22.8°C) and boiling point at or above 100°F (37.8°C).

OSHA class IC Liquid. Liquid that has a flash point at or above 73°F (22.8°C), but below 100°F (37.8°C).

Combustible Liquid. Any liquid that has a closed cup flash point at or above 100°F (37.8°C), as determined by the test procedures and apparatus set forth in NFPA-30 1.7.4. Combustible liquids are classified as OSHA Class II or OSHA class III liquids as follows:

OSHA class II Liquid. Liquid that has a flash point at or above 100°F (37.8°C) and below 140°F (60°C).

OSHA class IIIA Liquid. Liquid that has a flash point at or above 140°F (60°C) but below 200°F (93°C).

OSHA class IIIB Liquid. Liquid that has a flash point at or above 200°F (93°C).

**Appendix C23-B  
HAZARDOUS MATERIAL CONTROL AND MANAGEMENT (HMC&M) CHECKLIST  
SURFACE SHIP PROGRAM**

		Yes	No
OVERVIEW			
1.	<u>Centralized Inventory Management/Tracking.</u> Is the Navy-developed, hazardous inventory control system windows (HICSWIN) software used to record and control hazardous material (HM)? C2302a		
2.	<u>Requisitioning and Receiving Authorized HM.</u> Is a hazardous materials minimization center (HAZMINCEN) in operation and is it centrally managing the requisitioning and receiving of authorized HM? C2302a		
3.	<u>HM Container Labeling.</u> Are HM containers labeled in accordance with chapter C23 and applicable references? C2302a		
4.	<u>Storage of HM.</u> Is the HAZMINCEN storing incompatible HM separately to prevent the occurrence of an adverse reaction? Are the HAZMINCEN and storage facilities designed and being operated to prevent risks to personnel or to the space in which they are stored? C2302a		
5.	<u>Controlling HM Issue/Re-issue/Return.</u> Is HM available to work-centers 24 hours a day? Is the HAZMINCEN collecting previously issued HM for reuse, alternate use, or offload? Is the HM issue/return/re-issue being recorded in HICSWIN? Is the HAZMINCEN restricting the amount of HM in use to the lowest level necessary for the work performance of ship work-centers? C2302a		
6.	<u>HM Container Compatibility.</u> Is HM stored in containers reserved and configured exclusively for that specific HM? C2302a		
7.	<u>Consolidation/Offload/Disposal of Used or Excess HM.</u> Is HM being processed for safe offload/disposal in accordance with this chapter and other applicable documentation? Does the ship have optimal procedures and facilities for the turn-in of used HM, empty HM containers, and HM-contaminated items? C2302a		
8.	<u>HM use and Handling Requirements.</u> Are personnel using protective equipment when using and handling HM? Is the ship transporting, storing and using HM safely throughout the ship? C2302a		

		Yes	No
9.	<u>Training.</u> Has the HM Coordinator received HMCM training, per chapter B3? Is the HM Supervisor a graduate of the hazardous material control and management (HMC&M) Technician Navy Enlisted Classification Code(SNEC) 9595 Course and the CHRIMP/HICS Technician Course? C2302a		
<b>CENTRALIZED INVENTORY MANAGEMENT/TRACKING</b>		Yes	No
10.	Is the Navy-developed, HICSWIN software used to record and control HM? C2302b		
<b>REQUISITIONING AND RECEIVING AUTHORIZED HM</b>		Yes	No
11.	Before ordering any HM, does the ship determine a valid requirement exists (planned maintenance systems(PMS), technical manual) and determine if the HM is authorized on the type-ships hazardous material list? C2302c(1)		
12.	Are SHML Feedback Report (SFR) submitted for HM not listed on the type-ships hazardous material list (T-SHML), for which a valid requirement exists including justification for the material? Has the commanding officer (or a designated officer O-5 or above) signed the SFR? Has the ship obtained a material safety data sheet (MSDS) from the manufacturer or supplier and retained the MSDS aboard? C2302c(1)		
13.	Does the ship only procure and use standard stock HM? C2302c(2)		
14.	If ships or other commands are approached by commercial vendors offering HM not listed in the ships hazardous material list (SHML) for shipboard use or for substitution for stock-numbered HM, do they refer vendors to the shore side HAZMINCEN or naval inventory control point (NAVICP), Code 0772 C2302c(2)		
15.	Does the supply department check all containers of HM upon receipt to ensure that they contain a manufacturer's label as described in paragraph C2302d? C2302c(3)		
16.	When authorized HM containers are accepted and brought aboard, are they immediately placed in a stowage location based on the hazard characteristic code (HCC) associated with the product? C2302c(3)		
<b>HM CONTAINER LABELING</b>		Yes	No
17.	Are all HM containers labeled at all times? C2302d (1)		

		Yes	No
18.	Do labels for shipboard identification of HM containers clearly identify the material name, the manufacturer's name and address, stock number, HCC, and the nature of the hazard presented by the HM including the target organ potentially affected by the material? (A label may be a tag, sign, placard, or gummed sticker.) C2302d (2)		
19.	When dispensing HM from one container to another unlabeled container, do HAZMINCEN personnel annotate the receiving container to indicate the material name, manufacturer name and address, and the nature of the hazard (including target organ) as specified by the manufacturer to preserve the continuity of information? C2302d (3)		
<b>STORAGE of HM</b>		Yes	No
20.	Does the HAZMINCEN store and centrally control the issue of all HM with a SHML material maintenance inventory (MMI) of "Y" and collection of all HM for disposal for the ship? C2302e (1)		
21.	Is HM stored in containers and compartments reserved and configured exclusively for HM? Are bulk and infrequently used HM stored in compliant storage spaces and only moved to the HAZMINCEN when needed? C3202e(2)		
22.	Are HM stowage locations posted with a CAUTION sign that states "Hazardous Material Storage Area"? C2302e(4)		
23.	Are HM stowage locations other than lockers equipped with supply and exhaust ventilation? C2302e(5)		
24.	Are HM stowage compartments and shelves marked to identify the type of HM stored by HCC, and is the compartment clean and dry? C2302e (6)		
25.	Are containers stacked so that they will not crush lower containers, become imbalanced, or be difficult to access? C2302e(8)		
26.	Is material used on a first-in, first-out basis, considering shelf life? C2302e(9)		
27.	Is smoking, eating, or drinking in stowage areas? C2302e (10)		
28.	Are open flames or spark producing items prohibited in HM stowage areas? C2302e (11)		
29.	Does the gas free engineer monitor stowage compartments for oxygen depletion, suspect explosive atmospheres, presence of potentially toxic vapors, and CO <sub>2</sub> accumulation any time the question arises as to the safety of a stowage area? C2302e(12)		

		Yes	No
30.	Is only explosion-proof electrical equipment operated in potentially explosive environments? Are explosion-proof electrical fixtures maintained in proper condition in applicable HM stowage areas? C2302e (13)		
31.	Are all containers sealed and protected against physical damage and secure for heavy seas? C2302e(14)		
32.	Are containers secured with metal banding or other tie-downs vice nylon, polypropylene or manila line? C2302e(15)		
	<b>Flammable Storage Requirements (FSR)</b>		
33.	Are flammable and combustible materials stored separately from oxidizing materials? C2302e FSR (1)		
34.	Are in-use flammable liquid cabinets being used within or near the workspace to stow a limited (seven-day) quantity of flammable liquids used routinely on a daily basis? C2302e FSR (2)		
35.	Are in-use flammable liquid cabinets being used to store less than 30 gallons of flammable liquid per work-center? C2302e FSR (2)		
36.	Are in-use flammable lockers labeled as follows:  <b>FLAMMABLE LIQUIDS</b>  <b>DURING STRIP SHIP CONDITION, THE CONTENTS OF THIS CABINET SHALL BE RELOCATED TO A FLAMMABLE LIQUIDS STOREROOM, ISSUE ROOM, OR READY SERVICE STOREROOM.</b>  Restrict access to HM stowage locations to personnel authorized by the responsible division officer. Entry to confined locations shall occur only after obtaining the gas free engineer's approval as specified in chapter B8 of this manual. C2302e FSR (2)		
37.	Are machinery spaces compliant with the requirement to NOT store in-use flammables and combustible material? C2302e FSR (3)		
38.	Are all lubricating oils and petroleum products with a flash point greater than or equal to 200 degrees Fahrenheit but less than 1,500 degrees Fahrenheit stored under fixed HALON or CO <sub>2</sub> gas flooding or sprinkler protection or on the weather deck under protection from the elements? C2302e FSR (4)		

		Yes	No
39.	Are ordinary combustible ensured materials such as rags, paper and wood prohibited from being stowed in flammable stowage areas? C2302e FSR (5)		
40.	Are oily rags packed in approved containers, in accordance with reference C23-7, and stowed in flammable storage areas? C2302e FSR (6)		
<b>Toxic Storage Requirements (TSR)</b>			
41.	Are all toxic materials stored in cool, dry, well ventilated spaces separated from all sources of ignition, acids and acid vapors, caustics, and oxidizers? C2303e TSR(1)		

<b>Corrosive Storage Requirements (CSR)</b>			
42.	Is it ensured that acids and alkalis are stowed separately from each other? C2303e CSR(1)		
43.	Is it ensured that corrosive materials are not stored near oxidizers or other incompatible materials? C2303e CSR(2)		
44.	Are acids stowed in a locker lined with acid-resistant material in the flammable liquids storeroom separated by a partition, or by at least three feet, from all other material? C2303e CSR(3)		
<b>Oxidizer Storage Requirements (OSR)</b>			
45.	Is it ensured that oxidizers are stored in a separate compartment/storeroom? C2303e OSR(1)		
<b>Aerosol Storage Requirements (ASR)</b>			
46.	Are ship's stores aerosol stock items stowed in the flammable liquid storeroom? C2303e ASR(1)		
47.	Are aerosol containers stowed in areas with temperatures above 120 degrees Fahrenheit or adjacent to steam lines, hot zones, or heat sources? C2303e ASR(2)		

<b>CONTROLLING HM ISSUE/RE-ISSUE/RETURN</b>		Yes	No
48.	Is HM available to work-centers 24 hours a day? C2303f(1)		
49.	Are only limited quantities of HM that are essential for immediate needs during a work shift issue/re-issued from the HAZMINCEN issue room or flammable liquid storeroom? Is a seven day supply or less of each routinely-used item in or near the user compartment? Is longer storage to address special needs being authorized, in writing, by the HM Coordinator and Safety Officer? C2303f (2)		

50.	At the completion of a maintenance action, the end of the workday, or the end of a seven day use period, do work-centers return unused HM that was issued from the HAZMINCEN and its container as well as any residue from the maintenance action to the HAZMINCEN? C2303f(3)		
51.	Is unused HM being consolidated with like material and appropriate inventory adjustments made in HICSWIN? C2303f(3)		
52.	Are empty containers free from contaminants being retained for future use with the same HM? C2303f(3)		
53.	Are rags or other residual materials used with HM being processed aboard (if capable) or containerized for shore processing? C2303f(3)		

**HM CONTAINER COMPATIBILITY**

		Yes	No
54.	Are HM containers compatible with the substances they contain? (e.g., do not place corrosive in metal drums) C2303g		

**CONSOLIDATION/OFFLOAD/DISPOSAL  
OF USED OR EXCESS HAZARDOUS MATERIAL**

		Yes	No
55.	Is ship's force complying with transfer and disposal policy provided in reference C23-1, appendix L? C2302h(1)		
56.	Is the HAZMINCEN consolidating used and excess HM for offload? C2303h(2)		
57.	Does Ship's force use HICSWIN to generate the offload forms (DD 1348-1 or DD 1348-1A)? C2303h(3)		
58.	Are all hands controlling and offloading rags, protective clothing, empty containers, and items used in spill response contaminated by hazardous substances with the same precautions as applied to all other HM? C2303h(5)		
59.	Do ships force exhaust beneficial uses for a HM prior to transfer or disposal? (This action includes increasing the useful life of the material by extending the shelf life per approved procedures outlined in reference C23-2 or redistribution within the ship for reutilization). C2303h(6)		

60.	Do ships force <b>segregate</b> collected used HM? (They shall normally fill a container with one type of HM, i.e., all the used HM in a container shall normally be of only one stock number. The container shall be labeled and stowed in accordance with this Chapter.) C2303h(7)		
61.	When the HAZMINCEN is ready for offload, does ships force contact the local shore-side HAZMINCEN, normally the local fleet and industrial supply center (FISC), for assistance to request a pick-up and ascertain local requirements? C2303h(8)		
62.	If the contents of a HM container are unknown, does the label state so? C2303h(8)		
63.	When transferring HM ashore to a Navy activity, is an MSDS provided upon request? C2303h(9)		
64.	Does the ship collect its used lube oils separately and store and label for eventual shore recycling? (They shall also collect synthetic lube oils and hydraulic oils separately from other used/waste oils.) C2303h(10)		

**HM USE AND HANDLING REQUIREMENTS**

		Yes	No
65.	Does ship's force comply with HM use and handling requirements as directed by maintenance requirement card (MRC), Hazardous Material User's Guide (HMUG), Naval Ships' Technical Manual (NSTM), industrial hygiene survey, or manufacturer's instructions? C2303i(1)		
66.	Does ship's force use personal protective equipment (PPE) as directed by MRC, HMUG, NSTM, industrial hygiene survey, or manufacturer's instructions? C2303i(2)		
67.	Does ship's force transfer contents of a damaged container to a new properly labeled container, and handle the emptied container as HM? C2303i(3)		

**HM STORAGE SEGREGATION STANDARDS**

		Yes	No
68.	Does the HAZMINCEN segregate hazardous materials in accordance with the primary and secondary segregation requirements detailed in the HM storage segregation matrix found in chapter C23 appendix C23-A? C2303		

**GENERAL HANDLING AND USE REQUIREMENTS**

		Yes	No

69.	Does the HAZMINCEN and ships force handle and use hazardous materials as directed by MRC, HMUG, NSTM, industrial hygiene survey, or manufacturer's instructions? C2304a		
70.	Are work-center supervisors ensuring that, prior to using any HM, personnel under their supervision are trained on the hazards associated with that material, and that they have been provided with necessary protective clothing and equipment (i.e., eye protection, respirators, and gloves)? C2304b(1)		
71.	Is surplus material returned to the appropriate storage area or HAZMINCEN when not being used? C2304e		
72.	Are incompatible materials prevented from being mixed in the same collection containers? C2304g		
73.	Are warning labels from containers intact (e.g., not obliterated or removed)? C2304k		
74.	Are scrapings and cleaning rags soaked with flammable or combustible liquids in a covered metal container? C2304o		
75.	Are aerosol containers kept away from steam lines, electronic equipment, hot water, and other heat sources such as prolonged exposure to sunlight? C2304p		
76.	Is aerosol spray use controlled as to not disperse near flames, hot surfaces or ignition sources? C2304q		
77.	Are aerosols containing material with a flash point less than 73 degrees Fahrenheit on board ship used only when required for a specific use and authorized by the cognizant division officer? C2304r		
78.	Are controls in place to prevent calcium hypochlorite coming into contact with paints, oils, greases, wetting agents, detergents, acids, antifreeze, alkalis, or combustible materials? C230		
79.	Is calcium hypochlorite dispensed with clean, dry utensils and only in amounts required for immediate use? C2304u		
<b>SPECIALTY MATERIAL</b>		Yes	No
80.	Does ship's Force refer to reference C23-7 for specific storage, handling, and disposal guidance for all HM (including specialty material)? C2305		

81.	Are liquid inorganic acids, such as hydrochloric, sulfuric, nitric and phosphoric acids stowed and bottled in glass or plastic in such a manner that they are cushioned against shock? C2305d(1)		
82.	Are medical acids stowed in corrosive lockers located in the medical storeroom? C2305d(3)		
83.	Are liquid and solid organic acids, such as glacial acetic, oxalic, carbolic, cresylic, and picric acids permitted to come in contact with the eyes or skin? C2305e		
84.	Are alkalis (bases), such as sodium hydroxide, trisodium phosphate, sodium carbonate, potassium hydroxide, lithium hydroxide, and ammonium hydroxide (ammonia water) stowed in designated lockers, cabinets, or chests? C2305f		
85.	Is organic chlorine laundry bleach stowed in a cool, dry place as far from conditions of high heat and humidity as possible? C2305h		