TECHNICAL MANUAL

NAVAIROSH REQUIREMENTS FOR THE SHORE ESTABLISHMENT

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Total number of pages in this manual is 283, consisting of the following:

Page No.	# Change No.	Page No.	# Change No.	Page No.	# Change No.
Title	1	6-1 - 6-7	0	B-2 - B-4	1
A	1	6-8	RAC 1	B-5 - B-22	0
i - xii	0	6-9 - 6-21	0	C-1 - C-3	0
xiii	RAC 1	6-22 blank	0	C-4 blank	0
xiv blank	RAC 1	7-1 - 7-9	0	D-1 - D-19	0
1-1 - 1-8	0	7-10	1	D-20	RAC 1
2-1 - 2-20	0	7-11	RAC 1	D-21	0
3-1 - 3-5	0	7-12 blank	RAC 1	D-22 - D-23	1
3-6 - 3-7	RAC 1	8-1 - 8-10	0	D-24	RAC 1
3-8 - 3-18	0	9-1 - 9-4	0	D-25 - D-28	0
4-1	RAC 1	9-5	1	D-29	RAC 1
4-2 - 4-3.....	0	9-6	0	D-30 - D-31	0
4-4.....	1	9-7 - 9-8	1	D-32 - D-33	1
4-5 - 4-25	0	9-9 - 9-12	0	D-34 - D-37	0
4-26 blank	0	9-13 - 9-14	1	D-38 blank	0
5-1 - 5-2	RAC 1	10-1 - 10-8	0	Index 1 - Index 8	0
5-2A	RAC 1	11-1 - 11-6	0	Index 9	RAC 1
5-2B blank	RAC 1	12-1 - 12-11	0	Index 10-Index 13	0
5-3 - 5-6	0	12-12 blank	0	Index 14	RAC 1
5-7 - 5-8	RAC 1	13-1 - 13-11	0	Index 15-Index 17	0
5-8A	RAC 1	13-12 blank	0	Index 18 blank ..	0
5-8B blank	RAC 1	A-1 - A-6	0		
5-9 - 5-18	0	B-1	0		

Zero in the column indicates an original page.

TABLE OF CONTENTS

NOTE

An alphabetical index is located at the back of this manual.

Chapter		Page
	LIST OF ILLUSTRATIONS	xii
	LIST OF TABLES	xiii
1.	**PURPOSE, SCOPE AND RESPONSIBILITIES**	1-1
1-1.	Purpose	1-1
1-2.	Navy Occupational Safety and Health (NAVOSH) Program	1-1
1-2.1.	Background	1-1
1-2.2.	Implementation	1-2
1-3.	Scope and Applicability	1-2
1-3.1.	Scope	1-2
1-3.2.	Applicable Personnel	1-3
1-3.3.	Applicable Workplaces, Equipment and Operations	1-4
1-4.	Conflicting Regulations	1-5
1-5.	Revisions	1-5
1-6.	Standards Incorporated by Reference	1-6
1-6.1.	General	1-6
1-6.2.	Use of Referenced Standards	1-6
1-6.3.	Selected References	1-6
1-6.4.	Current Editions	1-7
1-6.5.	Guidance Materials	1-7
1-7.	Safety Violations and Hazardous Conditions	1-7
1-8.	Responsibilities	1-7
1-8.1.	Commanding Officers	1-7
1-8.2.	Supervisory Personnel	1-8
1-8.3.	All Personnel	1-8
1-9.	DOD Poster	1-8
2.	**WALKING AND WORKING SURFACES**	2-1
2-1.	General	2-1
2-1.1.	Scope	2-1
2-1.2.	Housekeeping	2-1
2-1.3.	Floors, Decks, and Stairs	2-1
2-1.4.	Aisles and Passageways	2-2
2-1.5.	Aircraft	2-3
2-1.6.	Floor Capacities	2-3
2-2.	Guarding Floor and Wall Openings and Holes	2-3

TABLE OF CONTENTS (Continued)

Chapter		Page
2-2.1.	General	2-3
2-2.2.	Elevated Work Levels	2-4
2-2.3.	Floor Openings	2-4
2-2.4.	Floor Holes	2-5
2-2.5.	Wall Openings	2-6
2-2.6.	Wall Holes	2-6
2-3.	Fixed Industrial Stairs	2-7
2-3.1.	General	2-7
2-3.2.	Where Required	2-7
2-3.3.	Spiral Stairways	2-7
2-3.4.	Winding Stairways	2-7
2-3.5.	Construction	2-7
2-3.6.	Railings and Handrails	2-7
2-3.7.	Landings	2-7
2-4.	Access to Vessels	2-8
2-5.	Ladders	2-8
2-5.1.	General	2-8
2-5.2.	Fixed Ladders	2-10
2-5.3.	Portable Ladders	2-10
2-5.4.	Job-Made Ladders	2-14
2-5.5.	Ladders Aboard Ships	2-14
2-6.	Scaffolds	2-14
2-6.1.	General	2-14
2-6.2.	Construction	2-14
2-6.3.	Guarding Scaffold Edges	2-15
2-6.4.	Access	2-16
2-6.5.	Painting	2-16
2-6.6.	Inspection	2-16
2-6.7.	Loading	2-16
2-6.8.	Weather Restrictions	2-16
2-6.9.	Specific Scaffold Types	2-17
2-6.10.	Manually Propelled Mobile Scaffolds, Work Platforms and Ladder Stands	2-18
2-6.11.	Barge (Pontoon) Scaffolds	2-18
2-7.	Powered Platforms	2-20
2-8.	Aerial Lift Trucks	2-20
2-9.	Personnel Hoists	2-20
2-10.	Manlifts	2-20
3.	**BUILDINGS, GROUNDS AND SPECIAL OPERATIONS**	3-1
3-1.	General	3-1
3-2.	Building Facilities	3-1
3-2.1.	Minimum Design Load	3-1
3-2.2.	Passageways and Thoroughfares	3-1
3-2.3.	Doors	3-1
3-2.4.	Elevators	3-1

TABLE OF CONTENTS (Continued)

Chapter		Page
3-2.5.	Illumination	3-2
3-2.6.	Chambers and Vaults	3-2
3-2.7.	Offices and Office Equipment	3-3
3-3.	Means of Egress	3-4
3-4.	Warning Signs and Color Codes	3-4
3-4.1.	Scope	3-4
3-4.2.	Accident Prevention Warnings	3-4
3-5.	Groundskeeping	3-8
3-5.1.	General	3-8
3-5.2.	Ice and Snow	3-8
3-5.3.	Vegetation	3-8
3-6.	Construction	3-8
3-6.1.	General	3-8
3-6.2.	Traffic Control at Construction Sites	3-10
3-6.3.	Excavations and Trenches	3-11
3-7.	Motor Vehicles	3-13
3-7.1.	General	3-13
3-7.2.	Motor Vehicles Operated on the Job Site	3-15
3-7.3.	Mechanical Equipment	3-17
3-7.4.	Heavy Construction Equipment	3-17
3-7.5.	Multi-Piece Rim Wheels	3-17
3-8.	Maritime Operations	3-17
3-8.1.	Ship Repair and Shipbuilding	3-17
3-8.2.	Longshoring	3-17
3-8.3.	Diving Operations	3-18
3-9.	Special Industries	3-18
4.	**OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL**	4-1
4-1.	General	4-1
4-2.	Hazardous Materials	4-1
4-2.1.	Scope	4-1
4-2.2.	General	4-1
4-2.3.	Labeling	4-1
4-2.4.	Employee Instruction	4-4
4-2.5.	Material Safety Data Sheets	4-4
4-2.6.	Gas Freeing	4-4
4-3.	Toxics	4-5
4-3.1.	General	4-5
4-3.2.	Permissible Exposure Limit (PEL) Values	4-5
4-3.3.	Control of Exposures to Toxic Materials	4-5
4-3.4.	Storage and Handling of Toxic Materials	4-6
4-3.5.	Disposal of Toxic Materials	4-6
4-3.6.	Specific OSHA Requirements	4-6
4-4.	Ventilation	4-6
4-4.1.	General	4-6
4-4.2.	Ventilation Systems	4-7

TABLE OF CONTENTS (Continued)

Chapter		Page
4-4.3.	Work in Confined Spaces	4-7
4-5.	Medical Services and First Aid	4-7
4-5.1.	Medical Servies	4-7
4-5.2.	First Aid	4-8
4-5.3.	Maritime Operations	4-8
4-6.	Sanitation	4-9
4-6.1.	Housekeeping	4-9
4-6.2.	Waste Disposal	4-9
4-6.3.	Vermin and Pest Control	4-9
4-6.4.	Water Supply	4-9
4-6.5.	Toilet Facilities	4-10
4-6.6.	Washing Facilities	4-10
4-6.7.	Consumption of Food and Beverages	4-11
4-7.	Target Programs	4-11
4-7.1.	Noise Control and Hearing Conservation	4-11
4-7.2.	Asbestos	4-11
4-7.3.	Sight Conservation	4-12
4-7.4.	Personal Protective Equipment	4-12
4-8.	Radiation Protection	4-12
4-8.1.	Ionizing Radiation	4-12
4-8.2.	Nonionizing Radiation	4-12
4-9.	Thermal Stress	4-12
4-10.	Human Factors Considerations	4-13
4-11.	Industrial Hygiene Technical Assistance	4-13
4-11.1.	General	4-13
4-11.2.	Activities Located in Non-NAVMED Commands	4-13
4-11.3.	All Other Shore Activities	4-14
5.	**FLAMMABLE, COMBUSTIBLE AND OXIDING MATERIALS**	5-1
5-1.	General	5-1
5-2.	General Safety Precautions	5-1
5-2.1.	Hazardous Materials Safety Program	5-1
5-2.2.	Labeling and Material Safety Data Sheets	5-1
5-3.	Specific Materials	5-1
5-3.1.	Acetylene	5-1
5-3.2.	Hydrogen	5-1
5-3.3.	Oxygen	5-1
5-3.4.	Nitrous Oxide	5-1
5-3.5.	Flammable and Combustible Liquids	5-2
5-3.6.	Liquified Petroleum Gases	5-9
5-3.7.	Acids and Alkalies	5-9
5-3.8.	Solvents	5-10
5-3.9.	Flammable, Combustible and Oxidizing Solids	5-10
5-3.10.	Explosives and Blasting Agents	5-10

TABLE OF CONTENTS (Continued)

Chapter		Page
5-3.11.	Anhydrous Ammonia	5-11
5-4.	Spray Finishing Operations	5-11
5-4.1.	General	5-11
5-4.2.	Spraying Operations	5-11
5-4.3.	Paint Removing	5-14
5-4.4.	Aircraft Painting and Paint Removal	5-14
5-4.5.	Ship Painting and Paint Removal	5-14
5-5.	Dip Tank Operations	5-14
5-6.	Refueling and Transfer Operations	5-14
5-6.1.	Motor Vehicles	5-14
5-6.2.	Aircraft Fuel Servicing	5-16
5-6.3.	Marine Service Stations	5-16
5-6.4.	Longshoring	5-16
5-6.5.	Bulk Plants	5-17
5-6.6.	Processing Plants	5-18
5-7.	Laboratories	5-18
5-7.1.	Permissible Quantities	5-18
5-7.2.	Fume Hoods	5-18
5-7.3.	Storage	5-18
5-7.4.	Additional Requirements	5-18
5-8.	Fuel Gas Systems	5-18
5-9.	Ship Repairing	5-18
6.	**PERSONAL PROTECTIVE EQUIPMENT**	6-1
6-1.	General	6-1
6-1.1.	Basic Policy	6-1
6-1.2.	PPE Checklist	6-2
6-1.3.	Training	6-9
6-1.4.	Employee Responsibilities	6-9
6-1.5.	Medical Evaluation	6-9
6-1.6.	Special Clothing	6-9
6-1.7.	Maintenance of PPE	6-9
6-1.8.	Storage of PPE	6-10
6-2.	Eye and Face Protection	6-10
6-2.1.	General	6-10
6-2.2.	Face Shields	6-10
6-2.3.	Hoods	6-10
6-2.4.	Safety Glasses	6-10
6-2.5.	Goggles	6-11
6-2.6.	Radiant Energy Protection	6-12
6-3.	Hearing Protection	6-12
6-4.	Respiratory Protection	6-12
6-4.1.	General Policy	6-12
6-4.2.	Respiratory Hazards	6-14
6-4.3.	Respirator Selection	6-14
6-4.4.	Breathing Air	6-15
6-4.5.	Respirator Fit	6-15

TABLE OF CONTENTS (Continued)

Chapter		Page
6-4.6.	Respirator Maintenance	6-16
6-5.	Head Protection	6-16
6-5.1.	Hard Hats	6-16
6-5.2.	Bump Caps	6-16
6-5.3.	Hair Protection	6-17
6-6.	Safety Footwear	6-17
6-6.1.	General	6-17
6-6.2.	Safety-Toe Footwear	6-17
6-6.3.	Other Safety Footwear	6-17
6-7.	Protective Clothing	6-18
6-7.1.	General	6-18
6-8.	Other Protective Equipment	6-18
6-8.1.	Safety Harnesses, Lanyards, Lifelines and Drop Lines	6-18
6-8.2.	Safety Nets	6-19
6-8.3.	Electrical Protection	6-20
6-8.4.	Lifesaving Equipment	6-20
7.	**FIRE PREVENTION**	7-1
7-1.	General	7-1
7-1.1.	Fire Prevention Program	7-1
7-1.2.	Standards	7-1
7-1.3.	Chapter Coverage	7-2
7-2.	General Requirements	7-3
7-2.1.	Notification of Fire Department	7-3
7-2.2.	Firefighting	7-3
7-2.3.	Fire Protection Equipment	7-3
7-2.4.	Fire Doors	7-3
7-3.	Fire Alarm and Detection Systems	7-3
7-4.	Fire Suppression Systems and Extinguishing Agents	7-4
7-4.1.	General	7-4
7-4.2.	Portable Fire Extinguishers	7-4
7-4.3.	Standpipes	7-5
7-4.4.	Fixed Extinguishing Systems	7-5
7-5.	Fire Protection in Specific Work Situations	7-6
7-5.1.	Welding and Cutting Operations	7-6
7-5.2.	Storage Areas	7-6
7-5.3.	Painting Operations	7-6
7-5.4.	Electrical Work	7-6
7-5.5.	Land Transportation Activities	7-7
7-5.6.	Construction/Demolition Work	7-8
7-5.7.	Aviation-Related Activities	7-9
7-5.8.	Ship Repair and Overhaul	7-10
7-5.9.	Longshoring and Waterfront Operations	7-10

TABLE OF CONTENTS (Continued)

Chapter		Page
8.	**FIRED AND UNFIRED PRESSURE VESSELS AND HEATING AND COOLING EQUIPMENT**	8-1
8-1.	General	8-1
8-2.	Compressed Air	8-1
8-2.1.	Air Compressors	8-1
8-2.2.	Air Receivers	8-4
8-2.3.	Other Equipment	8-4
8-2.4.	Construction Operations	8-5
8-3.	Compressed Gas	8-5
8-3.1.	General	8-5
8-3.2.	Handling Compressed Gas Cylinders	8-5
8-3.3.	Inspection of Systems	8-7
8-3.4.	Safety Relief Devices for Tanks and Cylinders	8-7
8-3.5.	Color Coding and Marking	8-7
8-3.6.	Disposal	8-8
8-4.	Heating and Cooling Systems	8-9
8-4.1.	General	8-9
8-4.2.	Ventilation	8-9
8-4.3.	Testing Electrical Installations	8-9
8-5.	Refrigerant Systems	8-9
8-5.1.	Detection of Refrigerant Leaks	8-9
8-5.2.	Handling Refrigerant Cylinders	8-9
8-5.3.	Safety Precautions in Refrigeration Plants	8-9
8-6.	Compressed Gases in Maritime Situations	8-10
8-6.1.	General	8-10
9.	**MATERIALS HANDLING AND STORAGE**	9-1
9-1.	General	9-1
9-1.1.	Scope	9-1
9-1.2.	Personal Protection	9-1
9-1.3.	Personnel	9-1
9-1.4.	Equipment	9-1
9-1.5.	Manual Handling	9-1
9-2.	Conveyors	9-2
9-2.1.	Stop Controls	9-2
9-2.2.	Transfer, Loading and Discharge Points	9-2
9-2.3.	Riding Conveyors	9-2
9-2.4.	Screw Conveyors	9-3
9-2.5.	Overhead Conveyors	9-3
9-2.6.	Warning Signs	9-3
9-2.7.	Maintenance	9-3
9-2.8.	Detailed Requirements	9-3
9-3.	Powered Industrial Trucks	9-3
9-3.1.	References	9-3

TABLE OF CONTENTS (Continued)

Chapter		Page
9-3.2.	Clearances	9-4
9-3.3.	Fueling	9-4
9-3.4.	Carbon Monoxide	9-4
9-3.5.	Forktrucks	9-4
9-3.6.	Tractor-Trailer Trains	9-5
9-4.	Weight Handling Equipment	9-5
9-4.1.	General	9-5
9-4.2.	Operators	9-7
9-4.3.	Signals	9-7
9-4.4.	Operating Requirements	9-8
9-4.5.	Chain Falls and Pull-Lifts	9-12
9-4.6.	Rigging - General	9-12
9-4.7.	Slings	9-13
9-5.	Storage	9-14
9-6.	Transportation	9-14
10.	**MACHINERY AND MACHINE GUARDING**	10-1
10-1.	General	10-1
10-1.1.	Scope	10-1
10-1.2.	References	10-1
10-2.	General Requirements	10-3
10-2.1.	Protection Against Hazards	10-3
10-2.2.	Training	10-3
10-2.3.	Inspection	10-3
10-2.4.	Anchoring Machinery	10-3
10-2.5.	Machine Controls	10-3
10-2.6.	Defective Equipment	10-4
10-2.7.	Dust Control	10-4
10-3.	Hazards of Machines	10-4
10-3.1.	Moving Parts	10-4
10-3.2.	Flying or Falling Material	10-5
10-3.3.	Inherently Hazardous Material	10-5
10-4.	Safeguarding the Point of Hazard	10-5
10-4.1.	Primary Methods of Safeguarding	10-5
10-4.2.	Secondary Methods of Safeguarding	10-7
11.	**PORTABLE TOOLS**	11-1
11-1.	General	11-1
11-1.1.	Safe Condition	11-1
11-1.2.	Intended Use	11-1
11-1.3.	Secure Positioning	11-1
11-1.4.	Storage	11-1
11-1.5.	Personal Protective Equipment	11-1
11-1.6.	Training	11-1
11-2.	Hand Tools	11-2
11-2.1.	Handles	11-2

TABLE OF CONTENTS (Continued)

Chapter		Page
11-2.2.	Impact Tools	11-2
11-2.3.	Sharp-Edged Tools	11-2
11-2.4.	Cuts and Strokes	11-2
11-2.5.	Electrical Work	11-2
11-2.6.	Standards	11-2
11-3.	Power Tools	11-2
11-3.1.	Controls	11-2
11-3.2.	Inspection	11-3
11-3.3.	Power Source Requirements	11-3
11-3.4.	Guarding Portable Powered Tools	11-5
11-4.	Other Portable Tools	11-5
11-4.1.	Explosive Actuated Fastening Tools	11-5
11-4.2.	Lawn Mowers	11-6
11-4.3.	Jacks	11-6
12.	**WELDING AND HOT WORK**	12-1
12-1.	General	12-1
12-2.	General Requirements	12-1
12-2.1.	Safe Equipment	12-1
12-2.2.	Rules and Instructions	12-1
12-2.3.	Qualified Personnel	12-2
12-2.4.	Location	12-2
12-3.	Oxygen-Fuel Gas Systems	12-2
12-3.1.	General	12-2
12-3.2.	Cylinders and Containers	12-3
12-3.3.	Manifolds	12-3
12-3.4.	Service Piping Systems	12-3
12-3.5.	Welding Hose	12-3
12-3.6.	Torches	12-4
12-3.7.	Additional Standards	12-4
12-4.	Arc Welding and Cutting	12-4
12-4.1.	General	12-4
12-4.2.	Voltage	12-4
12-4.3.	Design	12-4
12-4.4.	Installation	12-5
12-4.5.	Operation and Maintenance	12-5
12-5.	Resistance Welding	12-5
12-6.	Fire Protection	12-5
12-6.1.	Nature of Fire Hazards	12-5
12-6.2.	Designated Safe Location	12-5
12-6.3.	Floor and Wall Protection	12-5
12-6.4.	Ducts	12-6
12-6.5.	Availability of Fire Extinguishing Equipment	12-6
12-6.6.	Fire Watch	12-6
12-7.	Personal Protection	12-7
12-7.1.	General	12-7

TABLE OF CONTENTS (Continued)

Chapter		Page
12-7.2.	Eye Protection	12-7
12-7.3.	Protective Clothing	12-8
12-8.	Work in Confined Spaces	12-10
12-8.1.	Ventilation	12-10
12-8.2.	Placing Equipment	12-10
12-8.3.	Warning Sign	12-10
12-8.4.	Gas Welding and Cutting	12-10
12-8.5.	Electrode Removal	12-10
12-9.	Environmental Safety	12-10
12-9.1.	General	12-11
12-9.2.	Labels	12-11
12-9.3.	Ventilation	12-11
12-10.	Pipelines	12-11
13.	**ELECTRICAL AND ELECTRONICS**	13-1
13-1.	General	13-1
13-1.1.	Navy Publications	13-1
13-1.2.	OSHA Publications	13-1
13-1.3.	National Consensus Standards	13-1
13-2.	General Requirements	13-2
13-2.1.	Personnel Requirements	13-2
13-2.2.	Personal Protection	13-2
13-2.3.	Working on Energized Circuits	13-6
13-2.4.	Batteries	13-8
13-2.5.	Inspections	13-8
13-2.6.	Supply Stations and Lines	13-9
13-3.	Electrical Systems	13-9
13-3.1.	General Requirements	13-9
13-3.2.	Wiring Design and Protection	13-9
13-3.3.	Wiring Methods, Components and General Use Equipment	13-9
13-3.4.	Specific Purpose Equipment and Installations	13-9
13-3.5.	Hazardous Locations	13-9
13-3.6.	Special Systems	13-10
13-4.	Electronics	13-10
13-4.1.	General	13-10
13-4.2.	Tag Out/Lock Out	13-10
13-4.3.	Precautions During Ship Overhaul and Repair	13-10
13-4.4.	Energizing When Ship is in Drydock	13-11
13-4.5.	Radio Frequency (RF) and Microwave Hazards	13-11
13-4.6.	Laser Hazards	13-11
13-4.7.	Hazardous Material	13-11
13-5.	Construction	13-11
13-6.	Ships	13-11

TABLE OF CONTENTS (Continued)

Appendix		Page
A	DEFINITIONS	A-1
B	REFERENCES	B-1
C	ABBREVIATIONS	C-1
D	NAVAIROSH REQUIREMENTS FOR SHORE ACTIVITIES; CROSS REFERENCE WITH DOL, OSHA STANDARDS	
	Section 1: DOL, OSHA Standard to NAVAIROSH Requirement	D-1
	Section 2: NAVAIROSH Requirement to DOL, OSHA or Other Standard	D-15

LIST OF ILLUSTRATIONS

Figure	Title	Page
4-1	SF400 - Class A Explosives	4-17
4-2	SF401 - Class B Explosives	4-17
4-3	SF402 - Class C Explosives	4-17
4-4	SF403 - Nonflammable Gases	4-17
4-5	SF404 - Flammable Gases	4-18
4-6	SF405 - Flammable Liquids	4-18
4-7	SF406 - Flammable Solids	4-18
4-8	SF407 - Oxidizing Materials that are not Organic Peroxides	4-18
4-9	SF408 - Organic Peroxides Classed as Oxidizing Materials	4-19
4-10	SF409 - Poisonous, Nonirritant Gases	4-19
4-11	SF410 - Poisonous, Nonirritant Liquids and Solids	4-19
4-12	SF411 - Poisonous, Irritant Materials	4-19
4-13	SF412 - Poisonous, Irritant Materials	4-20
4-14	SF413 - Fissile Class I Radioactive Materials, Radioactive White-I ...	4-20
4-15	SF414 - Fissile Class II Radioactive Materials, Radioactive Yellow-II	4-20
4-16	SF415 - Fissile Class III Radioactive Materials, Radioactive Yellow-III	4-20
4-17	SF416 - Corrosive Materials	4-21
4-18	SF417 - Empty Containers	4-21
4-19	SF418 - Spontaneously Combustible Materials	4-21
4-20	SF419 - Water-Reactive Materials	4-21
4-21	SF423 - Blasting Agents	4-22
4-22	SF420 - Biomedical Materials	4-22
4-23	SF421 - Materials Prohibited from Passenger Aircraft	4-22
4-24	SF422 - Magnetized Material	4-22
4-25	Hazardous Material Label (NFPA 704M)	4-23
4-26	NFPA Hazardous Material Label Tag	4-24

LIST OF TABLES

Table	Title	Page
2-1.	Standards for Specific Types of Scaffolds	2-17
4-1.	DOT Labels Used for Hazardous Materials ..	4-15
4-2.	National Stock Numbers for Symbols and Numerals Used on the NFPA Label	4-23
4-3.	NFPA Hazard Identification System	4-25
5-1.	Maximum Allowable Size of Containers and Portable Tanks	5-3
6-1.	Checklist for the Selection of Protective Equipment	6-3
12-1.	Welding Filter Shade Selection	12-9

CHAPTER 1

PURPOSE, SCOPE, AND RESPONSIBILITIES

1-1. PURPOSE. This manual promulgates NAVAIRSYSCOM Occupational Safety and Health (NAVAIROSH) requirements for NAVAIRSYSCOM shore activities. These NAVAIROSH requirements have as their specific objective ensuring that NAVAIRSYSCOM personnel, both civilian and military at NAVAIRSYSCOM shore activities, are afforded protection from occupational hazards to a degree equal to or greater than that which is required for employees in the private sector by the Occupational Safety and Health (OSH) Act of 1970.

1-2. NAVY OCCUPATIONAL SAFETY AND HEALTH (NAVOSH) PROGRAM

1-2.1. BACKGROUND. This manual replaces NAVMAT P-5100, *Safety Precautions for Shore Activities*, which was initially published in 1967, last changed in 1970 and cancelled in August 1983. Since P-5100 was written, major changes have taken place in the area of safety and occupational health. The passage of the Occupational Safety and Health Act (OSHAct) of 1970, which became effective on April 28, 1971, was one of the most significant events that has taken place in the field of workplace safety and health in nearly 60 years.

1-2.1.1. When Congress passed the OSHAct, it authorized the promulgation of groups of already codified standards. The initial set of standards published in the act consisted of standards that already had the force of law, such as those issued by authority of the Walsh-Healey Act, the Construction Safety Act, and the 1958 Amendments of the Longshoremen's and Harbor Workers' Compensation Act. Many of the adopted standards, however, were derived from voluntary national consensus standards previously prepared by such groups as the American National Standards Institute (ANSI) and the National Fire Protection Association (NFPA). Although the OSHAct and the standards contained in the Act, were directed primarily towards the private sector, section 19 directed Federal agencies to establish and maintain comprehensive occupational safety and health programs consistent with the standards published in Section 6 of the OSHAct.

1-2.1.2. The purpose of the manual is to provide, in one document, guidance on acceptable workplace safety and health standards that are to be implemented within the Naval Air Systems Command. The manual is organized similar to the OSHA standards, however, it provides additional interpretations, where needed, and it includes numerous references to

a variety of Navy and national consensus safety and occupational health documents.

1-2.1.3. This manual is considered to be fully consistent with the OSHA standards. If any inconsistencies are identified, comply with the OSHA standard until the inconsistency is resolved by COMNAVAIRSYSCOM (09E2).

1-2.1.4. It is our intention to keep the manual current and to implement all valid recommendations in order to make it as useful as possible. Just as the OSHA standards have been refined since passage of the OSHAct, this manual will, likewise, evolve into a more comprehensive document. Your ideas and comments on what is needed by field activity safety and occupational health personnel will help in this evolutionary process. Recommended changes, additions or deletions should be submitted in writing (in accordance with OPNAVINST 4790.2) using a Technical Publications Deficiency Report (OPNAV Form 4790/66). For your convenience, three copies of this form have been included in the back of this manual. Additional copies of OPNAV Form 4790/66 may be requisitioned from the Naval Publications and Forms Center (NPFC), Philadelphia, PA 19120.

1-2.2. IMPLEMENTATION. The NAVOSH program is implemented by two documents. OPNAVINST 5100.19A (NOTAL) provides standards for Navy forces afloat. OPNAVINST 5100.23B, "Navy Occupational Safety and Health (NAVOSH) Program Manual", provides policies and guidelines for administration of the NAVOSH Program Navywide. This manual provides NAVAIROSH requirements for NAVAIRSYSCOM shore activities.

1-3. SCOPE AND APPLICABILITY

1-3.1. SCOPE. The requirements published in this manual apply to all NAVAIRSYSCOM personnel worldwide, both civilian and military, in applicable workplaces or operations (paragraph 1-3.3). These requirements prescribe the minimum safeguards necessary to ensure an acceptable level of employee safety and health in NAVAIRSYSCOM workplaces. It is not practicable for this manual to address every operation and working condition which might be encountered at NAVAIRSYSCOM shore activities. The fact that a specific hazard is not addressed by this manual or by the references incorporated by this manual shall not be cause for disregarding the hazard. It is incumbent upon commands to issue supplementary requirements, as necessary, for the specific safety needs of their personnel and operations. Because the NAVAIROSH requirements are minimum requirements, more stringent requirements should be implemented where it is determined to be necessary for the protection of NAVAIRSYSCOM personnel, property and missions.

1-3.2. APPLICABLE PERSONNEL.

1-3.2.1. NAVAIRSYSCOM Personnel. For the purpose of this manual, the term "NAVAIRSYSCOM personnel" shall include the following categories:

a. Civilian--General Merit, General Schedule and Wage Grade employees; Youth/Student Assistance Program employees; foreign nationals directly employed by NAVAIRSYSCOM commands; nonappropriated fund employees; and volunteer workers.

b. Military--U. S. Navy personnel on active duty; U.S. Military Reserve or National Guard personnel on active duty or in drill status; foreign national military personnel assigned to NAVAIRSYSCOM commands; and personnel of other branches of the Armed Forces serving at a NAVAIRSYSCOM activity.

1-3.2.2. Contractor Personnel. Except as noted in this paragraph below, NAVAIROSH requirements do not apply to the safety of contractor employees at contractor workplaces on or off Naval installations. NAVAIROSH requirements apply to the Navy's government-owned, contractor-operated facilities only if they involve:

(a) the occupational safety and health of Navy personnel;

(b) situations in which the United States traditionally, by admiralty law or contract, is liable for contractor employee injuries; and

(c) with respect to the contractor's employees, only those specific occupational safety and health matters over which the Department of Defense exercises statutory authority in accordance with the provisions of section B3(b) of DOD Instruction 6055.1, Department of Defense Occupational Safety and Health Program.

In all other matters affecting the safety and health of the contractor's employees, the contractor is responsible directly to the Department of Labor's Occupational Safety and Health Administration (OSHA) or to appropriate state office where OSHA has approved a state plan. However, NAVAIROSH requirements shall be applied by contract clauses to contractor-provided facilities or materials and to contractor operations when it is deemed necessary to protect NAVAIRSYSCOM personnel, property or missions.

1-3.3. APPLICABLE WORKPLACES, EQUIPMENT AND OPERATIONS. The NAVAIROSH requirements published in this manual apply to all NAVAIRSYSCOM shore activities and shorebased workplaces, equipment and operations worldwide, subject to the specific limitations and exceptions set forth in paragraphs 1-3.3.1 through 1-3.3.3 below. These requirements shall apply whether the work is performed on or off a NAVAIRSYSCOM installation and to all shipboard work performed at NAVAIRSYSCOM shore facilities. Specific limitations or exceptions shall be made, as required, for the workplaces, equipment, and operations described in the following paragraphs.

1-3.3.1. Military-Unique Equipment, Systems, and Operations. Subject to the provisions of paragraphs 1-3.3.1.1 and 1-3.3.1.2 below, the NAVAIROSH requirements of this manual do not apply to equipment, systems, and operations which are unique to the Navy's defense mission. Examples of military-unique equipment and systems include military weapons, ships, aircraft, missiles, tactical vehicles, ammunition, early warning systems, etc. Associated military operations such as field maneuvers, naval operations, military flight operations, equipment trials, etc. and associated research, test, and development operations dictated by design configurations or military capability are also excluded, as are any operations required under emergency conditions.

1-3.3.1.1. The exemption from NAVAIROSH requirements coverage authorized for military-unique equipment, systems, and operations does not generally extend to: (1) workplaces and activities which are comparable to those of industry in the private sector, and (2) industrial operations involving military-unique equipment or carried out in military-unique environments (e.g., the use of hand and portable power tools on board ship or aircraft, or the removal and transport of a weapons system from aircraft to a repair shop). In these situations NAVAIROSH requirements shall be followed unless specifically precluded by equipment or system design configurations, or other limitations resulting from workplace characteristics unique to the national defense mission. For example, implementation of certain engineering controls may not be feasible due to space or design restrictions aboard aircraft.

1-3.3.1.2. In military-unique workplaces which are exempt from NAVAIROSH requirements coverage, and otherwise subject only to Navy-developed safety standards and regulations, commands shall apply other applicable safety and health standards or equivalent criteria wherever feasible, consistent with essential requirements for military capability.

1-3.3.2. Special Statutory Authorities. NAVAIROSH requirements shall not apply to operations subject to mandatory safety standards derived from a separate, specific statutory authority. For example, standards for Explosives Safety are issued under the authority of 10 U.S.C. 172 (1970) and for Nuclear Safety and Health under the authority of 42 U.S.C. sections 2012, 2021, 2121(b), and 2201(b) (1976). In all areas of operation addressed by such special statutes, the special statute shall take precedence over the requirements contained in this manual where conflicts exist. However, in any situation not specifically covered by the special statute, the requirements established by this manual shall apply. Thus, a workplace in a Naval Air Rework Facility, subject to special explosive safety standards, is also subject to NAVAIROSH requirements for machine guarding, eye protection, etc.

1-3.3.3. Status of Forces Agreements. In overseas workplaces where status of forces agreements specify different standards, those standards take precedence over NAVAIROSH requirements, subject to the same limits set forth in subparagraph 1-3.3.2. above.

1-4. CONFLICTING REGULATIONS. All NAVAIRSYSCOM commands shall ensure that all command publications, instructions, manuals, specifications, technical orders, procedures, etc. which contain occupational safety and health provisions are reviewed and updated to conform to these NAVAIROSH requirements. Previously issued safety, fire protection, or health requirements issued by the various NAVAIRSYSCOM activities or offices that are found to be less stringent or less comprehensive than these NAVAIROSH requirements as they pertain to occupational safety and health, shall be modified to comply with these NAVAIROSH requirements. Safety, fire protection or health requirements issued by the various NAVAIRSYSCOM activities and offices for protection of Navy material, real property or missions that are more stringent or more comprehensive than these NAVAIROSH requirements may be retained. COMNAVAIRSYSCOM shall resolve any conflicts between current publications and NAVAIROSH requirements, as required. If a command determines that NAVAIROSH requirements criteria must be modified for application to a particular working condition within the command, the alternate criteria shall be submitted to COMNAVAIRSYSCOM and action taken in accordance with the procedures of OPNAVINST 5100.23B.

1-5. REVISIONS. Since one of the functions of the NAVAIROSH Program is to maintain workplace safety and health requirements which will provide employee protection equal to, or greater than, that provided by standards applicable

to the private sector, revision to this publication may be necessitated by the issue, change, or revocation of any Department of Labor (DOL) OSHA standards including emergency temporary standards (ETS). Since any changes in DOL OSHA standards will typically precede revisions to this manual, it is imperative that activity/unit commands be made aware of impending changes to DOL OSHA standards so that the standards may be implemented no later than the effective date for such changes in the private sector. Future revisions of NAVAIROSH requirements shall also incorporate any significant increases of coverage or stringency in existing national consensus standards such as those issued by the American National Standards Institute (ANSI) or the National Fire Protection Association (NFPA).

1-6. STANDARDS INCORPORATED BY REFERENCE

1-6.1. GENERAL. The NAVAIROSH requirements contained in this manual or incorporated by reference in this manual are mandatory and shall be implemented in all applicable workplaces and operations. The requirements contained in this manual are of necessity basic and general. In Chapters 2 through 13, more detailed requirements are incorporated by reference to other standards publications, e.g. other Navy regulations, DOL OSHA standards, and national consensus standards, such as American National Standards Institute (ANSI) and the National Fire Protection Association (NFPA).

1-6.2. USE OF REFERENCED STANDARDS. Because the requirements contained in this manual are general in nature, they are not intended to be the sole source of safety and health requirements for a given trade or operation. For example, the electrical requirements in Chapter 13 are very general and apply to almost any shore facility. Chapter 13 makes reference to the National Electrical Code and to 29 CFR 1910, Subpart S, for more detailed electrical requirements for shore facilities. In addition, NSTM 300 is referenced as it applies to shorebased personnel working aboard ship and NAVELEX 0101.110A is referenced for electronics operations. To include such lengthy, detailed standards in this manual would have made it unwieldy and would exceed the needs of most of the users.

1-6.3. SELECTED REFERENCES. It is not necessary for every user of this manual to have copies of all the standards incorporated by reference. However, each user should have ready access to DOL OSHA General Industry Standards (29 CFR 1910). As the NAVAIROSH requirements are implemented through the chain of command, upper echelons may elect to include all or part of the material from selected standards incorporated by reference, which are directly applicable to the operations of subordinate commands. An activity's safety and health office should maintain a library of those

standards incorporated by reference which are determined to be applicable to the activity's operations. An activity's operating departments may need only selected references which are directly applicable to the department's operations, relying on the safety and health office or on cognizant departments, i.e. Supply Department for NAVSUP documents, Public Works Department for NAVFAC documents, etc., for other referenced standards as they are needed.

1-6.4. CURRENT EDITIONS. The current edition of standards incorporated by reference shall be used. For this reason, the year of publication of national consensus standards is omitted from the reference, e.g. ANSI B56.1 - 1975 is referenced as ANSI B56.1. In the case of Navy instructions, the edition current at the time this manual, or changes, is issued will be referenced but subsequent editions of the instruction series shall be used, e.g. a reference to OPNAVINST 5100.XXA automatically includes subsequent editions (XXB; XXC, etc.) that may be issued.

1-6.5. GUIDANCE MATERIALS. There is a large body of safety and health literature which, though not binding as standards, should be used as guidance in the conduct of a NAVAIROSH program. Publications of the National Safety Council, manufacturers' instructions and trade association journals are excellent sources of guidance materials. Appendix B provides a detailed list of safety and health standards and guidance materials.

1-7. SAFETY VIOLATIONS AND HAZARDOUS CONDITIONS. Employees shall be advised of unsafe or unhealthy conditions by notices posted in accordance with OPNAVINST 5100.23B. Abatement actions shall be carried out in accordance with the policy guidelines of OPNAVINST 5100.23B. In imminent danger situations, work shall be stopped by appropriate supervisory personnel; all personnel not required for abatement of the imminent danger conditions shall be removed from the danger area.

1-8. RESPONSIBILITIES

1-8.1. COMMANDING OFFICERS. U. S. Navy Regulations, 1975, Article 0752, is quoted as follows: "The Commanding Officer shall require that persons concerned are instructed and drilled in all applicable safety precautions and procedures, that these are complied with, and that applicable safety precautions, or extracts therefrom, are posted in appropriate places. In any instance where safety precautions have not been issued or are incomplete, he or she shall issue or augment such safety precautions as he or she deems necessary, notifying when appropriate, higher authorities concerned."

1-8.2. SUPERVISORY PERSONNEL. Supervisory personnel shall be familiar with the NAVAIROSH requirements applicable to their operations and shall ensure that their subordinates are instructed in and carry out safety precautions applicable to their assigned tasks. Supervisors shall correct hazards brought to their attention or they shall request assistance as necessary in corrrecting hazards.

1-8.3. ALL PERSONNEL

a. Each employee is responsible for knowing and observing all safety and health precautions applicable to his/her workplace and for reporting hazards as provided in OPNAVINST 5100.23B.

b. The continuous cooperation and vigilance of all personnel are needed to ensure that operating procedures and work methods do not unnecessarily expose personnel to injury or property to loss or damage.

1-9. DOD POSTER. The Department of Defense Occupational Safety and Health Protection Program poster (DD Form 2272) shall be posted on official bulletin boards. The poster lists the activity's Occupational Safety and Health official and informs employees of their rights and responsibilities under the program. The poster shall not be covered by other material nor shall it be removed. (DD Form 2272 is available from Navy Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120. The stock number for the form is 0102-LF002-2720. Orders must be submitted on DD Form 1348, "DOD Single Line Item Requisition System Document".)

CHAPTER 2

WALKING AND WORKING SURFACES

2-1. GENERAL

2-1.1. SCOPE. The requirements contained or incorporated by reference in this chapter apply to all walking or climbing surfaces including those upon which personnel stand, sit, or lie. Also included are working surfaces such as benches, tables and desks. In situations in which the walking/working surface is the item being worked, such as aircraft or ship's cargo, facilities and/or procedures consistent with the requirements of this chapter shall be utilized to protect personnel from the hazards of slips, trips, and falls.

2-1.2. HOUSEKEEPING. All places of work shall be kept in a clean, orderly and sanitary condition to the extent allowable by the operation in progress. Under no circumstances shall poor housekeeping be permitted to pose a safety hazard or to intensify an existing hazard. Workplaces should be inspected daily to ensure that good housekeeping is maintained.

2-1.2.1. Tools and Equipment. Unnecessary tools, materials, and equipment shall not be permitted in or near walking and working areas, machinery and structures. Lockers, cribs, bins, sacks or storerooms shall be provided for the proper storage of tools and equipment. Hoses, lines, cables, and extension cords shall be elevated over passageways or be covered by adequate crossover planks or similar protective covers.

2-1.2.2. Debris. Rubbish and work-generated debris shall not be allowed to accumulate on walking or working surfaces. Scrap and other litter shall be gathered frequently and removed from the work area. Rubbish shall be disposed of in properly identified containers and cleared from work areas at the end of each work day.

2-1.3. FLOORS, DECKS, AND STAIRS. New or replaced floors, decks, platforms, and stairs shall be visually inspected and found safe before personnel are permitted to walk or work on them. Structural or surface hazards shall be corrected before normal work activities may be conducted.

2-1.3.1. Warning Signs and Barricades. Appropriate warning signs, hazard markings, or barricades shall be provided when temporary hazards are present, including openings in floors, slippery surfaces, or obstructions to walking. Signs,

markings and barricades shall be lighted as necessary to ensure visibility. See section 3-4 for additional standards governing the use of warning signs and barricades.

2-1.3.2. Tripping Hazards. Floors shall be kept free from all tripping hazards, such as protruding nails, splinters, holes, and loose boards. Loose or torn floor coverings shall be promptly repaired, replaced, or removed. Any tripping hazard that cannot be removed shall be barricaded off and marked as required in subparagraph 2-1.3.1.

2-1.3.3. Slipping Hazards. Floors and decks shall be kept dry, so far as possible, during working hours. Slippery conditions on walkways or working surfaces, such as those caused by water, grease, or oil, shall be eliminated as they occur. Textured mats, duck boards or other suitable nonskid materials shall be used when it is not practicable to barricade off slippery floors. Nonslip wax should be used to polish floors. Where wet processes are used, drainage shall be maintained, and dry standing places and/or protective footwear should be provided where practicable.

2-1.4. AISLES AND PASSAGEWAYS. Adequate, well-defined aisles and passageways shall be maintained in all work areas. Permanent aisles and passageways shall be appropriately marked (see NAVFAC P-309, "Color for Naval Shore Facilities", (NOTAL)). Aisles and passageways which are components of means of egress shall be maintained in accordance with section 3-3.

2-1.4.1. Blind Corners. Collision hazards at blind corners shall be minimized by means such as warning signs, sounding of horns on approach, and/or installation of a mirror set at the proper angle.

2-1.4.2. Uneven Surfaces. Abrupt changes in floor elevations in aisles shall be marked to warn against tripping hazards (see NAVFAC P-309 (NOTAL)). Where necessary, handrails shall be erected in accordance with subparagraph 2-3.6.

2-1.4.3. Working Aisles. Where mechanical handling equipment is used, working aisles shall be maintained as described in paragraph 9-3.2.

2-1.4.4. Dockboards. Portable and powered dockboards (or bridgeplates) shall be strong enough to carry the load imposed on them. They shall be secured in position either by being anchored or equipped with devices which will prevent their slipping. Handholds or other effective means shall be provided on portable dockboards to permit safe handling.

2-1.4.4.1. Blue Flags. Blue flags or signals shall be placed at both ends of a railcar or cut of cars while dockboards are in position or whenever personnel are otherwise working in, on, or under the cars.

2-1.4.4.2. Reference. Additional requirements on the design and construction of dockboards are in ANSI MH14.1, "Loading Dock Levelers and Dockboards," (NOTAL), which is hereby incorporated by reference.

2-1.5. AIRCRAFT. If it is absolutely necessary to walk on aircraft wings or fuselage, locally designed safeguards shall be used to prevent falls. Surrounding-type work docks or platforms with rails or "skylines" to which safety belts can be attached are examples of such safeguards.

2-1.6. FLOOR CAPACITIES. When placing or moving equipment or stores in or on a building, the maximum load limits approved for the floor or roof area must not be exceeded. Load limits shall be posted on plates affixed to the structure in which the work area is located. If the floor capacity for an area is not known or if there is any doubt about maintaining floor loading within permissible limits, the Public Works Department should be consulted. Permissible floor loading might be less than the posted limit when combustible material is being stored (see NAVFAC DM-8, "Fire Protection Engineering", (NOTAL)).

2-2. GUARDING FLOOR AND WALL OPENINGS AND HOLES

2-2.1. GENERAL. This section deals with the prevention of persons or objects falling from one level to another level through floor, roof or wall openings or from stairways, platforms, decks, runways or other elevated surfaces.

2-2.1.1. Guarding Requirements. This section contains guarding requirements for shore facilities. (Shipboard railings shall be in accordance with 29 CFR 1915.73, 1915.75 and 29 CFR 1918, Subpart D.) The detailed specifications for the construction of railings, toeboards, and covers in 29 CFR 1910.23(e) shall be followed except that existing guardrails 36 to 44 inches high are acceptable. Guardrails with heights greater than 44 inches are permissible providied that additional or wider mid-rails are installed so that openings beneath the top rail will not permit the passage of a 19-inch or larger spherical object.

2-2.1.2. Equivalent Protection. Where the installation of fixed guardrails is not practicable due to the temporary nature of the hazard or due to normal operations which require removal of the railing, equivalent railing may be used. Examples of equivalent railing are taut chains or ropes of adequate strength attached to the top and interme-

diate positions of well-secured stanchions. The top rail must be sufficiently taut and the stanchions sufficiently secured so that the maximum deflection when a load of 200 pounds is applied in any direction at any point on the top rail does not exceed 3 inches in one direction, which includes the free hanging sag in the rope or chain.

2-2.2. ELEVATED WORK LEVELS. All elevated work levels, such as platforms, open-sided floors and runways, which are 4 feet or more above adjacent floor or ground levels or any distance above water shall be guarded by a standard railing or equivalent on all open sides, except where there is an entrance to a ramp, stairway or fixed ladder. A standard toeboard shall be provided if personnel can pass beneath the open sides or if there is moving machinery or other equipment for which falling materials could create a hazard. Additional guarding shall be provided where employees entering on runways may be exposed to machinery, electrical equipment or other hazards in addition to falling. Standard railings, or the equivalent, and toeboards shall be provided for all open-sided floors, roofs, walkways, platforms or runways, regardless of height, that are above or next to dangerous equipment, installations or operations. When material is stacked near the edge of an elevated work level, paneling or equivalent-strength screening with openings less than 1 inch in greatest dimension shall be provided so that the material is not stacked higher than the paneling or screening. Runways used exclusively for special purposes, such as oiling shafting or filling tank cars, may have the railing on the working side omitted where operating conditions warrant, provided the runway is at least 18 inches wide.

2-2.3. FLOOR OPENINGS. A floor opening is an opening measuring 12 inches or more in its least dimension through which persons might fall.

2-2.3.1. Stairway Openings. Floor openings for stairways shall be guarded by standard railings and toeboards on all exposed sides except the side providing access to the stairs.

2-2.3.2. Ladderways. Ladderway floor openings or platforms shall be guarded by standard railings and toeboards on all exposed sides except at the entrance to the opening. The passage through the railing shall either be provided with a swinging gate or be offset so that a person cannot walk directly into the opening.

2-2.3.3. Hatchways and Chutes. Hatchway and chute floor openings shall be guarded by one of the following:

a. Hinged covers of standard strength and construction and a permanent standard railing with only one side open for access. When the opening is not in use, the cover shall be closed or the exposed side shall be guarded by removable standard railings.

b. A removable standard railing and toeboard on not more than 2 sides of the opening and fixed standard railing and toeboards on all other exposed sides. The removable railing shall be kept in place when the opening is not in use and shall be mounted so as to be conveniently replaceable.

c. Where operating conditions necessitate the feeding of material into any hatchway or chute opening, protection shall be provided to prevent a person from falling through the opening.

2-2.3.4. Pits and Trap Doors. Pits and trap-door openings shall be guarded by floor-opening covers of standard strength and construction. When the cover is not in place, the opening shall be protected on all exposed sides by removable standard railings or shall be constantly attended by a worker.

2-2.3.5. Manholes. Manhole openings shall be guarded by standard covers which need not be hinged in place. When the cover is not in place, the manhole opening shall be protected by standard railings or a worker shall be in constant attendance to warn other personnel of the open manhole.

2-2.3.6. Skylights. Wherever there is a danger of falling through a skylight opening, it shall be guarded by a fixed standard railing on all exposed sides or by a cover capable of bearing a 200-pound load. Roofing sections that are not load bearing but are similar to the rest of the roof, such as corrugated plastic panels as part of a corrugated metal roof, shall be appropriately guarded or marked.

2-2.3.7. Temporary Floor Openings. Temporary floor openings shall have standard railings or be constantly attended. Warning signs shall be erected as specified in subparagraph 2-1.3.1.

2-2.4. FLOOR HOLES. A floor hole is an opening measuring less than 12 inches in its greatest dimension and more than 1 inch in its least dimension through which objects might fall. Floor holes shall be guarded by either a standard railing with standard toeboards on all exposed sides or a floor hole cover of standard strength and construction that leaves no openings more than 1 inch wide and is secured

against accidental displacement. When the cover is not in place, the floor hole shall be protected by a removable standard railing or be constantly attended.

2-2.5. WALL OPENINGS. A wall opening is an opening at least 30 inches high and 18 inches wide in any wall or partition through which a person might fall. Any wall opening, including windows and temporary openings, the bottom of which is within 3 feet of the working surface and where there is a drop from the opening of 4 feet or more, shall be provided with barriers capable of withstanding a force of 200 pounds applied from the working side.

2-2.5.1. Working Openings. A working opening shall be provided with a standard rail or equivalent barrier and with grab handles capable of withstanding a force of 200 pounds in any direction. The grab handles shall be at least 12 inches long and be installed with a clearance of at least 3 inches from the side framing of the opening and with the centers about 4 feet from the floor. Railings on working openings may be removable but should be mounted so that reinstallation is convenient. When the opening is not in use for handling materials, the railing shall be kept in position even if the opening is provided with a door. If the bottom of the opening is within 4 inches of the walking surface, a standard toeboard shall be provided except that when a chute is attached to the opening, a toeboard is not required.

2-2.5.2. Window Wall Openings. Window wall openings shall be protected with a standard railing or an enclosing screen that will withstand a load of at least 200 pounds applied horizontally at any point on the working side of the barrier. Screens may be of solid construction, of grill work with openings no more than 8 inches long, or of slatwork with openings no more than 4 inches wide with length unrestricted. If the bottom of a window opening is below a landing or platform, a standard toeboard shall be provided on the walking surface adjacent to the window opening.

2-2.6. WALL HOLES. A wall hole is an opening from 1 to 30 inches high of any width in any wall or partition through which an object might fall. When there is the possibility of material falling through a wall hole in which the lower edge of the working side of the hole is less than 4 inches above the floor and the other side is more than 5 feet above the next lower level, the hole shall be protected by a standard toeboard or an enclosing screen. The hole shall be similarly protected regardless of height above the next lower level if there is equipment or process on the lower level which may be damaged by falling materials.

2-3. FIXED INDUSTRIAL STAIRS

2-3.1. GENERAL. This section applies to permanent general industrial stairs, both interior and exterior. It includes stairs around machinery, tanks, and other equipment, and stairs leading to or from floors, platforms, and pits. See section 3-3 for additional requirements for stairs used as means of egress. Stairways for construction operations shall be in accordance with 29 CFR 1926.501.

2-3.2. WHERE REQUIRED. Permanent stairs shall be provided between working levels under any of the following conditions:

a. Where operations require regular travel between levels;

b. Where personnel may be exposed to acids, caustics, gases, or other harmful substances in moving between levels;

c. Where personnel normally must carry tools or equipment by hand.

The requirements of this section do not preclude the use of fixed ladders, as described in section 2-5, where the use of fixed ladders is common practice.

2-3.3. SPIRAL STAIRWAYS. Spiral stairways shall not be permitted except for special limited use and secondary access where conventional stairways cannot practically be provided.

2-3.4. WINDING STAIRWAYS. Winding stairways may be installed on tanks and similar round structures where the diameter of the structure is at least 5 feet.

2-3.5. CONSTRUCTION. Stairs shall be constructed in accordance with 29 CFR 1910.24(c) through (j).

2-3.6. RAILINGS AND HANDRAILS. Flights of stairs having 4 or more risers shall be equipped with stair railings or handrails constructed in accordance with 29 CFR 1910.23(e)(2) and (5). The number and placement of stair railings and handrails shall be in accordance with 29 CFR 1910.23(d).

2-3.7. LANDINGS. Long flights of stairs should be provided with intermediate platforms where practical and where such stairs are frequently used. Platforms shall be at least as wide as the stairs and at least 30 inches long, measured in the direction of travel. Stairway platforms shall be provided where doors or gates open directly on to the stairway; the swing of the door shall not reduce the effective width of the platform to less than 20 inches.

2-4. ACCESS TO VESSELS. Personnel shall board and leave vessels, including barges, by an approved gangway, where possible, or by a straight ladder or Jacob's ladder. Boarding or departing via cargo-handling gear or by climbing up or down a save-all is prohibited. Means of access to vessels shall be in accordance with 29 CFR 1915.74 or with 29 CFR 1918.11, Subpart C.

2-5. LADDERS

2-5.1. GENERAL. Work performed from ladders should be kept to a minimum. The use of ladders where scaffolds, platforms or other substantial working surfaces could be used shall be avoided.

2-5.1.1. Maintenance. Ladders shall be maintained in good condition at all times. The joint between rungs or steps and side rails shall be tight; all hardware and fittings securely attached; movable parts shall operate freely without binding or undue play. Metal bearings of locks, wheels, pulleys, etc., shall be frequently lubricated. All parts shall be free from sharp edges, burrs and splinters; wood parts shall be free from shake, wane, compression failures, decay and other irregularities. Frayed or badly worn rope shall be replaced. Safety feet and other auxiliary equipment shall be kept in good condition to ensure proper performance.

2-5.1.2. Inspection. All ladders shall be inspected before each use. Users shall be alert for any defects which may appear while the ladder is in use. Portable wood ladders should be inspected monthly. Portable metal ladders and all fixed ladders should be inspected at regular intervals not to exceed one year. The conditions of use of a ladder and its exposure to corrosive atmospheres may necessitate more frequent inspections. If a ladder tips over or is exposed to excessive heat as in the case of fire, it shall be inspected immediately. Defective ladders shall be withdrawn from service and conspicuously marked "Dangerous - Do Not Use" while awaiting repair or destruction.

2-5.1.3. Protective Coatings. Wood ladders, when used under conditions where decay may occur, shall be treated with a nonirritating preservative. Wood ladders shall not be painted with opaque paint or any other coating that may hide defects. They may be coated with a clear shellac or other transparent material or treated with linseed oil. Metal ladders shall be painted or treated as necessary to resist corrosion or rusting.

2-5.1.4. Rungs. The term "rung" as used herein includes steps and other horizontal ladder members intended for climbing.

2-5.1.4.1. Spacing. Rungs shall be evenly spaced no more than 12 inches apart.

2-5.1.4.2. Surfaces. Rungs on metal ladders shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

2-5.1.4.3. Slippery Materials. Rungs shall be kept free of oil, grease, and other slippery materials. Personnel should remove such materials from their shoes before using a ladder. Slippery substances found on any part of a ladder shall be cleaned off immediately.

2-5.1.5. Single Rail. Wood ladders consisting of cleats fastened across a single rail shall not be used.

2-5.1.6. Maximum Load. The maximum load which may be imposed on a ladder which meets minimum requirements shall be 250 pounds.

2-5.1.7. Ladder Usage. The following precautions apply to all ladders; additional requirements for portable ladders are in paragraph 2-5.3.

a. Personnel ascending or descending a ladder shall face the ladder.

b. Personnel shall not run up a ladder or run or slide down a ladder.

c. Personnel shall have the free use of both hands while climbing up or down ladders. Equipment belts or hoisting ropes shall be used to carry materials.

d. Only one person at a time shall be allowed on a ladder or run of ladder except for double-cleated ladders (see subparagraph 2-5.3.1.7). Only one person at a time shall be permitted on scaffold planks supported by ladder jacks attached to ladders.

e. The use of ladders during storms or high winds shall be prohibited unless absolutely necessary in which case portable ladders shall be securely lashed in position.

f. Ladders with broken or missing rungs, broken side rails or other faulty equipment shall not be used. Improvised repairs shall not be made. See subparagraph 2-5.1.2 for disposition of defective ladders.

2-5.1.8. Construction of Ladders. The standards in this manual are for general and easily recognizable requirements. Detailed specifications for ladder construction are in the following standards which are incorporated by reference:

a. Portable wood ladders - 29 CFR 1910.25 and ANSI A14.1, "Safety Requirements for Portable Wood Ladders", (NOTAL).

b. Portable metal ladders - 29 CFR 1910.26 and ANSI A14.2, "Safety Requirements for Portable Metal Ladders", (NOTAL).

c. Portable plastic ladders - ANSI A14.5, "Safety Requirements for Portable Reinforced Plastic Ladders", (NOTAL).

d. Fixed ladders - 29 CFR 1910.27 and ANSI A14.3, "Safety Requirements for Fixed Ladders", (NOTAL).

e. Job-made ladders - 29 CFR 1926.450(b) and ANSI A14.4, "Safety Requirements for Job-Made Ladders", (NOTAL).

2-5.2. FIXED LADDERS. The detailed specifications, including required clearances and cage and well dimensions, for fixed ladders in 29 CFR 1910.27 shall be observed. The requirements of paragraph 2-5.1 shall be followed as they apply to fixed ladders.

2-5.3. PORTABLE LADDERS

2-5.3.1. General. Portable ladders shall be used for temporary and infrequent situations for which suitable stairways, ramps, runways or fixed ladders are not available. Work performed from ladders shall be kept to a minimum. Ladders shall not be used as substitutes for scaffolds or as guys, braces or skids or for other than their intended purpose.

2-5.3.1.1. Horizontal Position. Ladders shall not be used in a horizontal position as platforms, runways, scaffolds or gangways.

2-5.3.1.2. Unattended Ladders. Ladders that are not in use or are otherwise unattended shall be lowered to the ground or floor or shall be securely lashed to prevent their falling.

2-5.3.1.3. Storage. Ladders should be stored on edge in racks which provide access for inspection and which allow for safe removal of ladders for use. Nothing shall be placed on ladders in storage. Ladders shall be supported at a sufficient number of points to prevent sagging and permanent set. Ladders carried on vehicles shall be adequately

supported to avoid sagging and shall be securely positioned to minimize chafing and the effects of road shock. Wood ladders shall be stored in a well-ventilated place which is not exposed to the elements; they shall not be stored near radiators, stoves, steam pipes or other places subject to extreme heat or dampness.

2-5.3.1.4. Secure Footing. Ladders shall be placed on a secure level footing. When used, levelers shall be securely attached to the ladder. Ladders shall not be placed on boxes, barrels or other unstable bases.

2-5.3.1.5. Guarding Ladders. Ladders placed in passageways, driveways or other thoroughfares shall be guarded by barricades and warning signs in accordance with subparagraph 2-1.3.1. Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked open, locked or guarded.

2-5.3.1.6. Splicing. Shore ladders shall not be spliced or otherwise joined together to provide longer sections except for sectional ladders (see subparagraph 2-5.3.2.7).

2-5.3.1.7. Two-Way Traffic. Separate ladders or double-cleated ladders shall be provided at construction projects more than 2 stories in height or where warranted by heavy traffic. Double-cleated ladders shall have a center rail with one side of the ladder designated "up" and the other "down".

2-5.3.1.8. Extension Above Surface. No portable ladder shall be used to gain access to or from an upper walking surface unless the top of the ladder extends at least 3 feet above the place of access to the higher surface.

2-5.3.1.9. Top Rungs. The top 3 rungs of a straight ladder or the top step of a stepladder shall not be used as steps.

2-5.3.1.10. Lowering Ladders. Ladders should be handled carefully. They should not be allowed to drop on their sides or fall endwise.

2-5.3.1.11. Electrical Hazards. Ladders with metal rungs, braces, trusses, struts or other metal reinforcement shall not be used near live electrical circuits. Portable metal ladders shall not be used within 4 feet of any exposed live conductor. The use of metal ladders is prohibited in all electrical work and in electric arc welding. All portable metal ladders shall have signs or decals reading "Caution - Do Not Use Near Electrical Equipment" placed on the inside of the side rails between the third and fourth or fourth and fifth rungs.

2-5.3.2. Nonself-Supporting Ladders. Nonself-supporting (straight) ladders include single, extension and sectional ladders. The length of single ladders or individual sections of ladders shall not exceed 30 feet.

2-5.3.2.1. Placement. Nonself-supporting ladders shall be placed so as to avoid the possibility of the foot sliding away from the vertical support, the top falling backward, or the top sliding laterally along the top support. After being placed, ladders should be lashed, blocked or otherwise secured to prevent displacement.

2-5.3.2.2. Top Support. Ladders shall be placed so that both rails are substantially supported at the top. To support the top of a ladder at a window or other opening, a board or other device shall be attached across the back of the ladder extending across the opening and providing firm support against the wall or the frame of the opening.

2-5.3.2.3. Pitch. When placed against a wall or other fixed object, the pitch of the ladder should be such that the base of the ladder is 1/4 of the working length distance from the vertical plane of the top support. (The working length of a ladder is the distance measured along the side rail from the base of the ladder to the point of top support.) When conditions prevent placing a ladder at this pitch, the ladder shall be lashed or otherwise held securely in position.

2-5.3.2.4. Nonslip Bases. Nonslip bases shall be installed on all nonself-supporting ladders. Nonslip bases on metal ladders shall be made of insulating materials. Nonslip bases are not a substitute for lashing, holding or blocking ladders used on slippery, metal, concrete or sloping surfaces.

2-5.3.2.5. Single Ladders. Single ladders shall not exceed 30 feet in length except that mason's ladders may be up to 40 feet long and that trolley ladders shall not exceed 20 feet in height.

2-5.3.2.6. Extension Ladders. Wood extension ladders shall have only one sliding section; metal extension ladders shall have no more than 2 sliding sections. When fully extended with required overlaps, metal ladders with one sliding section shall not exceed 48 feet; all wooden ladders and those metal ladders which have 2 sliding sections, shall not exceed 60 feet. Extension ladders shall be erected so that the sliding sections rest on and ride on the base section.

a. An overlap of 3 feet shall be maintained between sections of ladders up to 36 feet of extended length; 4 feet for metal ladders 36 to 44 feet; 5 feet for wood ladders over 36 feet and metal ladders over 44 feet. Extension ladders shall be equipped with positive stops which will ensure the required overlaps.

b. Adjustments in ladder height shall be made by the user while standing at the base of the ladder. Adjustments shall not be made from any level above the locking device or while the user is standing on the ladder. The locking devices shall be properly engaged before the ladder is used.

2-5.3.2.7. Sectional Ladders. Sectional ladders consist of two or more separate sections of ladder which are designed to be combined to form a single ladder. Sectional ladders longer than 30 feet shall not be used. Bottom and intermediate sections shall not exceed 6-1/2 feet; top sections shall not exceed 9 feet. Connection joints shall be no less than 1 foot and shall fit closely without binding or unnecessary play. Intermediate and top sections used as bottom sections or as single ladders shall be equipped with nonslip bases as required by subparagraph 2-5.3.2.4.

2-5.3.3. Self-Supporting Ladders. Self-supporting ladders include stepladders and trestle ladders. Self-supporting ladders shall be fully opened with the spreader in the locked position before use; they shall not be used unopened as a substitute for single ladders. Metal self-supporting ladders shall have all four feet equipped with nonskid, insulating material.

2-5.3.3.1. Stepladders. Stepladders shall not exceed 20 feet measured along the front rails except the painter's ladders shall not exceed 12 feet. They shall not be used where vigorous or strenuous activity by the user presents the hazard of overturning the ladder.

a. Bracing on the back of stepladders shall not be used for climbing.

b. The top of a stepladder shall not be used as a step. Tools shall not be left on top of stepladders unless secured tools holders are provided.

2-5.3.3.2. Trestle Ladders. Trestle ladders consist of two single ladders hinged at the top. Extension trestle ladders have a third ladder which is vertically adjustable. The hinged sections shall not exceed 20 feet measured along the

side rails; the extension section also shall not exceed 20 feet. When used to support light scaffolding, trestle ladders shall be spread so that the inside width of the bottom is equal to or greater than 5-1/2 inches per foot of ladder length.

2-5.4 JOB-MADE LADDERS. Job-made ladders are heavy-duty ladders primarily used to provide access to and from work areas at construction or demolition operations. They are temporary means of access until the job is completed or permanent stairs or ladders are installed. Standards for construction details are contained in 29 CFR 1926.450(b) and ANSI A14.4, (NOTAL) which are incorporated by reference.

2-5.5. LADDERS ABOARD SHIPS. Requirements for construction and use of ladders are generally the same aboard ship as ashore. Detailed requirements and permissible variations are found in the following publications:

a. 29 CFR 1915.72

b. 29 CFR 1918.25.

2-6. SCAFFOLDS

2-6.1. GENERAL. A scaffold is any temporarily located elevated platform. A scaffold shall be provided for personnel engaged in work that cannot be done safely from the ground or from other solid construction, except for light work of short duration that can safely be done from a securely placed ladder.

2-6.2. CONSTRUCTION. Scaffolds shall be constructed to comply with standards specified in 29 CFR 1910.28. The use of "shore", "lean-to", or other makeshift scaffolds is prohibited. All scaffolds shall be designed to support four times the anticipated load. Wire or fiber rope used for scaffold suspension shall be capable of supporting at least six times the intended load. Scaffolding in dry docks or aboard ships or other vessels shall be constructed in accordance with 29 CFR 1915.71.

2-6.2.1. Supervision. Scaffolding shall be erected, moved, dismantled, or altered only under the supervision of a competent person who is experienced in scaffold work.

2-6.2.2. Footing. The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement.

2-6.2.3. Planking. All planking or platforms shall be overlapped (minimum 12 inches) or secured from movement. Scaffold planks shall extend over their end supports not less than 6 inches, nor more than 12 inches.

2-6.2.4. Altering. No scaffold shall be altered or moved horizontally while it is in use or is otherwise occupied.

2-6.2.5. Overhead Protection. Workers on scaffolding exposed to hazards of objects falling from above shall be protected by an overhead covering. Such overhead coverings shall be provided not more than 9 feet above the platform and shall consist of 2 inch planking or material of equivalent strength laid tight.

2-6.3. GUARDING SCAFFOLD EDGES. Guardrails and toeboards shall be provided on all open sides of scaffolds or staging that are more than 10 feet above a solid surface or are any distance above water, with the following exceptions:

a. Scaffolding wholly within the interior of a building, covering the entire floor area of a room, and having no side exposed to a hoistway, elevator shaft, stairwell, or other floor opening; or

b. Where the nature of the scaffolding precludes installation of railings (see paragraph 6-8.1 for required protection in this case).

c. Scaffolding used in ship repair, shipbuilding, or shipbraking operations shall have open sides and ends equipped with guardrails and toeboards on the scaffold platform which is 5 feet or more above a solid surface or any distance above water. The rails and toeboards shall be in accordance with 29 CFR 1915.71(j).

d. Scaffolds 4 feet to 10 feet in height, having a minimum horizontal dimension in either direction of less than 45 inches, shall have standard guardrails installed on all open sides and ends of the platform.

2-6.3.1. Railing. Guardrails and toeboards used on scaffolds ashore shall meet the requirements of 29 CFR 1910.23(e) except that the top rail may be from 36 to 42 inches high and the intermediate rail may be 1 X 6 lumber. Fiber rope rails shall not be used as equivalent guardrails where exposed to flame or chemicals.

2-6.3.2. Protection Below. Where personnel must work or pass under a scaffold, a screen shall be provided along the entire opening between toeboard and guardrail consisting of No. 18 U. S. Standard wire 1/2-inch mesh, or equivalent.

2-6.4. ACCESS. A safe means of access from below shall be provided to scaffold platforms by standard stairs, fixed ladders, ladders forming integral parts of prefabricated staging or equivalent safe access. Access from above to staging more than 3 feet below the point of access shall consist of a straight portable ladder complying with paragraph 2-5.3 or a properly secured Jacob's ladder of the double rung or flat tread type. Jumping on to or from a scaffold is prohibited.

2-6.5. PAINTING. Wood scaffolding shall not be painted.

2-6.6. INSPECTION. Structural members, support ropes, and scaffold equipment shall be inspected daily by a competent person before work is started. Any component that is damaged or weakened shall be repaired or replaced at once. The scaffold shall not be used until all defects are corrected.

2-6.7. LOADING. Scaffolds shall not be loaded with more than the working load for which they are intended.

2-6.7.1. Raising or Lowering Objects. Throwing or dropping tools or other objects from scaffolds is prohibited. Throwing materials onto a scaffold platform is prohibited. Objects that cannot be reached easily and safely by hand shall be raised and lowered by hand line. A tag line shall be used on materials being hoisted onto a scaffold.

2-6.7.2. Storage on Scaffolds. Tools, equipment, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard to personnel on or below the scaffold. While necessary tools are not being used they shall be placed in secured containers to prevent them from being knocked off the scaffold.

2-6.7.3. Bracing for Loads. Scaffolds to be used as loading or unloading platforms for materials shall first be sufficiently braced and reinforced for such purposes.

2-6.7.4. Resisting Lateral Stress. When severe lateral stress from heavy loads, shocks, or vibrations must be resisted, bolted or patented clamp connections shall be used.

2-6.8. WEATHER RESTRICTIONS. Personnel shall not be permitted to work on scaffolds during storms or high winds nor when scaffolds are covered with ice or snow. Clinging ice shall be removed from all guardrails and the planking shall be sanded or otherwise protected against slipping hazards. Platform planking shall not be turned over to meet this requirement, if it is covered with snow, sleet, or ice.

2-6.9. SPECIFIC SCAFFOLD TYPES. Table 2-1 lists the specific types of scaffolds addressed in the Department of Labor OSHA Standards. The requirements of the DOL, OSHA standards for design, construction and safe use of scaffolds shall be followed. If a type of scaffolding not specifically addressed is to be used, it shall be designed and erected under the supervision of a registered professional engineer as required by paragraph 2-6.2.

Table 2-1. STANDARDS FOR SPECIFIC TYPES OF SCAFFOLDS

Scaffold Type	DOL OSHA Standards 1910.28	1915.71	1926.451
Wood Pole	(b)	(c)	(b)
Tube and Coupler	(c)	-	(c)
Tubular Welded Frame	(d)	-	(d)
Outrigger	(e)	-	(g)
Mason's Adjustable Multiple-Point Suspension	(f)	-	(h)
Two-Point Suspension (Swinging)	(g)	-	(i)
Stone Setters' Adjustable Multiple-Point Suspension	(h)	-	(j)
Single-Point Adjustable Suspension	(i)	-	(k)
Boatswain's Chair	(j)	-	(l)
Carpenters' Bracket	(k)	-	(m)
Bricklayers' Square	(l)	-	(n)
Horse	(m)	(g)	(o)
Needle Beam	(n)	-	(p)
Plasterers', Decorators', and Large-Area	(o)	-	(q)
Interior Hung	(p)	-	(r)
Ladder-Jack	(q)	-	(s)
Window-Jack	(r)	-	(t)
Roofing Brackets	(s)	-	(u)
Crawling Boards or Chicken Ladders	(t)	-	(v)
Float or Ship	(u)	-	(w)
Form	-	-	(x)
Pump-Jack	-	-	(y)

2-6.10. MANUALLY PROPELLED MOBILE SCAFFOLDS, WORK PLATFORMS AND LADDER STANDS

2-6.10.1. General. Design, construction, and erection of manually propelled scaffolds, work platforms, and ladder stands shall comply with the standards set forth in 29 CFR 1910.29.

2-6.10.2. Footing. Scaffolds, stands, or platforms in use shall rest on a suitable footing and shall stand plumb. When the scaffold, stand or platform is in use, casters or wheels shall be locked to prevent movement.

2-6.10.3. Moving Scaffolds. No person shall remain on a scaffold while it is being moved. Scaffolds shall be moved only on level surfaces free of obstructions and openings. Moving force shall be applied as close to the base as practicable. Provision shall be made to stabilize the tower during movement. Particular care shall be taken that the scaffold does not foul overhead electric or telephone lines, roof members, or suspended fixtures (see subparagraph 13-2.2.9).

2-6.11. BARGE (PONTOON) SCAFFOLDS. Scaffolds erected on barges for work on the hull of ships afloat shall be of the independent pole type. The barge shall be of an approved design and shall be thoroughly seaworthy in every detail.

2-6.11.1. Proportional Dimensions

2-6.11.1.1. Width. The overall width of the erected poles shall not exceed 80 percent of the width of the barge.

2-6.11.1.2. Length. Distance between the end poles shall not exceed 80 percent of the barge length.

2-6.11.1.3. Height. The height of the working platform shall not be greater than the distance between the end poles.

2-6.11.1.4. Weight. Weight of the scaffold shall not constitute more than 50 percent of the total displacement of the barge-scaffold system.

2-6.11.1.5. List. The maximum working load concentrated at the greatest point of leverage shall not cause the scaffold to list more than 3 degrees. Ballast may be employed to correct this list.

2-6.11.1.6. Center of Gravity. The combined center of gravity of the barge and scaffold shall be kept as low as possible. The combined center of gravity shall be in the same vertical line with the center of buoyancy when the

barge is floating in still water. If necessary, ballast permanently secured to the barge may be used to bring about this condition.

2-6.11.1.7. Metacentric Height. The height of the scaffold and the length of the cantilever putlogs beyond the inboard poles shall be limited to distances ensuring a metacentric height sufficient for adequate initial stability, or "righting arm".

2-6.11.2. Barge Requirements. The barge shall have a minimum of 1 foot of freeboard and shall be equipped with fenders. When in position alongside a ship, the barge shall be secured to the ship. The gap between the work platform and the ship's hull shall not exceed 1 foot.

2-6.11.3. Scaffolding. Poles shall be centered on the barge in all directions. All poles shall be firmly secured to the deck of the barge by means of two 6-inch by 6-inch angle clips. The clips shall be welded or bolted to the deck and spaced so the backs fit snugly against the larger dimension of the uprights. They shall be bolted in this position, from one to the other through the uprights, by at least three, but no more than four, 1/2-inch galvanized steel bolts equipped with lock washers.

2-6.11.4. Protection of Personnel. In addition to guardrails (see 29 CFR 1915.71(j)) the following procedures shall be taken as necessary to protect personnel on barge scaffolds.

2-6.11.4.1. Safety Belts. Safety belts (subparagraph 6-8.1.3), secured to the scaffold, shall be worn by workers if rocking of the scaffold is severe enough to make it difficult for workers to maintain proper balance at all times.

2-6.11.4.2. Life Rings. At least one approved life ring (see subparagraph 6-8.4.2) shall be provided on the barge.

2-6.11.4.3. Camels. When barge scaffolds are used for working between two ships or between a ship and the wharf, camels shall be provided to prevent crushing of the barge through movement of the vessels.

2-6.11.4.4. Securing Vessel Engines. Before permitting work from a scaffold at or near the stern of a vessel, assurance must be obtained from the ship's Commanding Officer that the vessel's engines have been secured. When possible, the barge shall be kept clear of propellers.

2-6.11.4.5. Weather and Dock Trials. Work from barge scaffolds shall not be permitted in rough weather nor during dock trial of a ship.

2-7. POWERED PLATFORMS. Powered platforms for exterior building maintenance shall be installed, maintained, and used in compliance with the standards in 29 CFR 1910.66 and in ANSI A120.1, "Safety Code for Powered Platforms for Exterior Building Maintenance", (NOTAL).

2-8. AERIAL LIFT TRUCKS. The detailed design and operating requirements for aerial lift trucks in 29 CFR 1910.67 and ANSI A92.2, "Vehicle Mounted Elevating and Rotating Aerial Devices", (NOTAL), shall be followed. In addition to these mandatory requirements, the manufacturer's recommendations should also be followed.

2-9. PERSONNEL HOISTS. Personnel hoists used to carry workers engaged in construction, modification or demolition operations shall be designed and used in accordance with 29 CFR 1926.552(c) and ANSI A10.4, "Safety Requirements for Personnel Hoists", (NOTAL). Permanently installed elevators are discussed in paragraph 3-2.4.

2-10. MANLIFTS. Manlifts shall be used only for transporting personnel who are trained and authorized in their use. No materials of any kind shall be handled on any manlift. Manlifts shall be fabricated and installed to meet the design requirements of 29 CFR 1910.68 and ANSI A90.1, "Safety Standard for Manlifts", (NOTAL).

CHAPTER 3

BUILDINGS, GROUNDS, AND SPECIAL OPERATIONS

3-1. GENERAL. This chapter contains or incorporates by reference requirements for buildings, structures, grounds and other special operations.

3-2. BUILDING FACILITIES

3-2.1. MINIMUM DESIGN LOAD. All buildings and permanent structures where work is performed shall conform to the design load specifications of NAVFAC DM-2, "Structural Engineering", (NOTAL), or to applicable local building codes, whichever is more stringent.

3-2.2. PASSAGEWAYS AND THOROUGHFARES. Tripping, slipping, and falling hazards shall be eliminated or guarded against as required by paragraph 2-1.3.

3-2.3. DOORS

3-2.3.1. Posting. Signs shall be posted on doors opening into passageways reading: "CAUTION OPEN DOOR SLOWLY".

3-2.3.2. Spring Tension. Springs on self-closing doors shall be kept at the proper tension so doors will not close too rapidly.

3-2.3.3. Revolving Doors. Only one person at a time shall enter any one section of a revolving door.

3-2.3.4. Door Stops. Loose-type door stops shall be put in a safe place when not in use to prevent tripping.

3-2.4. ELEVATORS. Elevators shall be installed, operated and maintained in accordance with ANSI A17.1, "Elevators, Dumbwaiters, Escalators, and Moving Sidewalks", (NOTAL) and with applicable local civil codes. Elevators shall be inspected and tested in accordance with NAVFAC MO-322, "Inspection of Shore Facilities", (NOTAL). The requirements for elevators on construction projects in 29 CFR 1926.552 shall be complied with.

3-2.4.1. Capacity. In each elevator there shall be posted a card or plate indicating its rated capacity. The safe capacity for passenger elevators shall be expressed in terms of the maximum number of passengers to be carried and for freight elevators in the maximum number of pounds. The rated capacity shall not be exceeded.

3-2.4.2. Self-Service Elevators. Self-service elevators shall have operating instructions and emergency procedures clearly outlined and posted inside the car.

3-2.4.3. Operators. Only trained persons shall operate elevators other than self-service elevators. Such training shall include the use of emergency devices.

3-2.4.4. Authorized Use. Personnel shall not use freight elevators unless the elevator is authorized for passenger use. Elevators not authorized for passenger use shall carry signs to that effect.

3-2.5. ILLUMINATION. Areas where work is in progress or employees are otherwise present shall be adequately lighted with either natural or artificial illumination. Lighting shall be free from glare caused by exposed bulbs or reflected from highly polished surfaces. Lighting shall conform to the standards contained in Illuminating Engineering Society Pamphlet RP-7, "Practice for Industrial Lighting", (NOTAL) (formerly ANSI A11.1) and IES RP-1, "Practice for Office Lighting", (NOTAL) (formerly ANSI A132.1) for minimum illumination intensities.

3-2.5.1. Lighting Conditions. Periodic checks shall be made of lighting conditions for the amount of light, the presence of shadow, and the presence of spotty lighting. Lamps of proper voltage, wattage, and type shall be provided with a sufficient number of gloves and reflectors to prevent glare.

3-2.5.2. Cleaning. Globes, reflectors, and walls shall be kept clean at all times. Where painted areas are too dark to allow proper reflection, the walls shall be repainted in lighter shades.

3-2.5.3. Fixtures. Fluorescent tube fixtures shall be protected from damage by means of louvers, hinged covers, ceiling troughs, or the equivalent. Tubes exceeding 40 inches in length shall be provided with supplementary supporting brackets or other means of preventing drop-out.

3-2.5.4. Emergency Lighting. Emergency lighting shall be provided where it is required by standards incorporated by reference in paragraph 3-3 or when it is determined by the Safety Officer that darkness due to loss of power will impair employee egress or will create or increase other hazardous conditions.

3-2.6. CHAMBERS AND VAULTS. Each door on walk-in refrigerators, freezers, cold storage rooms, conditioning ovens or vaults shall be equipped with an inside door handle or bump bar to open the door from the inside. Doors fitted

with locks must be designed so locks can be opened from the inside. Locks independent of inside opening arrangements shall not be permitted. Emergency escape procedures shall be posted on the inside of the doors. Instructions shall be printed or painted in luminous colors and on material that withstands dampness or extreme temperatures, as applicable, for reasonable periods of time.

3-2.7. OFFICES AND OFFICE EQUIPMENT. The following standards are for office occupancies and for office-type equipment regardless of location.

3-2.7.1. Filing Cabinets. Individual upright filing cabinets should be fastened together, making certain cabinets of differing sizes, that have projecting corners, are not aligned together. The following precautions should be posted on the top of filing cabinets:

a. "Do not leave drawers open"
b. "Open one drawer at a time"
c. "Use handle for opening and closing"

3-2.7.2. Desks. Desks and other furniture placed on smooth surfaces should be equipped with rubber feet to prevent creeping. All office equipment placed on desks and all other appurtenances of desks shall be positioned to minimize the possibility of injury to personnel.

3-2.7.2.1. Glass Tops. Broken glass tops should be disposed of immediately and the desk should not be used until thoroughly cleaned of broken glass. Acrylic, polycarbonate, or other suitable plastic material should be used in lieu of glass on desks and tables. Broken glassware of any kind shall never be placed in wastebaskets. Broken glass shall be wrapped in heavy paper marked "broken glass" and placed by the wastebasket at the end of the day.

3-2.7.2.2. Open Drawers. Desk or other furniture drawers should not be left open so as to present a tripping or bumping hazard.

3-2.7.3. Chairs. Spring tension adjusting bolts on swivel chairs shall be inspected periodically.

3-2.7.4. Typewriters. Typewriter-well mechanisms on desks shall be inspected periodically to see that connections are secure. Care shall be exercised to guard against sudden movement of the typewriter platform when the typewriter is not in place. Typewriters or other heavy items shall not be placed on the sliding shelves of desks.

3-2.7.5. Fans. Fans shall be inspected periodically for loose blades or defective guards. Ventilating fans exposed

to contact within 7 feet of the floor or other walking surface shall be equipped with guards having openings sufficiently small to prevent the passage of a ball 9/16 of an inch in diameter. Properly-fitted, taut nylon mesh coverings may be used to meet this requirement.

3-2.7.6. Duplicating Machines. Duplicating machines shall not be placed or used in confined areas that do not have adequate exhaust ventilation. (See section 4-4 for ventilation standards.)

3-3. MEANS OF EGRESS. Safe evacuation of personnel from a building in an emergency is important to reduce injuries and loss of life. The provision and maintenance of well-marked, easily-recognized and unobstructed means of egress greatly reduce delays, confusion and resultant panic in emergency situations. Means of egress shall be provided and maintained in accordance with:

a. 29 CFR 1910, Subpart E, "Means of Egress",

b. NFPA 101, "Life Safety Code", (NOTAL), and

c. NAVFAC DM-8, "Fire Protection Engineering", (NOTAL).

Compliance with these standards shall be achieved by means that are not in themselves hazardous to occupants under normal conditions of occupancy. These standards are minimum standards and shall be supplemented by any other provisions necessary for the safe egress of personnel during emergencies.

3-4. WARNING SIGNS AND COLOR CODES

3-4.1. SCOPE. This section details the specifications for the usage and format of warning signs and symbols used in various work situations. Included are specifications for the lettering and color schemes of accident prevention tags, safety instruction signs, and danger and caution signs calling attention to imminent and potential dangers. Detailed color specifications are given in NAVFAC P-309, "Color for Naval Shore Facilities", (NOTAL).

3-4.2. ACCIDENT PREVENTION WARNINGS. Required accident prevention signs and symbols shall always be visible when work is being performed. These signs and symbols shall be removed or covered promptly when the hazards no longer exist. All signs shall have round or blunt corners. Signs shall be free from sharp edges, burrs, splinters, or other sharp projections. The ends or heads of bolts or other

fastening devices shall be located in a nonhazardous position. Detailed specifications for signs are given in ANSI Z35.1, "Specifications for Accident Prevention Signs", (NOTAL).

3-4.2.1. Sign Wording. Wording of signs shall be concise and easily read. Signs should be accurate and contain sufficient information to be easily understood.

3-4.2.2. Danger Signs. Danger signs shall be used only where an immediate hazard exists. Personnel shall be instructed that danger signs indicate immediate danger and that special precautions should be taken. The primary color for the upper panel of danger signs shall be red with a black outline. Additional sign wording shall be inserted on a white lower panel.

3-4.2.3. Caution Signs. Caution signs shall be used only to warn against potential hazards or to caution against unsafe practices. All personnel shall be instructed that caution signs indicate the existence of a potential hazard and that proper precaution shall be taken. Caution signs shall have yellow as the primary color with a black upper panel and border. The word "CAUTION" shall appear on the black panel, and the lower yellow panel shall be used for additional wording in black lettering.

3-4.2.4. Exit Signs. Exit signs shall have the word "EXIT" in plainly legible letters not less than 6 inches high. Principal strokes of letters shall not be less than 3/4 of an inch wide. The letters shall be red or green on a white field or white on a red or green field; the selected scheme should be consistent with state or local civil requirements and shall be used consistently throughout the activity. Every exit sign shall be suitably illuminated either internally or externally by an adequate and reliable light source, except that internally illuminated exit signs shall be provided in all occupancies where reduction of normal illumination is permitted.

3-4.2.5. Safety Instruction Signs. Safety instruction signs shall be used for general instructions and suggestions relating to safety measures. These signs shall be white with a green upper panel containing white letters. Any additional wording on the sign shall be black lettered on the lower white panel.

3-4.2.6. Directional Signs. Directional signs other than automotive traffic signs (see subparagraph 3-4.2.8) shall be white with a black panel and a white directional symbol. Any additional wording on the sign shall be black lettered on the white background.

3-4.2.7. Slow-Moving Vehicle Emblem. This emblem is to be used for identifying vehicles that are designed to move slowly (25 miles per hour or less) on public roads. This emblem is not a clearance marker for wide machinery, nor does it replace required lighting or marking of slow-moving vehicles. The emblem consists of a fluorescent yellow-orange triangle with a dark red border. Design specifications and mounting requirements contained in Society of Automotive Engineers Publication J943, "Emblem for Identifying Slow-Moving Vehicles", (NOTAL), shall be followed.

3-4.2.8. Traffic Signs. All traffic control signs or devices including those used for protection of construction personnel shall conform to ANSI D6.1, "Manual for Uniform Traffic Control Devices for Streets and Highways", (NOTAL).

3-4.2.9. Biological Hazard Signs. Biological hazard warnings shall signify the actual or potential presence of a biohazard. This includes containers, rooms, materials, experimental animals, or combinations thereof which contain or are contaminated with viable hazardous agents. Biological hazard signs shall be designed and used in accordance with 29 CFR 1910.145(e)(4).

3-4.2.10. Accident Prevention Tags. Accident prevention tags shall be used as temporary means of warning personnel of an existing hazard. They shall not be used in place of danger and caution signs which are for permanent or longterm application. Personnel shall be instructed as to the meaning of each accident prevention tag and the precautions that should be taken. ANSI Z35.2, "Specifications for Accident Prevention Tags", (NOTAL) shall be used by activities for guidance in local procurement of tags.

3-4.2.10.1. "Do Not Start" Tags. "Do Not Start" tags shall be conspicuously placed to block the starting mechanism of vehicles or other equipment. The background color for these tags shall be red with white, gray, or etched letters.

3-4.2.10.2. "Danger" Tags. "Danger" tags shall only be used where an immediate hazard exists. All employees should be instructed that "Danger" tags indicate immediate danger and that special precautions are necessary.

3-4.2.10.3. "Caution" Tags. "Caution" tags shall be used only to warn against potential hazards or to caution against unsafe practices. All employees should be instructed that "Caution" tags indicate a possible hazard against which proper precautions should be taken.

3-4.2.10.4. "Out of Order" Tags. "Out of Order" tags shall be used only for indicating that a piece of equipment or machinery is out of order and potentially hazardous.

3-4.2.10.5. "Biological Hazard" Tags. "Biological Hazard" tags shall signify the actual or potential presence of a biohazard.

Table 3-1. ACCIDENT PREVENTION TAGS Deleted.

3-4.2.11. Safety Color Code. The standards in this subparagraph are general in nature. More detailed color coding requirements are in NAVFAC P-309. Color code standards applicable to pipelines and compressed gas cylinders are in MIL-STD-101B, "Color Code for Compressed Gas Cylinders and Pipelines", (NOTAL).

3-4.2.11.1. Red. Red shall be the basic color for fire protection equipment and apparatus, danger, and stop as in the following examples:

a. Sprinkler systems and other automatic extinguishing systems and portable fire extinguishers other than stainless steel shall be red. Mobile firefighting apparatus shall be painted in accordance with NAVFAC P-309.

b. Emergency stop bars on machines shall be red.

3-4.2.11.2. Yellow. Yellow shall be the basic color for designating caution. Yellow shall be used for marking physical hazards (striking against, stumbling, falling,

tripping, and caught in between). Solid yellow, yellow and black stripes, yellow and black checkers (or yellow with a suitably contrasting background) shall be used interchangeably in combinations that will attract the most attention in the particular environment.

3-4.2.11.3. Flammable Containers. Red is the Navy's standard color for firefighting devices and should not be used on containers of liquids that will burn or explode. Flammable liquid containers should be painted yellow with the contents identified in large black letters on the container shells. The tops and spouts of red containers in use for flammable liquids shall be painted yellow and the contents identified with black or white lettering.

3-5. GROUNDSKEEPING

3-5.1. GENERAL. The housekeeping and walking surface requirements of section 2-1 are applicable to outside areas.

3-5.2. ICE AND SNOW. Ice and snow shall be removed from walkways and steps as soon as possible. If ice cannot be removed, it should be rendered less slippery by the application of gritty material.

3-5.3. VEGETATION

3-5.3.1. Near Buildings. Grass and weeds shall not be permitted to grow unchecked within 50 feet of buildings. Mowing shall be accomplished in accordance with the "Instructions for Safe Mowing" in ANSI B71.1, "Safety Specification for Power Lawn Mowers, Lawn and Garden Tractors and Lawn Tractors", (NOTAL).

3-5.3.2. Site Clearing. Removal of vegetation shall be done in accordance with ANSI Z133.1, "Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees and for Cutting Brush", (NOTAL). Site clearing by burning shall be conducted under the supervision of the Fire Department.

3-5.3.3. Harmful Plants and Animals. Personnel who might be exposed to harmful plants and animals shall be instructed regarding the potential hazards, how to avoid them, and the first-aid procedures to be followed in the event of exposure.

3-6. CONSTRUCTION

3-6.1. GENERAL. The standards in this manual, including those incorporated by reference, are applicable to construction operations unless superseded by a requirement specifically directed to construction operations. The standards in

this section address operations and conditions usually associated with construction, however, they can be applied to other operations; i.e., a trench dug for any reason shall meet the requirements of paragraph 3-6.3.

3-6.1.1. Contractor Operations. Except for those operations conducted by Naval Construction Battalions, construction projects at Navy activities are usually performed under contract. The standards in this manual shall be applied to protect Navy personnel and property from hazards resulting from contractor operations. 32 CFR 7, "Armed Services Procurement Regulations", requires that construction contracts include a clause stipulating that contractors must comply with the U. S. Army Corps of Engineers', EM 385-1-1, "General Safety Requirements Manual", (NOTAL).

3-6.1.2. References. The basic standards reference for construction operations is 29 CFR 1926 which is hereby incorporated by reference and which should be readily available to personnel with safety and health responsibilities in construction operations. The construction operations listed below are usually large-scale projects performed by contractors. It is recommended that the references listed be incorporated into contracts as applicable. In any event, the requirements of these references shall be followed to protect Navy personnel and property from hazards resulting from contractor operations.

a. Asphalt Paving - ANSI A10.17, "Safe Operating Practice for Asphalt Pavement Construction", (NOTAL).

b. Concrete Construction - 29 CFR 1926, Subpart Q; and ANSI A10.9, "Safety Requirements for Concrete Construction and Masonry Work", (NOTAL).

c. Demolition - 29 CFR 1926, Subpart T; and ANSI A10.6, "Safety Requirements for Demolition", (NOTAL). When asbestos is encountered, exposure shall be controlled in accordance with OPNAVINST 5100.23B, "Navy Occupational Safety and Health (NAVOSH) Program Manual" and with 29 CFR 1910.1001.

d. Dredging - ANSI A10.15, "Safety Requirements for Dredging", (NOTAL).

e. Steel Erection - 29 CFR 1926, Subpart R; and ANSI A10.13, "Safety Requirements for Steel Erection", (NOTAL).

f. Tunneling - 29 CFR 1926, Subpart S.

3-6.1.3. Heat-Producing Equipment. Approval for the use of heat-producing equipment shall be obtained in accordance with paragraph 12-2.4. The use of portable space heaters shall be in accordance with 29 CFR 1926.154. Additional

guidance may be found in ANSI A10.10, "Safety Requirements for Temporary and Portable Space Heating Devices and Equipment Used in the Construction Industry", (NOTAL).

3-6.1.4. Temporary Lighting

3-6.1.4.1. Guards. Temporary lights shall be equipped with guards to prevent accidental contact with the bulb, except that guards are not required when the construction of the reflector is such that the bulb is deeply recessed.

3-6.1.4.2. Cords. Temporary lights shall be equipped with heavy duty electric cords with connections and insulation maintained in safe condition. Temporary lights shall not be suspended by their electric cords unless cords and lights are designed for this means of suspension. Splices shall have insulation equal to that of the cable.

3-6.1.4.3. Hazardous Locations. Portable electric lighting used in moist and/or other hazardous locations, as for example, drums, tanks, and vessels, shall be operated at a maximum of 12 volts. (See paragraph 13-3.5).

3-6.1.4.4. Illumination Levels. Illumination levels at construction sites shall be in accordance with 29 CFR 1926.56.

3-6.2. TRAFFIC CONTROL AT CONSTRUCTION SITES. The following standards are applicable to operations which are on or adjacent to roadways such that traffic hazards are presented to pedestrians, persons in vehicles, or personnel engaged in the operation.

3-6.2.1. Signs and Barricades. Properly illuminated signs and barricades for the information, protection, and safety of exposed personnel shall be provided and properly maintained in accordance with ANSI D6.1, "Manual on Uniform Traffic Control Devices for Streets and Highways", (NOTAL). Provisions shall be made to allow for passage of emergency vehicles. Signs and barricades shall be removed when they are no longer needed. Applicable state and local regulations shall be followed; any contradiction in regulations shall be resolved before starting operations.

3-6.2.1.1. Illumination. During darkness (darkness shall be considered to extend from 1 hour before sunset to 1 hour after sunrise) and other times of low visibility, signs and barricades shall be reflectorized or illuminated with red and yellow-colored flashers. Red shall be used to indicate stop conditions, and yellow shall be used for all caution conditions.

3-6.2.1.2. Striping. All barricades or warning-light supports shall be striped in white-black, orange-white, or as specified by the governing agency.

3-6.2.2. Flagmen. When signs, signals, and barricades do not provide necessary protection on or adjacent to a highway or street, flagmen or other appropriate traffic controls shall be provided. Signaling directions by flagmen shall conform to ANSI D6.1, (NOTAL). Flagmen shall use red flags at least 18 inches square or sign paddles; red lights shall be used for hand signaling during periods of darkness. Flagmen shall wear a high visibility red or orange warning garment while flagging. Warning garments worn at night shall be made of reflectorized material.

3-6.2.3. Pedestrians. Safe walkways (see section 2-1) shall be provided for pedestrians. In addition to a safe walking surface, pedestrians shall also be protected from any hazards incident to the operation.

3-6.2.4. Traffic Hazards and Worker Safety. When necessary, a worker shall be stationed in the vicinity of the construction crew to assist traffic control and forewarn crews of approaching hazards. Workers exposed to vehicular traffic shall wear vests marked with or made with reflectorized or high visibility material.

3-6.3. EXCAVATIONS AND TRENCHES. This paragraph discusses general safety standards for excavating and trenching operations. Detailed requirements are in 29 CFR 1926, Subpart P, which is incorporated by reference. A trench is a narrow excavation (less than 15 feet wide) with a depth greater than its width; standards applicable to excavations also apply to trenches unless superseded by a specific trenching requirement.

3-6.3.1. Obstacles. Trees, boulders, and other surface encumbrances that present hazards to the operation shall be removed before excavation is started. Underground utility installations shall be located prior to excavation. When underground utility installations are uncovered, they shall be properly supported and protected.

3-6.3.2. Sides, Slopes, and Faces. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other effective means. Special attention shall be given to slopes that may be adversely affected by weather or moisture content.

3-6.3.3. Supporting Systems. Supporting systems, i.e. piling, cribbing, shoring, etc., shall be designed by a qualified person and shall meet accepted engineering requirements.

3-6.3.3.1. Protection of Personnel. The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground or by other equivalent means.

3-6.3.3.2. Adjoining Structures. If the stability of adjoining buildings or walls is endangered by excavations, necessary shoring, bracing, or underpinning shall be provided. Such shoring, bracing, or underpinning shall be inspected daily and maintained. Wherever any side of an excavation is masonry wall, such wall shall be braced as necessary to insure stability. Except in hard rock, excavations below the base or footing of any foundation or retaining wall shall not be permitted unless the wall is underpinned.

3-6.3.3.3. Heavy Equipment. When heavy construction equipment is operated on a level above or near an excavation, the side of the excavation shall be sheet piled, shored, and braced to resist the extra pressure.

3-6.3.3.4. Inspections. Daily inspections of excavations and supporting systems shall be made by a competent person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard personnel. In addition to daily inspection, excavations shall be inspected after rainstorms or other hazard increasing occurrences, such as earthquakes or nearby blasting.

3-6.3.4. Water. Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the adjacent area. Water shall not be allowed to accumulate in an excavation.

3-6.3.5. Storage Near Edges. In excavations that employees may be required to enter, excavated or other material shall be stored and retained at least 2 feet from the edge of the excavation unless effective barriers or retaining devices are provided.

3-6.3.6. Stop Logs. When mobile equipment is operated near excavations, substantial stoplogs or barricades shall be installed.

3-6.3.7. Remote Excavations. Adequate physical barrier protection shall be provided at all remotely located excava-

tions. All temporary wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

3-6.3.8. Atmosphere Conditions. In excavations where oxygen deficiency or the release of toxic gases or vapors is possible, the atmosphere shall be tested by a gas free engineer or other qualified person in accordance with NAVSEA Technical Manual S6470-AA-SAF-010 (NOTAL) to determine if oxygen or toxic levels are safe for personnel (see section 4-3). When flammable or combustible gases or vapors are or may be present, all sources of ignition shall be eliminated or safeguarded. Attended emergency rescue equipment, such as breathing apparatus, safety harness with line, basket stretcher etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.

3-6.3.9. Trenching.

3-6.3.9.1. Protection of Personnel. The sides of trenches more than 5 feet high shall be shored or laid back to a stable slope, or some other equivalent means shall be used to protect workers who may be exposed to cave-ins. Refer to Table P-1 of 29 CFR 1926.652 as a guide in sloping of banks. Trenches less than 5 feet deep shall also be protected when examination of the ground indicates hazardous ground movement may be expected. Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than 5 feet in depth and 8 feet or more in length. In lieu of shoring in hard soil, the sides of the trench above the 5-foot level may be sloped to prevent collapse but shall not be steeper than a 1-foot rise to each horizontal half foot.

3-6.3.9.2. Means of Exit. When workers are required to be in trenches 4 feet deep or more, an adequate means of exit (ladder or steps) shall be provided. The ladders or steps shall be located so that no more than 25 feet of lateral travel is required to reach them.

3-6.3.9.3. Removal of Supports. Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly, and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

3-7. MOTOR VEHICLES

3-7.1. GENERAL. Vehicles shall be operated in conformance with good driving practice and all applicable civilian

ordinances and Navy regulations. Operators of Navy motor vehicles shall undertake daily inspections and maintenance as specified by NAVFAC P-300 (NOTAL) to ensure safe operating conditions. No operator shall be permitted or required to operate a vehicle which is known to be unsafe. Operators shall be alert and physically fit. Unauthorized persons shall not be permitted to ride in motor vehicles. Cargo shall not be transported in any way that would compromise the safety of passengers. No explosives, flammables, or toxic substances shall be transported in a vehicle carrying riders other than authorized workers.

3-7.1.1. Emergency and Safety Equipment. Operators of motor vehicles shall display warning devices on the highway while the vehicle is disabled. Trucks, buses, or truck-tractors shall always carry two red flags not less than 12 inches square and equipped with standards to be used as daylight warnings. Vehicles operating from one-half hour after sunset to one-half hour before sunrise shall also carry three red electric lanterns or three red reflector flares, and three fuses. When vehicles are carrying explosives or other highly flammable materials, only the required electric lanterns or reflector flares, in addition to the flags, shall be carried.

3-7.1.1.1. Fire Extinguishers. Operators shall be familiar with the operation of fire extinguisher equipment carried by motor vehicles.

3-7.1.1.2. Seat Belts. Installation requirements for seat belts are contained in NAVFAC P-300 (NOTAL). Requirements for the use of seat belts are in OPNAVINST 5100.12B, "Navy Traffic Safety Program", (NOTAL).

3-7.1.2. Special Precautions

3-7.1.2.1. Towing Vehicles. Except in emergencies, only vehicles designed for towing or pushing shall be used. A towbar must be used for towing. Both vehicles must be completely stopped before they are uncoupled, and, if necessary, the wheels should be blocked. No one shall go between the vehicles to uncouple them until both vehicles are completely stopped.

3-7.1.2.2. Fueling Vehicles. No fueling shall be done within a closed building. The vehicle's engine and lights shall be turned off during fueling operations. (See section 5-6.)

3-7.1.3. Special Types of Vehicles. Rules applying to the following vehicles are in addition to those applying to all motor vehicles.

3-7.1.3.1. Buses. Only operators with safe driving records shall be assigned to drive buses, including semi-trailer buses. Buses shall be operated in conformance with good driving practice and all applicable local ordinances. Passengers shall not be permitted to stand in moving buses unless handholds or straps are provided for each standing passenger.

3-7.1.3.2. Ambulances. Ambulances shall only be used for transportation of the sick, injured, and necessary supporting personnel. Only Commanding Officers, their representatives, or duty officers may authorize emergency runs or prescribe the circumstances under which they are ordered. Each emergency run shall be recorded in the duty log of the local medical department. Ambulances shall be operated in conformance with good driving practice and all applicable local ordinances.

3-7.1.3.3. Motor Fire Apparatus. Only fire department personnel shall be allowd to ride on fire apparatus except when otherwise authorized by the Fire Chief. Motor fire apparatus shall be operated in conformance with good driving practice and all applicable local ordinances.

3-7.1.3.4. Trucks and Trailers. No trucking equipment shall be operated unless it is in good repair and all safety devices are in proper working condition.

a. Vehicles equipped with airbrakes shall not be operated unless the motor is running and the air pressure is at least 60 pounds.

b. Where loads overhanging the sides of vehicles are transported, special precautions shall be taken. Minimum precautions shall consist of walking flagmen or escort vehicles.

c. When towing, at least one safety chain or cable shall be used in addition to the trailer tongue or drawbar of the towed vehicle. The chain or cable shall be connected to prevent the towbar from dropping to the ground should the towbar connections fail. Trucks or tractors with airbrakes shall tow only trailers equipped with airbrakes. No truck or tractor shall pull or tow any trailer until proper air connections are established between the two units.

3-7.2. MOTOR VEHICLES OPERATED ON THE JOB SITE. This paragraph applies to motor vehicles that operate within an off-highway job site not open to public traffic. Vehicles used in storage operations are discussed in Chapter 9.

3-7.2.1. Lights. When visibility conditions warrant additional light, all vehicles shall be equipped with at least

two headlights and two taillights. All vehicles shall have brake lights regardless of light conditions.

3-7.2.2. Warning Device. All vehicles shall be equipped with an adequate audible warning device at the operator's station.

3-7.2.3. Obstructed View. No worker shall use any motor equipment having an obstructed view to the rear unless the vehicle has a reverse signal alarm audible above the surrounding noise level, or the vehicle is backed up only when an observer signals to do so.

3-7.2.4. Cab Shield and Canopies. All haulage vehicles whose payload is loaded by cranes, power shovels, etc., should have a cab shield or canopy adequate to protect the driver from falling or shifting materials. If a truck is not equipped with a shield or canopy, the driver shall leave the cab and stand clear while the truck is being loaded. Whenever it is necessary to pass the load over the cab, the driver shall stand clear whether or not a shield or canopy is provided.

3-7.2.5. Transporting Workers. Vehicles used to transport personnel shall have seats firmly secured and adequate for the number of workers to be carried.

3-7.2.6. Seat Belts. Refer to NAVFAC P-300 (NOTAL) for seat belt installation requirements. Refer to OPNAVINST 5100.12B (NOTAL) for requirements on the use of seat belts.

3-7.2.7. Trucks With Dump Bodies. Trucks with dump bodies shall be equipped with a device capable of being locked in position to prevent accidental lowering of the dump body.

a. Operating levers controlling hoisting or dumping shall be equipped with a latch or other device that will prevent accidental starting or tripping of the mechanism.

b. Trip handles for tailgates of dump trucks shall be arranged so the operator will be in the clear when dumping.

3-7.2.8. Fenders and Mud Flaps. All rubber-tired motor vehicle equipment shall be equipped with fenders except that mud flaps may be used in lieu of fenders whenever motor vehicle equipment is not designed for fenders.

3-7.2.9. Inspection. Safety equipment on all vehicles in use shall be thoroughly checked at the beginning of each shift. All defects shall be corrected before the vehicle is placed in service.

3-7.3. *MECHANICAL EQUIPMENT.* This section applies to mechanical equipment used in construction operations.

3-7.3.1. General Requirements. All equipment left unattended at night next to a highway or construction area shall be identified by appropriate lights or reflectors, or by barricades equipped with appropriate lights or reflectors.

3-7.3.1.1. Positioning of Equipment. Heavy machinery and equipment suspended or held aloft hy slings, jacks, or hoists shall be substantially blocked or cribbed to prevent falling or shifting. Bulldozer and scraper blades, endloader buckets, dump bodies, and similar equipment shall be fully lowered or blocked when being repaired or not in use. All controls shall be in a neutral position with the motors stopped and brakes set unless work being performed requires otherwise. Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and the parking brake set.

3-7.3.1.2. Cab Glass. All cab glass shall be safety glass or equivalent. Cab glass shall not introduce visible distortion affecting the safe operation of machines.

3-7.3.2. Rollover Protective Structures. Refer to 29 CFR 1926, Subpart W, for specific requirements regarding rollover protective structures.

3-7.4. *HEAVY CONSTRUCTION EQUIPMENT.* The safety equipment and operating requirements in 29 CFR 1926, Subpart O, shall be complied with for Navy construction equipment including earthmoving equipment, offhighway trucks, pile-drivers, etc.

3-7.5. MULTI-PIECE RIM WHEELS. The servicing of multipiece rim wheels shall be accomplished in accordance with 29 CFR 1910.177.

3-8. MARITIME OPERATIONS

3-8.1. SHIP REPAIR AND SHIPBUILDING. In addition to the requirements contained in this manual, the standards in 29 CFR 1915 and the Naval Ships Technical Manual (NSTM) (NOTAL) shall be applied to ship repair and shipbuilding operations. 29 CFR 1915 is applicable to all work on ships and vessels. The Naval Ship's Technical Manual (NSTM) contains specific requirements for operations involving Navy ships and vessels.

3-8.2. LONGSHORING. Standards specific to longshoring operations are in 29 CFR 1917 and 1918. The NSTM contains requirements applicable to ship's gear and other shipboard features pertaining to longshoring operation involving Navy vessels. Longshoring operations involving cargoes of haz-

ardous materials shall be in accordance with 46 CFR 146 and 49 CFR 171-179 and with applicable Naval Sea Systems Command ordnance publications.

3-8.3. DIVING OPERATIONS. Diving operations shall be conducted in compliance with 29 CFR 1910, Subpart T, and NAVSEA 09904-LP-001-9010, "U. S. Navy Diving Manual" (NOTAL).

3-9. SPECIAL INDUSTRIES. The Occupational Safety and Health Administration includes standards in 29 CFR 1910, Subpart R, "Special Industries", which are applicable to the industries and operations listed below. Although these standards, with the exception of telecommunications, have limited application within the Naval establishment, the following sections of 29 CFR 1910 are incorporated by reference and shall be complied with where applicable:

a. 29 CFR 1910.261; Pulp, Paper, and Paperboard Mills

b. 29 CFR 1910.262; Textiles

c. 29 CFR 1910.263; Bakery Equipment

d. 29 CFR 1910.264; Laundry Machinery and Operations

e. 29 CFR 1910.265; Sawmills

f. 29 CFR 1910.266; Pulpwood Logging

g. 29 CFR 1910.268; Telecommunications (see paragraph 13-4.1).

CHAPTER 4

OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

4-1. GENERAL. This chapter contains or incorporates by reference requirements for all work environments ashore with respect to the handling and disposal of hazardous materials, medical services and first aid, exposure limits, ventilation, ionizing and nonionizing radiation, noise, and sanitation.

4-2. HAZARDOUS MATERIALS

4-2.1. SCOPE. This section addresses all hazardous materials as defined in Appendix A. This definition includes toxic materials as well as flammables, combustibles, and other materials having hazardous properties other than, or in addition to, toxicity. To avoid duplication, the requirements of this section are applicable to all hazardous materials. Additional requirements for flammable and combustible materials are provided in Chapter 5; additional requirements for toxics are contained in Section 4-3 of this chapter.

4-2.2. GENERAL. No hazardous material shall be used until the labeling and employee briefing requirements of paragraphs 4-2.3 and 4-2.4 have been fulfilled. A material of unknown properties shall be considered as a hazardous material and shall not be used until the nature and degree of the hazard, if any, have been determined and the applicable requirements of this section have been met. Information on specific hazardous materials must be obtained from the manufacturer. The Defense Logistics Agency operates the DOD Hazardous Materials Information System (HMIS) which provides basic reference data necessary to inform employees about hazardous materials in the workplace. Implementation of DOD HMIS in the Navy is in OPNAVINST 5100.23B, "Navy Occupational Safety and Health (NAVOSH) Program Manual".

4-2.3. LABELING

4-2.3.1. Transportation Labels. When hazardous materials are transported by rail, aircraft, ship or motor vehicle on public highways, the Department of Transportation (DOT) labeling system shall be used. DOT labels are illustrated in Figures 4-1 through 4-24. The use of DOT labels for shipping hazardous materials shall be in accordance with 49 CFR 171-179.

4-2.3.2. Activity Labeling System. Activities shall ensure containers of hazardous materials are labeled to indicate to personnel the hazards associated with the handling and use of such materials. In accordance with 29 CFR 1910.1200,

the OSHA Hazard Communication Standard, manufacturers, distributors and importers of hazardous material are required to place warning labels on the hazardous material containers. NAVSUPINST 5100.27, "Navy Hazardous Material Control Program," provides additional guidance on these labels. Procurement Officers or other cognizant personnel purchasing hazardous material must ensure all hazardous material received is properly labeled. If material is not properly labeled, the manufacturer, distributor or importer must be immediately contacted regarding labeling requirements. In addition to 29 CFR 1910.1200 requirements, two other labeling systems may be used to provide additional employee warning: the DOT system or the National Fire Protection Association (NFPA) 704M system. DOT labels shall be used only for items regulated by DOT. The NFPA symbols may be used on inside packages but not on shipping containers; they must not be visible during transportation which would be a violation of DOT regulations.

4-2.3.2.1. DOT Labels. Navy activities may use the DOT labeling system as a management tool to help identify and control hazardous materials. Miniature DOT labels are available commercially, and may be used on interior containers. In order to properly utilize the DOT system, activities must also use DOT-P-5800.3, "Hazardous Materials; Emergency Response Guidebook", (NOTAL), which is available from the Naval Supply Systems Command. Table 4-1 lists DOT labels as well as the United Nations hazard class which is the number appearing in the bottom corner of the label. The standard form numbers and national stock numbers are provided to assist in ordering these labels. It is reemphasized that the use of these labels for the shipping and transportation of hazardous materials by air or on public roadways and waterways shall be in strict accordance with DOT regulations 49 CFR 171-179.

4-2.3.2.2. NFPA Label. Navy activities may use the NFPA label in lieu of or in addition to the DOT system as a means of alerting personnel handling or using hazardous materials to the hazards involved. The NFPA label is established by NFPA 704M, "Identification of the Fire Hazards of Materials", (NOTAL). For positive identification of contents, the four-digit ID Number shown in DOT-P-5800.3 (NOTAL) should be entered in the bottom (white) diamond of the NFPA symbol under any applicable specific hazard symbols (see Figure 4-25). This label is for use at Navy shore activities only. It must not be placed on the shipping containers of off-station shipments of hazardous materials. Table 4-2 lists the national stock number for the symbols and numerals used on the NFPA label. Table 4-3 contains brief descriptions of the hazard degrees indicated by the numerals in the upper three sections of the label. More detailed descriptions are in NFPA 704M.

4-2.3.2.3. Selection of Labels. The appropriate DOT label should be on the shipping containers when the hazardous material is received; if the labels have been removed, proper labeling can be determined from shipping documents or from 49 CFR 171-179. Information for completing NFPA labels can be obtained from Material Safety Data Sheets (paragraph 4-2.5); or from HMIS (paragraph 4-2.2).

4-2.3.2.4. Application of Labels. As units are removed from the shipping container, the label(s) similar to those on the container shall be applied to the unit packages. When hazardous materials are dispensed from one container to another, the appropriate label(s) shall be applied to the receiving container. Labels shall be placed so as not to obscure other warnings, instructions, or product information.

4-2.3.2.5. Modification. The DOT and NFPA labeling systems are intended by their originators for use under specific conditions: DOT for transportation of hazardous materials and NFPA for hazardous materials involved in fires. In most instances the two labeling systems are adaptable to the handling, storage and use of hazardous materials under normal conditions. However, an activity may elect to modify the NFPA labels or the Potential Hazards information in DOT-P-5800.3 (NOTAL) to suit local conditions of use of a hazardous material. For example, NFPA labels may be printed locally in sizes to suit the container dimensions. Figure 4-26 shows an NFPA label tag which may be used on containers too small for the label or on containers on which the label would cover essential product information. Symbols may also be applied with rubber stamps, silk screens, stencils, or any other suitable process. Such modifications by activities should be approved by the activity's safety and health official and the Fire Department. The modifications authorized by this subparagraph are applicable only to the NFPA label and to DOT-P-5800.3 (NOTAL) when the latter is used for guidance in other than transportation situations. The local use of DOT labels for transportation evolutions should be in strict accordance with DOT regulations in 49 CFR 171-179 (see subparagraph 4-2.3.1).

4-2.3.2.6. Special Labeling Requirements. In addition to the general hazardous materials labeling requirements of this paragraph, the special labeling requirements of 29 CFR 1910 shall be complied with. Special labeling requirements for radioactive materials are in 29 CFR 1910.96(e). Labeling requirements for toxic materials used in welding, cutting and brazing operations are in 29 CFR 1910.252(f). Special labeling requirements for other materials, including asbestos, are in Subpart Z of 29 CFR 1910.

4-2.4. EMPLOYEE INSTRUCTION. Before beginning any operation involving the use of hazardous materials, employees shall be instructed as to the hazards involved, symptoms of exposure, and protective measures required. Employees shall be informed of procedures to be followed in case of spills, leaks, fire, overexposure, or other emergency situations. All personnel who may be exposed to hazardous materials due to their work shall be so instructed, including potentially exposed employees not directly involved in the hazardous material operation.

4-2.5. MATERIAL SAFETY DATA SHEETS. The primary source of information necessary to meet the requirements of paragraph 4-2.3 and 4-2.4 shall be the Material Safety Data Sheet (MSDS). These data sheets must be obtained for each hazardous material in accordance with FED-STD-313B, "Material Safety Data Sheets; Preparation and the Submission of," (NOTAL), and 29 CFR 1910.1200.

4-2.5.1. Obtaining MSDS. Procurement Officers and purchase personnel must ensure requisitions for the purchase of hazardous material include requirements to comply with FED-STD-313B and 29 CFR 1910.1200. If a properly completed MSDS is not available, the using activity should use HMIS (see paragraph 4-2.2) and/or contact the manufacturer.

4-2.5.2. Locally Prepared MSDS. If a MSDS cannot be obtained through any of the methods in subparagraph 4-2.5.1, the using activity's safety and health officer and the cognizant NRMC representative shall prepare an MSDS based on testing or other reliable sources of hazardous materials information.

4-2.5.3. Access to MSDS. Activities are required to maintain copies of MSDS for all hazardous materials used at the activity. All employees must be allowed access to the information in the data sheets. To meet the requirements of NAVSUPINST 5100.27 and 29 CFR 1910.1200, activities must either provide copies of the MSDS to each supervisor for hazardous material used by the supervisor's employees, or provide equivalent information to the supervisor.

4-2.6. GAS FREEING. Because of the potential for toxic and/or flammable atmospheres to be present or generated in confined, poorly ventilated or closed spaces, the atmosphere in such spaces must be tested and certified safe prior to and, if necessary, during operations involving personnel entry into the space or the performance of hot work on the exterior boundary of a space. Such testing and certification shall be accomplished in accordance with NAVSEA S6470-AA-SAF-010, "NAVSEA Gas Free Engineering Program", (NOTAL), and NAVAIRINST 5103.1, latest issue, chapter 23.

4-2.3.2.3. Selection of Labels. The appropriate DOT label should be on the shipping containers when the hazardous material is received; if the labels have been removed, proper labeling can be determined from shipping documents or from 49 CFR 171-179. Information for completing NFPA labels can be obtained from Material Safety Data Sheets (paragraph 4-2.5); or from HMIS (paragraph 4-2.2).

4-2.3.2.4. Application of Labels. As units are removed from the shipping container, the label(s) similar to those on the container shall be applied to the unit packages. When hazardous materials are dispensed from one container to another, the appropriate label(s) shall be applied to the receiving container. Labels shall be placed so as not to obscure other warnings, instructions, or product information.

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4-2.5. MATERIAL SAFETY DATA SHEETS. The primary source of information necessary to meet the requirements of paragraph 4-2.3 and 4-2.4 shall be the Material Safety Data Sheet (MSDS). These data sheets must be obtained for each hazardous material in accordance with FED-STD-313B, "Material Safety Data Sheets; Preparation and the Submission of," (NOTAL), and 29 CFR 1910.1200.

4-2.5.1. Obtaining MSDS. Procurement Officers and purchase personnel must ensure requisitions for the purchase of hazardous material include requirements to comply with FED-STD-313B and 29 CFR 1910.1200. If a properly completed MSDS is not available, the using activity should use HMIS (see paragraph 4-2.2) and/or contact the manufacturer.

4-2.5.2. Locally Prepared MSDS. If a MSDS cannot be obtained through any of the methods in subparagraph 4-2.5.1, the using activity's safety and health officer and the cognizant NRMC representative shall prepare an MSDS based on testing or other reliable sources of hazardous materials information.

4-2.5.3. Access to MSDS. Activities are required to maintain copies of MSDS for all hazardous materials used at the activity. All employees must be allowed access to the information in the data sheets. To meet the requirements of NAVSUPINST 5100.27 and 29 CFR 1910.1200, activities must either provide copies of the MSDS to each supervisor for hazardous material used by the supervisor's employees, or provide equivalent information to the supervisor.

4-2.6. GAS FREEING. Because of the potential for toxic and/or flammable atmospheres to be present or generated in confined, poorly ventilated or closed spaces, the atmosphere in such spaces must be tested and certified safe prior to and, if necessary, during operations involving personnel entry into the space or the performance of hot work on the exterior boundary of a space. Such testing and certification shall be accomplished in accordance with NAVSEA S6470-AA-SAF-010, "NAVSEA Gas Free Engineering Program", (NOTAL), and NAVAIRINST 5100.6, "Confined Space Entry and Work Program."

4-3. TOXICS

4-3.1. GENERAL. Toxics are substances that can have effects on personnel ranging from mild discomfort or euphoria to death. There are too many variables involved in controlling exposures to toxic materials for any one publication to address all possibilities. Each operation involving actual, suspected, or potential exposure of personnel to toxic materials must be carefully evaluated by technically competent personnel. This section provides basic criteria for the control of personnel exposures to toxic materials.

4-3.2. PERMISSIBLE EXPOSURE LIMIT (PEL) VALUES. Personnel shall not be exposed to concentrations of toxic materials, including nuisance particulates, in excess of the most stringent limits published in the latest edition of the following standards:

a. 29 CFR 1910, Subpart Z.

b. OPNAV Instructions in the 6200 series.

c. American Conference of Government Industrial Hygienists (ACGIH), Inc., "TLV's; Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment", (NOTAL).

4-3.2.1. Other Sources. Other sources, such as NIOSH Criteria Documents and manufacturer's recommendations, may be used as guidance in determining PEL's for toxic materials not listed in the standards set forth in paragraph 4-3.2.

4-3.2.2. Oxygen. Personnel shall not be exposed to oxygen-deficient (less than 20 percent oxygen) or enriched (greater than 22 percent oxygen) atmospheres. The oxygen content should be as near as possible to that contained in the normal, outside air. Oxygen shall not be added to the atmosphere of a work area to elevate the oxygen content. Ventilation shall be used to provide an oxygen level within the area that is consistent with that of the outside atmosphere. Specialized areas such as hyperbaric chambers are excluded from this requirement. Such specialized areas shall be controlled by the requirements of applicable regulations such as 29 CFR 1910, Subpart T; 29 CFR 1926, Subpart S; and the U. S. Navy Diving Manual (NAVSEA 0994-LP-001-9010), (NOTAL).

4-3.3. CONTROL OF EXPOSURES TO TOXIC MATERIALS. Control of employee exposure to toxic materials shall be accomplished to the extent feasible by engineering controls or substitution of less hazardous materials. If exposure levels cannot be controlled to below the PEL's (paragraph 4-3.2), person-

nel exposed to the toxic materials shall use the appropriate protective equipment as required in Chapter 6.

4-3.4. STORAGE AND HANDLING OF TOXIC MATERIALS

a. Containers shall be kept sealed and protected against physical damage.

b. Toxic materials shall be stored in accordance with DOD 4145.19-R-1 (NOTAL) and with NAVSUPINST 5100.27.

c. Breathing dusts, fumes, mists, gases or vapors of toxic materials shall be avoided. All contact with eyes and harmful contact with the skin shall likewise be avoided.

d. Materials containing toxic substances shall not be taken internally.

4-3.5. DISPOSAL OF TOXIC MATERIALS. Toxic materials shall be disposed of in accordance with OPNAVINST 5090.1, "Environmental and Natural Resources Protection Manual", (NOTAL).

4-3.6. SPECIFIC OSHA REQUIREMENTS. 29 CFR 1910, Subpart Z, contains approximately 25 sections which include standards for the control of specific hazardous substances. Because there are frequent additions and deletions of standards in Subpart Z, it is impractical to list all the covered substances. Nevertheless, Navy safety and health personnel shall be familiar with the current requirements of 29 CFR 1910, Subpart Z, in order to assure up-to-date compliance with those sections applicable to operations within their respective commands.

4-4. VENTILATION

4-4.1. GENERAL. Supervisory personnel shall use Material Safety Data Sheets (see paragraph 4-2.5) to identify what toxic materials may be released into the air of the working environment. Supervisors shall ensure that all employees are informed about potentially hazardous air contaminants and their associated hazards in accordance with paragraph 4-2.4. Tests of the work environment atmosphere shall be made as determined by the Gas Free Engineer, safety and health official, or the cognizant medical support facility.

4-4.1.1. Respirators. Where the air quality limits of section 4-3 cannot be achieved by mechanical ventilation, special work practices, substitution, or by engineering controls, respiratory protective devices shall be provided and used in accordance with section 6-4.

4-4.1.2. Flammables. Mechanical exhaust ventilation removes airborne flammables and combustible materials as well as toxic air contaminants from the workplace. The ventilation requirements in this section will effectively control contamination to prevent health hazards from airborne material. Additional ventilation standards for flammables and combustibles are in Chapter 5.

4-4.2. VENTILATION SYSTEMS. Ventilation systems shall be capable of capturing and exhausting airborne contaminants from the workplace so as to keep the concentrations of toxic material below the Permissible Exposure Limits specified in section 4-3. Ventilation systems shall be designed in accordance with 29 CFR 1910.94 and Industrial Ventilation: A Manual of Recommended Practices, by the American Conference of Government Industrial Hygienists, (NOTAL). The ventilation requirements for spray booths in 29 CFR 1910.107(d) shall be followed.

4-4.2.1. System Design. The design of ventilation systems is based in part on the physical characteristics of the hazardous material in use and the rate at which it is used. When a new material is introduced or there is an increase in the rate of use of a material, the ventilation system shall be evaluated to ensure that it is capable of maintaining contaminants within safe limits.

4-4.2.2. Monitoring. The workplace shall be tested at intervals determined by the Gas Free Engineer, safety and health official, or cognizant medical support facility to be sure that the ventilation system is actually controlling the airborne contamination levels.

4-4.2.3. Exhaust Discharge. Atmospheric contaminants removed by exhaust systems shall be discharged in such a manner that they do not present a hazard either elsewhere in the building, or outside of it.

4-4.3. WORK IN CONFINED SPACES. Ventilation requirements for work on or in confined spaces ashore shall be determined on a case-by-case basis by the Gas Free Engineer in accordance with NAVSEA S6470-AA-SAF-010 (NOTAL).

4-5. MEDICAL SERVICES AND FIRST AID

4-5.1. MEDICAL SERVICES. Medical personnel for advice and consultation on worksite health shall be available in accordance with Chapter 22 of the Manual of the Medical Department (NAVMED P-117), (NOTAL).

4-5.1.1. Emergency Medical Services. Provisions shall be made for prompt medical attention in case of serious injury. Equipment for transportation of the injured person to a

physician or hospital, or a communication system for contacting necessary ambulance service, shall be provided or arranged for.

4-5.1.2. Emergency Numbers. Telephone numbers and procedures for obtaining emergency medical treatment shall be conspicuously posted.

4-5.2. FIRST AID. First aid equipment and personnel with valid first aid certification, including cardiopulmonary resuscitation (CPR), shall be provided for the treatment of personnel at job sites remote from medical facilities. Because many factors can affect ambulance response time to and from a job site, it is not practical to establish a fixed distance to determine remoteness from medical facilities. The need for the availability of first aid treatment shall be determined on a case-by-case basis by the supporting medical facility considering distance and travel times, the nature of the operation, and the number of personnel involved. For example, all electrical workers shall receive CPR training; workers using highly toxic or corrosive materials shall be instructed in first aid procedures specific to the material being used. The provision of on-site first aid is not a substitute for competent medical evaluation and treatment.

4-5.2.1. First Aid Kits. When a first aid kit is recommended by the responsible medical authority, it shall be, as a minimum, a GSA General Purpose First Aid Kit or one with equivalent contents. Materials required in addition to the basic kit shall be determined and approved by the responsible medical authority. Access to and use of the first aid kit shall be restricted to personnel designated by the responsible medical authority. When required, approved first aid supplies shall be readily accessible.

4-5.2.2. Emergency Flushing Facilities. Where the eyes or body of an employee may be exposed to injurious corrosive materials, deluge showers and eye flushes meeting the requirements of ANSI Z358.1, "Emergency Eyewash and Shower Equipment", (NOTAL), shall be provided in the work areas for immediate emergency use. The area in front of the flushes and showers and access thereto shall be kept clear at all times.

4-5.3. MARITIME OPERATIONS. Where ambulance services equipped with Stokes basket stretchers are not available to shipboard operations, each vessel with 10 or more workers shall have one Stokes basket stretcher or equivalent, permanently equipped with bridles for attaching to the hoisting gear. A blanket or other liner for the patient shall be provided; stretchers shall be kept close to the vessel.

4-6. SANITATION

4-6.1. HOUSEKEEPING. All workplaces shall be maintained in a sanitary condition and free of health hazards to the extent that the nature of the work permits. To facilitate cleaning, all floors and work areas shall be kept free of unnecessary holes and openings and other unnecessary obstacles to cleaning. (See section 2-1.)

4-6.2. WASTE DISPOSAL

4-6.2.1. Waste Removal. Sweepings, waste, refuse, and garbage shall be removed as often as necessary to maintain workplace sanitation. The manner of removal and disposal shall not create a hazard to employee safety or health.

4-6.2.2. Waste Receptacles. All receptacles shall facilitate the maintenance of sanitary conditions. Any receptacle used for putrescible waste or refuse shall be so designed that it does not leak and may be thoroughly cleaned; the receptacle must be equipped with a cover that shall be self-closing or tight-fitting.

4-6.2.3. Work Near Waste Disposal. Work shall not be permitted in the vicinity of uncovered garbage. Work beneath or on the outboard side of a vessel must be clear of contamination from drainage or waste from overboard discharges.

4-6.2.4. Hazardous Waste Disposal. Hazardous waste shall be disposed of in accordance with OPNAVINST 5090.1, "Environmental and Natural Resources Protection Manual", (NOTAL).

4-6.3. VERMIN AND PEST CONTROL. Every enclosed workplace shall be constructed, equipped, and maintained to prevent entrance or harborage of birds, rodents, insects, and other pests. A continuing and effective pest management program shall be instituted where pests are detected. Pesticides shall be applied in a manner which will assure the safety of the applicator and other personnel. Pest control operations shall be performed only by, or under the direct supervision of, trained and certified personnel. Standards for these personnel are contained in BUMEDINST 6250.6B (NOTAL), BUMEDINST 6250.12A (NOTAL) and NAVFACINST 6250.5A (NOTAL) which are incorporated by reference.

4-6.4. WATER SUPPLY. Care must be taken to ensure that the water supply is safe for human consumption in all workplaces or is identified in accordance with subparagraph 4-6.4.4.

4-6.4.1. Drinking Water. An adequate supply of potable water shall be provided in all places of employment. Any container used to distribute drinking water shall be clearly

marked as such and shall not be used for any other purpose. Portable drinking water containers shall be capable of being tightly closed and shall be equipped with a tap; removal of water by dipping or pouring shall not be permitted. Individual sanitary cups or some equally sanitary device shall be conveniently available. Common drinking cups are prohibited. Unused disposable cups shall be kept in a sanitary container.

4-6.4.2. Potable Water. Potable water shall be provided in all places of employment for drinking and for washing of the person and, as necessary, for eye wash fountains, cooking, washing of foods, washing of cooking or eating utensils, washing of food preparation or processing premises, and personal service rooms. Potable water shall meet the requirements of OPNAVINST 5090.1, "Environmental and Natural Resources Protection Manual", (NOTAL).

4-6.4.3. Drinking Water Containers. All containers used to furnish drinking water shall be thoroughly disinfected at least once a week, or more frequently if circumstances require, by methods approved by medical authorities.

4-6.4.4. Nonpotable Water. Outlets for nonpotable water, such as water for industrial or firefighting use, shall be identified by signs to indicate that the water is not to be used for drinking, washing, or cooking purposes. There shall be no cross connection (open or potential) between potable and nonpotable water systems.

4-6.5. TOILET FACILITIES. Toilet facilities ashore shall be provided in accordance with 29 CFR 1910.141(c) except that toilet facilities at construction sites may be in accordance with 29 CFR 1926.51(c). Toilet facilities aboard ship shall be provided in accordance with OPNAVINST 9640.1, "Shipboard Habitability Program", (NOTAL).

4-6.6. WASHING FACILITIES. Adequate washing facilities shall be provided in every workplace and maintained in a sanitary condition. Adequate hot and cold running water, or warm running water shall be provided. A cleaning agent suitable to the materials and environments to which employees are exposed and individual hand towels or other approved apparatus for drying the hands shall be provided at washing facilities. Good personal hygiene practices shall be encouraged by informing workers of the need for removing surface contaminants by thorough washing of hands and face prior to eating or smoking. Personnel exposed to toxic substances shall be required to wash hands and face prior to eating or smoking. Employees who use showers shall be provided with individual clean towels.

4-6.7. CONSUMPTION OF FOOD AND BEVERAGES

4-6.7.1. Food Service Facilities. All food service facilities and operations shall be carried out in accordance with NAVMED P-5010-1, "Food Service Sanitation", (NOTAL). The food dispensed shall be wholesome, free from spoilage, and shall be processed, prepared, handled, and stored in such a way as to be protected against contamination.

4-6.7.2. No Food Consumption in Unsanitary Locations. Food or beverages shall not be stored, prepared, or consumed in toilet rooms or in areas where toxic materials are stored or handled, or where a toxic exposure may otherwise exist.

4-6.7.3. Waste Disposal Receptacles. Covered receptacles of smooth, corrosion-resistant, or disposable material shall be provided in lunch areas for disposal of waste food. Receptacles shall be adequate in number and so located as to encourage their use. Receptacles shall be covered in accordance with subparagraph 4-6.2.2. They shall be emptied at least once each working day and be maintained in a sanitary condition.

4-7. TARGET PROGRAMS. Certain areas of occupational safety and health have been targeted by CNO for special emphasis throughout the Navy. CNO interest is manifested by the inclusion of these programs in the NAVOSH Program Manual (OPNAVINST 5100.23B) which establishes programs and standards for these target areas.

4-7.1. NOISE CONTROL AND HEARING CONSERVATION. Hearing loss problems have been and continue to be a source of concern within the Navy, both ashore and afloat. Hearing loss attributed to occupational exposure to hazardous noise and the high cost of compensation claims have highlighted a significant problem which requires considerable attention. The goal of the Navy Hearing Conservation Program is to prevent occupational noise-related hearing loss among Navy personnel. Program elements are in Chapter 18, "Hearing Conservation and Noise Abatement", OPNAVINST 5100.23B. As a minimum, the standards and criteria in 29 CFR 1910.95 shall be complied with.

4-7.2. ASBESTOS. Asbestos is a fibrous material which is incombustible and possesses high tensile strength, good insulating properties, and moderate to good chemical resistance. Because of these characteristics, asbestos has been employed in many uses. For many years, the Navy used asbestos as lagging for high temperaure machinery, boilers and piping aboard ship and in the stationary machinery and piping of boiler plants in shore facilities. In recognizing the serious health hazards posed by asbestos exposure, the Navy has adopted stringent occupational health and environ-

mental protection standards for the control of asbestos. These standards are in Chapter 17, "Asbestos", of OPNAVINST 5100.23B. As a minimum, the standards and criteria of 29 CFR 1910.1001 shall be complied with.

4-7.3. SIGHT CONSERVATION. The industrial and operational environments of the Navy contain many hazards to vision such as impact, radiation, flash burns, and toxic chemicals. Program elements for the Navy Sight Conservation Program are in Chapter 19, "Sight Conservation", of OPNAVINST 5100.23B. Detailed requirements for eye protection are in section 6-2 of this manual.

4-7.4. PERSONAL PROTECTIVE EQUIPMENT. Personal protective equipment (PPE) shall be provided, used, and maintained when it has been determined by competent authority that its use is required and that such use will lessen the likelihood of occupational injuries and/or illnesses. PPE Program elements are addressed in Chapter 20, OPNAVINST 5100.23B. Detailed requirements for the use of PPE are in Chapter 6 of this manual.

4-8. RADIATION PROTECTION

4-8.1. IONIZING RADIATION. Protection of personnel against the hazards of ionizing radiation shall be in accordance with 29 CFR 1910.96 and with NAVMED P-5055, "Radiation Health Protection Manual", (NOTAL).

4-8.2. NONIONIZING RADIATION

4-8.2.1. Microwave and Radio Frequency. The protection of personnel against the hazards of microwave and radio frequency radiation shall be in accordance with 29 CFR 1910.97 and with NAVSEA OP 3565, "Electromagnetic Radiation Hazards to Ordnance, Personnel, and Fuel", (NOTAL) (also issued as NAVAIR 16-1-524 or NAVELEX 0967-LP-624-6010).

4-8.2.2. Laser. Requirements for the protection of personnel against the hazards of lasers are in NAVELEXINST 5100.12, "Navy Laser Hazard Prevention Program", (NOTAL) and in ANSI Z136.1, "Safe Use of Lasers", (NOTAL), which are incorporated by reference.

4-9. THERMAL STRESS. Operations or work environments which expose or have the potential to expose personnel to harmful temperature extremes shall be conducted under the procedures and safeguards of Chapter 3, "Ventilation and Thermal Stress Ashore and Afloat", of NAVMED P-5010, "Manual of Naval Preventive Medicine", (NOTAL) and OPNAVINST 5100.20B, "Prevention of Heat Casualties", (NOTAL).

4-10. HUMAN FACTORS CONSIDERATIONS. In order to minimize personnel injury caused by improperly designed equipment and machinery, new or modified equipment and machinery shall be designed with consideration of human engineering, life support and biomedical factors that affect human performance. Design factors, such as atmospheric conditions, adequate communications, efficient arrangement, and many others are required to be considered by MIL-STD-1472C, "Human Engineering Design Criteria for Military Systems, Equipment and Facilities".

4-11. INDUSTRIAL HYGIENE TECHNICAL ASSISTANCE

4-11.1. GENERAL. Industrial hygiene personnel at NAVMED activities are available to provide consultation on occupational health matters, to provide specific assistance in monitoring personnel exposures to toxic contaminants and other hazardous agents, and to evaluate the need for and recommend as appropriate the administrative and/or engineering controls and/or personal protective equipment required to control personnel exposures in any potentially hazardous situation.

4-11.2. ACTIVITIES LOCATED IN NON-NAVMED COMMANDS. Industrial hygiene services should be requested from the cognizant regional medical center which will provide, or arrange for, the required services. Industrial hygiene services are available in the following centers:

Industrial Hygiene Services

NAVREGMEDCEN	AUTOVON	COMMERCIAL
Bremerton, WA	439-9550	(206) 478-9550
Camp Lejeune, NC	484-5707	(919) 451-5707
Camp Pendleton, CA	993-4260	(714) 725-4260
Charleston, SC	794-6600	(803) 743-6600
Corpus Christi, TX	361-3465	(512) 939-3465
Great Lakes, IL	792-2492	(312) 688-2492
Guam, Marianas Islands	322-1110	339-2189
Jacksonville, FL	942-2841	(904) 772-2841
Long Beach, CA	873-6615	(213) 547-6615
Newport, RI/Portsmouth, NH	684-2302	(207) 439-1000
Oakland, CA	253-2458	(707) 646-2458
Pearl Harbor, HI	430-0111	(808) 474-1137
Philadelphia, PA	443-3734	(215) 755-3734
Portsmouth, VA	954-7377	(804) 444-7377
San Diego, CA	727-3850 -2442	(714) 233-2442
Subic Bay, Phillipine Islands	844-6995	
Yokosuka, Japan	234-7521	

Industrial Hygiene Services (Continued)

NAVREGMEDCEN	AUTOVON	COMMERCIAL
NAVSUBMEDCEN Groton, CT	241-4613	(203) 449-4613
NATNAVMEDCEN Bethesda, MD	295-5722	(301) 295-5722
NAVAEROSPREGMEDCEN Pensacola, FL	922-3639	(904) 452-3639
NAVHOSP Roosevelt Roads, PR	894-3920 Ext. 71-226	863-2000 Ext. 71-226

4-11.3. ALL OTHER SHORE ACTIVITIES. Activities outside the coverage of a NRMC should request industrial hygiene assistance from the nearest Navy Environmental and Preventive Medicine Unit (NAVENPVNTMEDU), as listed below, or from:

Navy Environmental Health Center
Naval Station
Norfolk, Virginia 23511
Autovon: 690-4657
Commercial: (804) 444-4657

UNIT NO.	LOCATION	AUTOVON	COMMERCIAL
2	Norfolk, VA	690-7671	(804) 444-7671
5	San Diego, CA	958-1261	(714) 235-1261
6	Pearl Harbor, HI	430-0111	(808) 471-9505
7	Naples, IT	625-1110 Ext. 724-4468	

Table 4-1. DOT LABELS USED FOR HAZARDOUS MATERIALS

TYPE OF MATERIAL	UN CLASS	FORM NO.	DESCRIPTION	NSN
Blasting Agents	1	SF 423	Blasting Agent (black on orange)	7540-01-074-7028
Corrosive Materials	8	SF 416	Corrosive (black on white)	7540-00-118-0611
Empty Containers	-	SF 417	Empty (black on white)	7540-00-118-0613
Explosives:				
Class A	1	SF 400	Explosive A (black on orange)	7540-00-118-0032
Class B	1	SF 401	Explosive B (black on orange)	7540-00-118-0083
Class C	1	SF 402	Explosive C (black on orange)	7540-00-118-0113
Flammable Compressed Gases	2	SF 404	Flammable Gas (black on red)	7540-00-118-0231
Flammable Liquids	3	SF 405	Flammable Liquid (black on red)	7540-00-118-0237
Flammable Solids	4	SF 406	Flammable Solid (black on white with vertical red stripes)	7540-00-118-0872
Nonflammable compressed gases	2	SF 403	Non-flammable Gas (black on green)	7540-00-118-0156
Oxidizing Materials that are not Organic Peroxides	5	SF 407	Oxidizer (black on yellow)	7540-00-118-0340
Oxidizing Materials that are Organic Peroxides	5	SF 408	Organic Peroxide (black on yellow)	7540-00-118-0343
Poisons:				
Gases, liquids, solids-irritant (domestic)	6	SF 411	Irritant (red inscription, black border, on white)	7540-00-118-0565
Gases, liquids, solids-irritant (export-import)	6	SF 412	Irritant (black on white)	7540-00-118-0575
Gases - nonirritant	2	SF 409	Poison Gas (black on white)	7540-00-118-0367
Liquids and solids-nonirritant	6	SF 410	Poison (black on white)	7540-00-118-0535

Table 4-1. DOT LABELS USED FOR HAZARDOUS MATERIALS (Continued)

TYPE OF MATERIAL	UN CLASS	FORM NO.	DESCRIPTION	NSN
Radioactive Materials:				
Fissile Class I	7	SF 413	Radioactive Material, Radioactive White - I (black on white with red)	7540-00-118-0583
Fissile Class 2	7	SF 414	Radioactive Material, Radioactive Yellow - II (black on white with red)	7540-00-118-0609
Fissile Class 3	7	SF 415	Radioactive Material, Radioactive Yellow - III (black on white with red)	7540-00-118-0610
Spontaneously Combustible Materials	4	SF 418	Spontaneously Combustible (black on white and red)	7540-00-118-0614
Water Reactive Materials	4	SF 419	Dangerous When Wet (black on blue)	7540-00-118-0660
Biomedical	-	SF 420	Biomedical (red on white)	7540-00-144-0575
Cargo Aircraft Only	-	SF 421	Danger - Peligro (black on orange)	7540-01-021-7384
Magnetized Material	-	SF 422	Magnetized Material (blue on white)	7540-01-021-7387

Figure 4-1. SF 400 - Class A explosives (black printing on orange)

Figure 4-2. SF 401 - Class B explosives (black printing on orange)

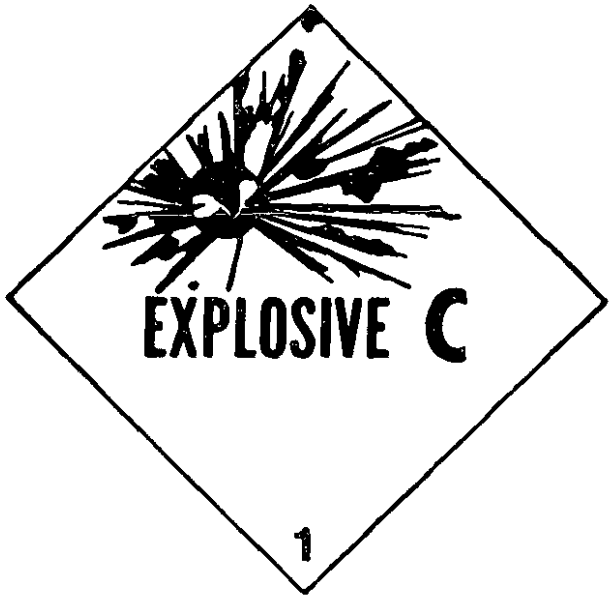

Figure 4-3. SF 402 - Class C explosives (black printing on orange)

Figure 4-4. SF 403 - Nonflammable gases (black or white and inscription printed on green)

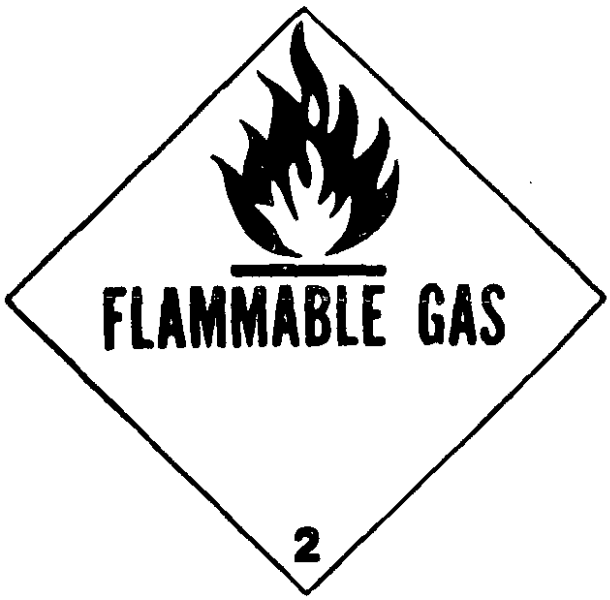

Figure 4-5. SF 404 - flammable gases (black or white symbol and inscription printed on red)

Figure 4-6. SF 405 - flammable liquids (black or white symbol and inscription printed on red)

Figure 4-7. SF 406 - flammable solids (black printing with red vertical stripes on white background with symbol overprinted)

Figure 4-8. SF 407 - Oxidizing materials that are not organic peroxides (black printing on yellow)

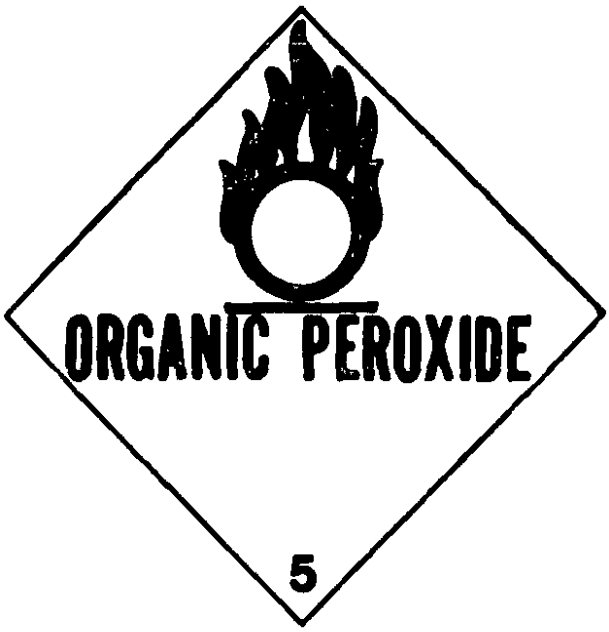

Figure 4-9. SF 408 - Organic peroxides classed as oxidizing materials (black printing on yellow)

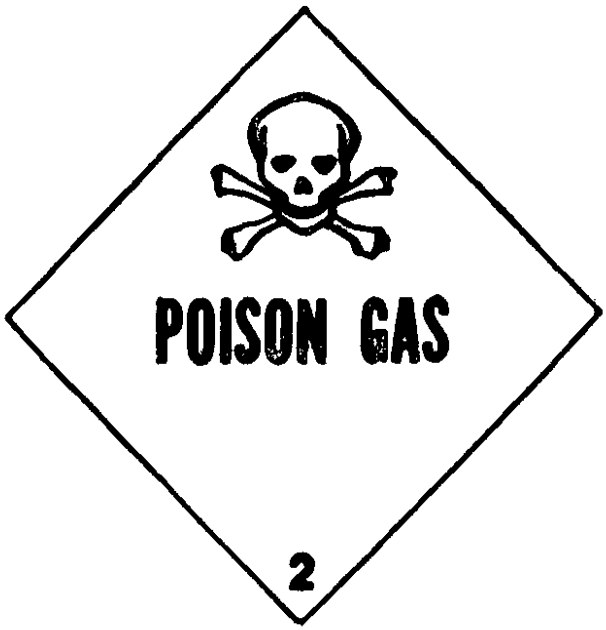

Figure 4-10. SF 409 - Poisonous, nonirritant gases (black printing on white)

Figure 4-11. SF 410 - Poisonous, nonirritant liquids and solids (black printing on white)

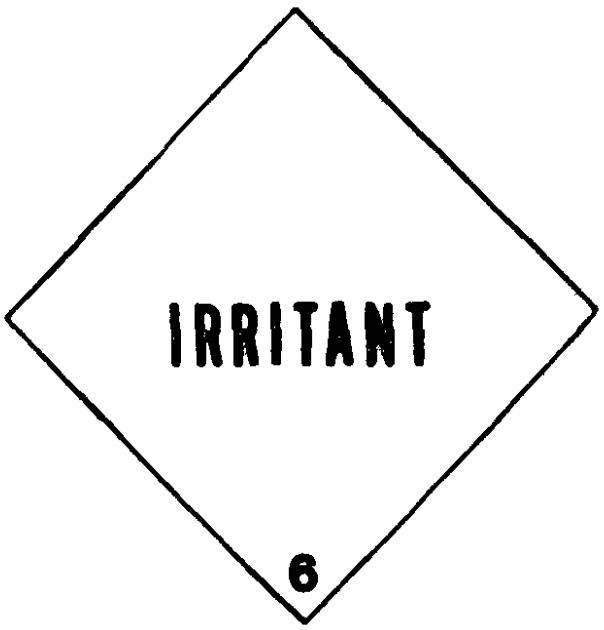

Figure 4-12. SF 411 - Domestic shipments of poisonous, irritant materials (red inscription, black border printed on white)

Figure 4-13. SF 412 - Import/export shipments of poisonous, irritant materials (black printing on white)

Figure 4-14. SF 413 - Fissile Class I radioactive materials, radioactive white-I (black printing on white with one red vertical bar)

Figure 4-15. SF 414 - Fissile Class II radioactive materials, radioactive yellow-II (black printing on yellow upper half and white lower half with black printing and two red vertical bars)

Figure 4-16. SF 415 - Fissile Class III radioactive materials, radioactive yellow-III (black printing on yellow upper half and white lower half with black printing and three red vertical bars)

Figure 4-17. SF 416 - Corrosive materials (black printing on white in top half and black background with white printing on bottom half)

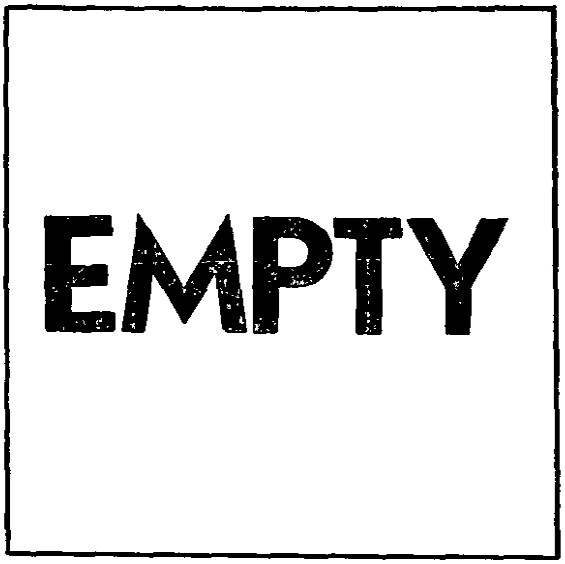

Figure 4-18. SF 417 - Empty containers (black printing on white)

Figure 4-19. SF 418 - Spontaneously combustible materials (black printing on white upper half and red lower half)

Figure 4-20. SF 419 - Water-reactive materials (black or white symbol and inscription printed on blue)

Figure 4-21. SF 423 - blasting agents (black printing on orange).

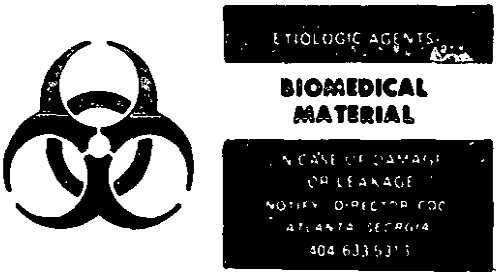

Figure 4-22. SF 420 - Biomedical materials (red printing on white.

Figure 4-23. SF 421 - Materials prohibited from passenger aircraft (black printing on orange).

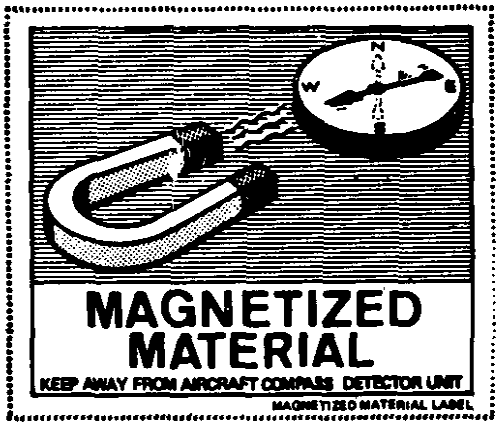

Figure 4-24. SF 422 - Magnetized material (blue printing on white).

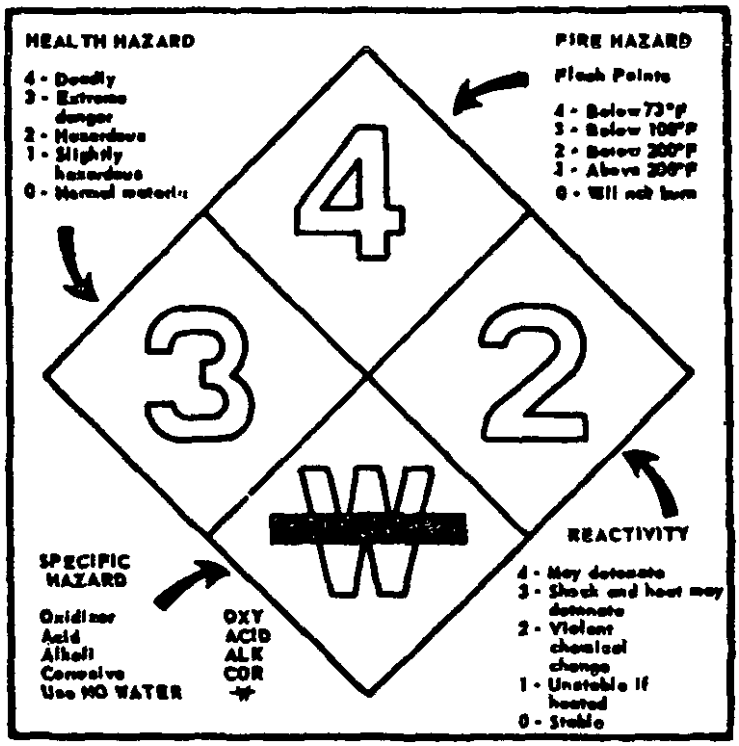

Figure 4-25. Hazardous Material Label, NFPA 704M (NSN 7690-00-152-0030, 4" x 4" size symbol)

Table 4-2. NATIONAL STOCK NUMBERS FOR SYMBOLS AND NUMERALS USED ON THE NFPA LABEL

SYMBOL (BLACK)	NSN	NUMERAL (WHITE)	NSN
OXY	9G 7690-00-152-0031	0	9G 7690-00-857-9697
COR	9G 7690-00-152-0032	1	9G 7690-00-857-9688
ACID	9G 7690-00-152-0033	2	9G 7690-00-857-9689
ALK	9G 7690-00-152-0034	3	9G 7690-00-857-9690
-W-	9G 7690-00-152-0035	4	9G 7690-00-857-9691

Examples of combinations of specific hazard symbols follow:

OXY ACID	OXY AKL -W-	OXY COR	OXY -W-	ACID -W-	ALK -W-	COR -W-

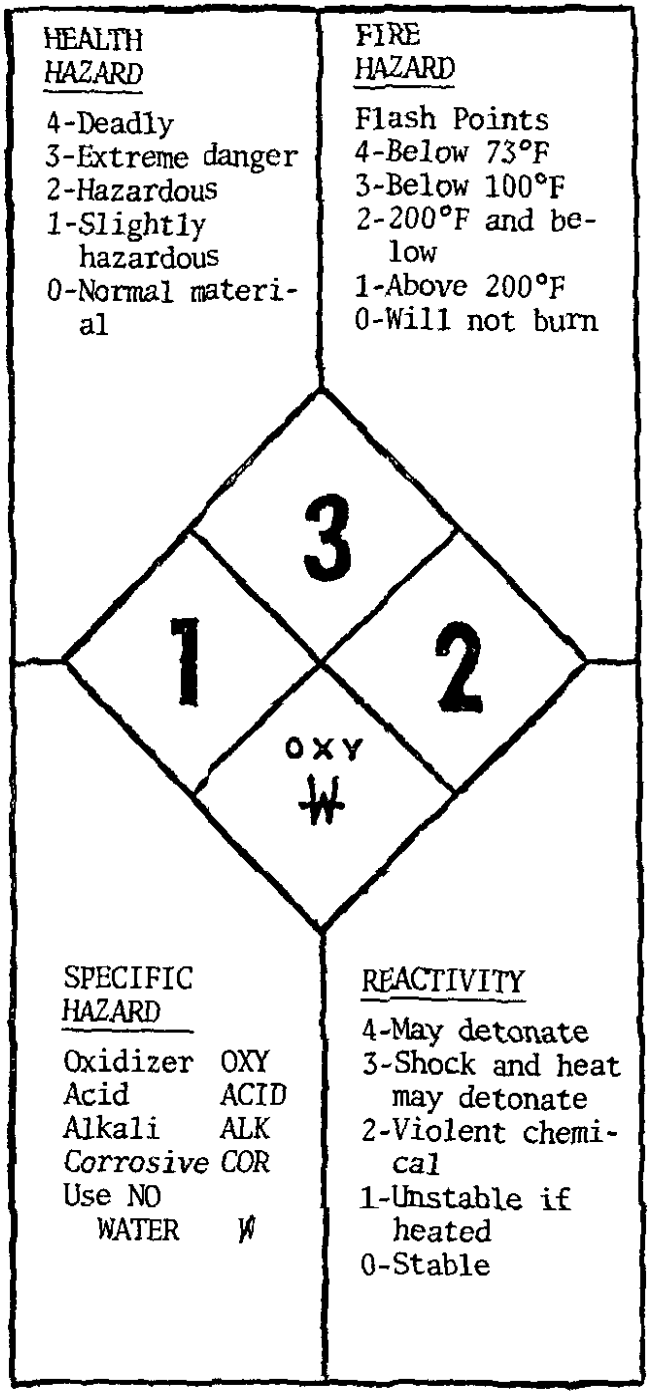

Figure 4-26. Hazardous Material Label Tag (NSN 9905-00-454-9347, 2-3/4" X 6" tag)

Table 4-3

NFPA HAZARD IDENTIFICATION SYSTEM

Identification of Health Hazard Color Code: BLUE		Identification of Flammability Color Code: RED		Identification of Reactivity (Stability) Color Code: YELLOW	
Type of Possible Injury		Susceptibility of Materials to Burning		Susceptibility to Release of Energy	
Signal		Signal		Signal	
4	Materials which on very short exposure could cause death or major residual injury even though prompt medical treatment was given.	4	Materials which will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or which are readily dispersed in air and will burn readily.	4	Materials which are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials which on short exposure could cause serious temporary or residual injury even though prompt medical treatment was given.	3	Liquids and solids that can be ignited under almost all ambient temperature conditions.	3	Materials which are capable of detonation or explosive reaction but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.
2	Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.	2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2	Materials which are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form potentially explosive mixtures with water.
1	Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given.	1	Materials that must be preheated before ignition can occur.	1	Materials which are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0	Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	0	Materials that will not burn.	0	Materials which are normally stable, even under fire exposure conditions, and which are not reactive with water.

CHAPTER 5

FLAMMABLE, COMBUSTIBLE AND OXIDIZING MATERIALS

5-1. GENERAL. This chapter contains or incorporates by reference standards for the use, handling, and storage of flammable, combustible and oxidizing gases, liquids, and solids. Many of the materials addressed, such as solvents, also meet the criteria of other hazardous materials as defined in Federal Standard 313B (see Appendix A). Section 4-2 contains requirements applicable to all hazardous materials.

5-2. GENERAL SAFETY PRECAUTIONS

5-2.1. HAZARDOUS MATERIALS SAFETY PROGRAM. Operations necessitating the use, handling, or storage of combustible or flammable materials shall conform to the requirements of the Hazardous Materials Safety Program as defined in NAVSUPINST 5100.27.

5-2.2. LABELING AND MATERIAL SAFETY DATA SHEETS. The requirements for labeling and the use of Material Safety Data Sheets for flammable and combustible materials are the same as the requirements for all hazardous materials given in section 4-2.

5-3. SPECIFIC MATERIALS

5-3.1. ACETYLENE. The transfer, handling, storage and utilization of acetylene in cylinders shall be in accordance with 29 CFR 1910.102(a), which references the Compressed Gas Association Pamphlet G-1, "Acetylene", (NOTAL). Piped systems for the transfer and distribution of acetylene shall be designed, installed, maintained, and operated in accordance with 29 CFR 1910.102(b), which references the CGA Pamphlet G-1.3, "Acetylene Transmission for Chemical Synthesis", (NOTAL).

5-3.2. HYDROGEN. The requirements for the design, storage, and use of hydrogen systems shall be in conformity with 29 CFR 1910.103.

5-3.3. OXYGEN. Oxygen systems shall be in conformity with 29 CFR 1910.104. Liquid Oxygen (LOX) shall be stored, handled and used in accordance with NAVAIR 06-30-501, "Technical Manual of Oxygen/Nitrogen Cryogenic Systems" (NOTAL).

5-3.4. NITROUS OXIDE. Piped systems for the transfer and distribution of nitrous oxide shall be designed, installed, maintained and operated in accordance with 29 CFR 1910.105,

which references the Compressed Gas Association Pamphlet G-8.1, "Standard for the Installation of Nitrous Oxide Systems at Consumer Sites", (NOTAL).

5-3.5. FLAMMABLE AND COMBUSTIBLE LIQUIDS

5-3.5.1. Classes of Liquids. Flammable liquids are those liquids which have flashpoints below 100 degrees Fahrenheit. Combustible liquids have flashpoints at or above 100 degrees Fahrenheit. Flammable liquids are Class I liquids; combustible liquids are Class II or III liquids. When a Class II or II liquid is heated for use to within 30 degrees Fahrenheit of its flashpoint, it shall be handled in accordance with the requirements for the next lower class of liquids (Class I or II). Further definitions and designation of classes and subclasses of flammable and combustible liquids are in Appendix A.

5-3.5.2. Tank Storage and Piping Systems. Tank storage of flammable and combustible liquids shall be in conformity with 29 CFR 1910.106(b). Piping systems containing flammable or combustible liquids shall be in conformity with 29 CFR 1910.106(c).

5-3.5.3. Container and Portable Tank Storage. Subparagraphs 5-3.5.3.1 to 5-3.5.3.5 apply only to the storage of flammable or combustible liquids in drums or other containers not exceeding 60 gallons in individual capacity, or in portable tanks not exceeding 660 gallons in individual capacity. (As used in this chapter a "container" is any drum, barrel or can with a capacity less than 60 gallons; a "portable tank" is a closed container having a liquid capacity over 60 gallons and not intended for fixed installation.) These subparagraphs do not apply to:

a. Storage containers in bulk storage service stations, or chemical processes;

b. Class I or Class II liquids in the fuel tanks of motor vehicles, aircraft, boats, or engines;

c. Flammable or combustible paints, oils, and varnishes used for painting or maintenance when not kept for a period exceeding 30 days or as otherwise determined by the Fire Chief; and

d. Beverages when packaged in individual containers not exceeding one gallon in size.

5-3.5.3.1. Design, Construction, and Capacity of Containers and Portable Tanks. Only approved containers and portable tanks shall be used. Unopened metal containers and portable tanks meeting the requirements of and containing products

authorized by Department of Transportation regulations 49 CFR 178 and 179 shall be deemed acceptable. Each portable tank shall be provided with emergency venting in accordance with 29 CFR 1910.106(d)(2)(ii). Pumps, faucets and pressure

relief vents of containers and portable tanks used for flammable or combustible liquids shall be kept leak-free and functioning. The maximum capacities for containers or portable tanks for flammable and combustible liquids shall be in accordance with Table 5-1, except that glass or approved plastic containers of no more than 1-gallon capacity may be used for a Class IA or IB flammable liquid under the following conditions:

a. Such liquid would be rendered unfit for its intended use by contact with metals, including stainless steel, or with a teflon lined safety container; or

b. The liquid would excessively corrode metal or teflon lined containers and create a leakage hazard.

Table 5-1. Maximum Allowable Size of Containers and Portable Tanks

Container Type	Flammable Liquids			Combustible Liquids	
	Class 1A	*Class 1B*	*Class 1C*	*Class II*	*Class III*
Glass or approved plastic	1 pt.*	1 qt.*	1 gal.	1 gal.	1 gal.
Metal (other than DOT drums)	NO	NO	NO	5 gal.	5 gal.
Approved safety cans	2 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Metal drums (DOT spec)	60 gal.	60 gal.	60 gal.	60 gal	60 gal.
Approved portable tanks	660 gal.	660 gal.	660 gal.	660 gal.	660 gal.

Container exemptions: Medicines, beverages, foodstuffs, cosmetics,, and other consumer items, when packaged according to commonly accepted practices, shall be exempt from the requirements of subparagraph 5-3.5.3.1.

*Containers of up to 1 gallon capacity may be used as permitted by subparagraph 5-3.5.3.1a or b.

5-3.5.3.2. Use of Storage Cabinets. Not more than 60 gallons of Class I or Class II liquids, nor more than 120 gallons of Class III liquids may be stored in a storage cabinet. Storage cabinets shall meet the requirements of 29 CFR 1910.106(d)(3). Cabinets shall be painted yellow and shall be labeled in conspicuous lettering: FLAMMABLE--KEEP FIRE AWAY.

5-3.5.3.3. Use of Inside Storage Rooms. Storage in inside storage rooms shall comply with 29 CFR 1910.106(d)(4), and the rooms themselves shall be constructed to meet the required fire-resistance rating for their use. Openings to other rooms or buildings shall be provided with noncombustible, liquid-tight raised sills or ramps at least 4 inches in height or the floor of the inside storage room shall be at

least 4 inches below the surrounding floor. Approved self-closing fire doors shall be used to secure the storage areas. Connections shall be liquid-tight where walls join floors.

5-3.5.3.4. Storage Inside Buildings. Flammable or combustible liquids shall not be stored in any way that impedes the use of exits, stairways or other areas normally used for the safe egress of personnel. Leaking containers shall be moved to an inside storage room or taken to a safe location outside the building and the contents transferred to an undamaged container.

a. Office Occupancies. The storage of flammable and combustible liquids in an office occupancy shall be strictly limited to the amount required for the maintenance and operation of equipment. The liquids shall be kept in closed metal containers stored in approved storage cabinets (see 29 CFR 1910.106(d)(3)), in safety cans or in an inside storage room (see subparagraph 5-3.5.3.3).

b. Exchanges and Commissaries. In rooms or areas accessible to customers, storage of flammable or combustible liquids shall be limited to quantities needed for display and normal merchandising purposes. Quantities stored shall not exceed 2 gallons per square foot of gross floor area. Where the aggregate quantity of additional stock exceeds 60 gallons of Class IA, or 120 gallons of Class IB, or 180 gallons of Class IC, or 240 gallons of Class II, or 500 gallons of Class III liquids, or any combination of Class I and Class II liquids exceeding 240 gallons, it shall be stored in a room or portion of the building that complies with the construction provisions for an inside storage room (see subparagraph 5-3.5.3.3).

c. General Purpose Warehouses. Storage in general purpose warehouses shall be in accordance with Tables H-14 and H-15 in 29 CFR 1910, and shall be in buildings or in portions of buildings cut off by standard firewalls. Material creating no fire exposure hazard to the flammable or combustible liquids may be stored in the same area.

d. Flammable and Combustible Liquid Warehouses or Storage Buildings. The total quantity of liquids within a building shall not be restricted, but the arrangement of storage shall comply with Tables H-14 and H-15 in 29 CFR 1910. The following additional safety precautions shall be taken:

(1) Containers in piles shall be separated by pallets or dunnage, where necessary, to provide stability and to prevent excessive stress on container walls.

(2) Portable tanks stored over one tier high shall be designed to nest securely, without dunnage. Adequate materials handling equipment shall be available to handle tanks safely at the upper tier level.

(3) No pile shall be closer than 3 feet to the nearest beam, girder, or other obstruction nor within 3 feet below sprinkler deflectors or discharge orifices of water spray or other overhead fire protection systems.

(4) Aisles of at least 3 feet width shall be provided where necessary to facilitate access to doors, windows, or standpipe connections.

(5) If the storage building is located 50 feet or less from a building or line of adjoining property that may be built upon, the exposing wall shall be a blank wall having a fire-resistant rating of at least 2 hours.

5-3.5.3.5. Storage Outside Buildings. Storage of flammable and combustible liquids outside buildings shall be in accordance with Tables H-16 and H-17 in 29 CFR 1910. The following requirements also apply:

a. A minimum distance of 10 feet (20 feet for construction operations) shall be maintained between buildings and outside storage of flammable or combustible liquids in closed containers or portable tanks except that quantities less than 1,100 gallons may be stored adjacent to one-story buildings devoted principally to the handling and storage of such liquids provided that the buildings have 2-hour fire-resistive exterior walls having no opening within 10 feet of the outside storage.

b. The storage area shall be graded in a manner to direct possible spills away from buildings, or shall be surrounded by a curb at least 6 inches high. When curbs are used, provisions shall be made for draining accumulations of ground water or spills of the liquids in storage. Drains shall terminate at a safe location and shall be accessible to operation under fire conditions.

c. The storage area shall be protected against tampering or trespassers and shall be kept free of weeds, debris, and other combustible material not necessary to the storage.

5-3.5.4. Incidental Storage, Handling and Use. This subparagraph applies to the storage, handling and use of flammable or combustible liquids which are incidental to the operation being performed. Flammable or combustible liquids shall be stored in tanks or closed containers.

5-3.5.4.1. Storage Outside Inside Storage Room or Cabinet. The quantity of liquid that may be located outside of an inside storage room, or storage cabinet in a building, or any one fire area of a building shall not exceed 25 gallons of Class IA liquids in containers; 120 gallons of Class IB, IC, II or III liquids in containers; or 660 gallons of Class IB, IC, II or III liquids in a single portable tank. (A fire area of a building is an area separated from the remainder of the building by construction having a fire resistance of at least 1 hour and having all communicating openings properly protected by an assembly having a fire resistance of at least 1 hour and having all communicating openings properly protected by an assembly having a fire resistance rating of at least 1 hour.)

5-3.5.4.2. Transferring Liquids. Flammable or combustible liquids shall be drawn from or transferred into vessels, containers, or portable tanks within a building only through a closed piping system, from safety cans, by means of an approved device drawing through the top, or from a container or portable tanks by gravity through an approved selfclosing valve. Transferring by means of air pressure on the container or portable tanks is prohibited. Areas in which flammable or combustible liquids are transferred in quantities greater than 5 gallons shall be separated from other operations by a 25-foot distance or by construction having a fire-resistance of at least 1 hour. Drainage, raised sills or depressed floor area shall be provided to control spills. Ventilation shall be used to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit. Transfer from one container to another shall be done only when containers are electrically bonded together. The transfer of flammable or combustible liquids to or from tank cars or tank vehicles shall be done in accordance with 29 CFR 1910.106(e)(4). Fueling operations are discussed in section 5-6.

5-3.5.4.3. Containers. Flammable or combustible liquids shall be kept in closed containers when not actually in use.

5-3.5.4.4. Leaks and Spills. Where flammable or combustible liquids are used or handled, means shall be provided to dispose promptly and safely of leakage or spills.

5-3.5.4.5. Sources of Ignition. Adequate precautions shall be taken to prevent the ignition of flammable vapors. Sources of ignition include but are not limited to open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition, including heat-producing chemical reactions; and radiant heat. Class I liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the point(s) of vapor release or otherwise within the possible path of vapor travel.

5-3.5.4.6. *Grounding. Class I liquids shall not be dispensed into containers unless the nozzle and container are electrically bonded together. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of this paragraph shall be deemed to have been complied with.*

5-3.5.4.7. Electrical Equipment. Electrical equipment in *the area of flammable or combustible liquid storage and* usage shall be in accordance with 29 CFR 1910.106(e)(7) and with paragraph 13-3.5.

5-3.5.4.8. Access. Adequate aisles shall be maintained for *unobstructed movement of personnel and so that fire protection* equipment can be brought to bear on any part of flammable or combustible liquid storage, use, or any unit physical operation.

5-3.5.4.9. *Ventilation. Except where paint spray booths* are utilized for control of flammable vapors, plant areas using Class I liquids shall be ventilated at a rate of not less than 1 cubic foot per minute, per square foot of solid floor area or as otherwise necessary to ensure a vapor *concentration below 10 percent of the lower explosive limit.* This shall be accomplished by natural or mechanical ventilation, with discharge or exhaust to a safe location outside of the building. Ventilation shall be arranged to include all floor areas or pits where flammable vapors may collect.

5-3.5.4.10. Empty Containers. Empty flammable or combustible liquid containers shall not be stored until they have been thoroughly cleansed of hazardous vapors unless storage is in accordance with the requirements for full containers. The fuel tanks of small gasoline engines shall be similarly cleaned before indoor storage.

5-3.5.4.11. Waste and Residue. Combustible waste material and residues in a building or unit operating area shall be kept to a minimum, stored in covered metal receptacles and disposed of daily.

5-3.5.4.12. Disposal. The disposal of flammable or combustible liquids and materials contaminated by such liquids shall be in accordance with OPNAVINST 5090.1, "Environmental and Natural Resources Protection Manual", (NOTAL).

5-3.5.4.13. Unit Physical Operations. Areas in which flammable or combustible liquids are handled or used in unit physical operations such as mixing, drying, evaporating,

filtering, distillation and similar operations which do not involve chemical change shall be in compliance with 29 CFR 1910.106(e)(3).

5-3.5.5. Fire Control.

5-3.5.5.1. Extinguishers. Suitable fire-control devices shall be available at locations where flammable or combustible liquids are stored. At least one portable fire extinguisher having a rating of not less than 12-B units shall be located outside of, but not more than 10 feet from, the door opening into any room used for storage of up to 60 gallons. For storage quantities over 60 gallons the extinguisher shall have a rating of 20-B units. Similarly, at least one portable fire extinguisher of 12-B units rating shall be located not less than 10 feet, nor more than 25 feet from any Class I or Class II liquid storage area located outside of a storage room but inside a building. See section 7-4 for additional extinguisher requirements.

5-3.5.5.2. Incompatible Materials. Oxidizers and materials which will react with water shall not be stored in the same room with flammable or combustible liquids.

5-3.5.6. Underground Leakage of Flammable and Combustible Liquids.

5-3.5.6.1. General. Any indication that flammable or combustible liquids have escaped into the ground shall be considered a potential, if not immediate, hazard. The source of such leakage shall be located and stopped as soon as possible.

5-3.5.6.2. Indications of Leakage. The possibility that unconfined flammable or combustible liquids exist underground will normally become known by discovery of combustible or flammable liquids or their vapors in normally inhabited subsurface structures such as basements, and tunnels; in other subsurface structures such as sewers and utility conduits; groundwater, on or in surface water, or emerging from cuts or slopes in the earth; or by loss of stock or presence of water in the storage facility.

5-3.5.6.3. Leakage in Basements and Tunnels. Since leakage in subsurface structures implies a strong potential hazard to life or property, immediate steps shall be taken to protect personnel from the danger of explosion and fire. Smoking or other sources of ignition shall not be permitted. Lights and other electrical switches shall not be turned on or off, and extension cords shall not be removed from outlets. After the presence of flammable vapors has been verified, the electric and gas services to the building

shall be disconnected or cut off from outside the structure. If liquids or vapors are within or above their flammable range, the evacuation of the building occupants shall be ordered.

5-3.5.6.4. Entering the Area. The activity Gas Free Engineer, Safety and Health Official, or Fire Chief shall determine the presence and extent of the flammable vapor concentration. If areas of vapor concentration above 10 percent of the lower flammable limits are exposed to a source of ignition, the area shall be immediately ventilated to reduce fire and explosion hazards. Conditions of safe entry shall be determined by the Gas Free Engineer, Safety and Health Official, or Fire Chief in accordance with NAVSEA S6470-AA-SAF-010, "NAVSEA Gas Free Engineering Program."

5-3.5.6.5. Leakage in Sewers and Utility Conduits. Liquids or vapors in sewers and utility conduits imply a potential for explosion or fire but, generally, a low potential of hazard to life and property. However, the requirements in paragraphs 5-3.5.6.3 and 5-3.5.6.4 shall be observed if the leakage is in the vicinity of structures used for human occupancy.

5-3.6. LIQUEFIED PETROLEUM GASES. The storage, handling and use of liquefied petroleum gases shall be in conformity with 29 CFR 1910.110.

5-3.7. ACIDS AND ALKALIES

5-3.7.1. General. Only the fire and explosion aspects of acids and alkalies are covered in this chapter; the toxic effects of acids and alkalies are included in Chapter 4.

5-3.7.1.1. Fire and Explosion Hazards. Fire and explosion hazards of acids and alkalies are due to their instability under adverse storage conditions. Also, some acids are strong oxidizing agents which can generate ignition temperatures upon contact with organic materials and other chemicals.

5-3.7.1.2. Precautions. Acids and alkalies shall not be mixed with other chemicals unless the results of the reaction are definitely known. Strong acids may react violently and produce explosive and toxic products.

5-3.7.2. Acid Transfer

5-3.7.2.1. Tank Trucks. Unloading of acids from tank trucks shall preferably be done in daylight with the immediate truck parking area elevated so that leakage and spillage will drain away from the truck and adjacent structures. The depth of acid in the truck and receiving tanks shall be regularly checked, and the capacity of the storage tank to receive the delivery shall be ascertained. Sufficient ullage shall be left in the storage tank to prevent overflow and buildup of excessive pressure due to variations in storage temperatures. Personnel making connections shall be provided with complete protective clothing.

5-3.7.2.2. Storage Tanks. Material for tanks, and associated piping, pumps, and valves shall be selected according to the type of acid and its strength. Foundations for tanks shall be of substantial construction, preferably of concrete. Vent valves shall be of sufficient size to permit equalization when the tank is being filled or emptied. A catch basin, pit, or depression large enough to contain the full capacity of the tank in case of rupture or major leakage shall be provided.

5-3.7.2.3. Drums. Open flames and spark-producing equipment or operations shall not be permitted on or near filled or empty drums. Filled drums shall be stored under cover where they will not be exposed to direct sunlight or to excessively high temperatures. Drums to be returned to a consignor shall not be washed, nor shall any water or other substance foreign to the original contents be put into the drum.

5-3.8. SOLVENTS. The variety of solvents used in formulations such as paints, adhesives, rubber, plastic materials, and degreasing solutions all present flammability hazards with the exception of chlorinated solvents. Depending upon the extent and conditions of their use, appropriate measures shall be taken in accordance with this section to minimize their flammable effects. Refer to Chapter 4 for a discussion of toxic-related hazards and required precautions.

5-3.9. FLAMMABLE, COMBUSTIBLE AND OXIDIZING SOLIDS. Flammable, combustible and oxidizing solids are materials, other than those classed as explosive, which are liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily. When ignited, such materials burn vigorously enough to create a serious hazard to personnel and property. Included in this class are spontaneously combustible, waterreactive, polymerizing, and oxidizing materials. The precautions for handling flammable, combustible and oxidizing solids in NFPA 49, "Hazardous Chemicals Data", (NOTAL), and in DOD 4145.19-R-1 (NOTAL), shall be complied with.

5-3.10. EXPLOSIVES AND BLASTING AGENTS. Safety policies for the use, handling, and storage of explosives and blasting agents come under the scope of OPNAVINST 8023.2B, "U. S. Navy Explosives Safety Policies, Requirements, and Procedures", (NOTAL). Users of this manual requiring specific guidance for handling explosives and blasting agents should consult OPNAVINST 8023.2B as well as the following sources:

a. NAVSEA OP-5, "Ammunition and Explosives Ashore", (NOTAL),

b. 49 CFR Part 173, "General Requirements for Shipments and Packagings",

c. Additional regulations and publications issued by NAVFAC and NAVSEA,

d. 29 CFR 1926, Subpart U and U. S. Army EM 385-1-1 for explosives use in construction operations.

5-3.11. ANHYDROUS AMMONIA. The storage and handling of anhydrous ammonia shall be in accordance with 29 CFR 1910.111.

5-4. SPRAY FINISHING OPERATIONS

5-4.1. GENERAL. The requirements of this section are applicable to spraying operations involving the use of flammable or combustible liquids. The storage, handling, and use of flammable and combustible liquids in spraying operations shall be in accordance with paragraph 5-3.5 unless specifically required otherwise by this section.

5-4.2. SPRAYING OPERATIONS

5-4.2.1. General. Spray application operations shall be confined to properly designated and constructed spray booths or properly designated spray areas. Spray booths shall be constructed and maintained as specified in 29 CFR 1910.107(b) and NFPA 33, "Spray Application Using Flammable and Combustible Materials", (NOTAL).

5-4.2.2. Separation From Other Operations. Spray booths shall be separated from other operations by not less than 3 feet, or by a partition or wall. This space shall not be used for storage or for other placement of materials or equipment.

5-4.2.3. Sources of Ignition. Electrical equipment, open flames, and other sources of ignition in spray-finishing areas shall conform to the following requirements:

a. There shall be no open flame or spark-producing equipment in a spraying area nor within 20 feet of a spraying area unless separated by a partition.

b. Space-heating appliances, steampipes, or hot surfaces shall not be located where deposits of combustible residues may accumulate.

c. There shall be no electrical equipment in any spraying area except wiring in rigid conduit or in boxes or fittings containing no taps, splices, or terminal connections.

d. Electrical wiring and equipment not subject to deposits of combustible residues but located in a spraying area shall be explosion-proof and approved for Class I, Division 1, Hazardous Locations.

e. Electric lamps outside of, but within 20 feet of, any spraying area shall be totally enclosed to prevent the falling of hot particles. They shall be protected from mechanical damage by suitable guards or by location. Portable electric lamps shall not be used in any spraying area during spraying operations.

f. All metal parts of spray booths, exhaust ducts, and piping systems conveying flammable or combustible liquids shall be electrically grounded. Airless high-fluid pressure spray guns and any conductive object being sprayed shall likewise be grounded.

5-4.2.4. Ventilation. Ventilation for spraying operations shall conform to the requirements of 29 CFR 1910.107(d).

5-4.2.5. Storage and Handling. The storage and handling of flammable or combustible liquids in connection with spraying operations shall be in compliance with paragraph 5-3.5 and with 29 CFR 1910.107(e). Only nonsparking tools shall be used in any area where organic particles are stored or applied.

5-4.2.6. Fire Protection. Spraying areas shall be protected with an approved automatic fire-extinguishing system. Automatic sprinkler systems, where provided, shall comply with the provisions of section 7-4. Sprinkler heads in spraying areas shall be kept as free from deposits as practical. Where automatic sprinkler protection is not available, a spray booth and its exhaust ducts may be protected with a dry chemical extinguishing system. An adequate supply of suitable portable fire extinguishers shall be installed near all spraying areas.

5-4.2.7. Operations and Maintenance. The following safety requirements shall be complied with:

a. Spraying shall not be conducted outside of predetermined spraying areas.

b. Spraying areas shall be kept as free as practicable from accumulations of combustible residues. Scrapers, spuds or other such tools used for cleaning shall be of nonsparking material.

c. Residue scrapings and contaminated debris shall be immediately removed from the premises and properly disposed of (see subparagraph 5-3.5.4.11 and 5-3.5.4.12).

d. Clothing of spray-finishing personnel shall not be left on the premises overnight unless kept in metal lockers.

e. Flammable (Class I) liquids shall not be used as solvents in cleaning operations except that solvents having flashpoints not less than those normally used in spraying operations may be used for cleaning spray nozzles and auxiliary equipment provided that such cleaning is conducted inside spray booths with the ventilation equipment in operation.

f. Spray booths shall not be alternately used for different types of materials, where the combination of the materials may be conducive to spontaneous ignition, unless all deposits of the first used material are removed from the booth and exhaust ducts prior to spraying with the second material.

g. NO SMOKING signs shall be conspicuously posted at all spraying areas.

h. Personal protective equipment shall be used as required by Chapter 6.

5-4.2.8. Electrostatic Spraying. Electrostatic spraying operations shall be conducted according to the requirements of 29 CFR 1910.107(h) and (i). Powder coating operations shall be in accordance with 29 CFR 1910.107(l).

5-4.2.9. Drying, Curing or Fusion Apparatus. Drying, curing or fusion apparatus in connection with spray application of flammable and combustible finishes shall be in accordance with 29 CFR 1910.107(j) and with NFPA 86A, "Standard for Ovens and Furnaces", (NOTAL).

5-4.2.9.1. Drying in Spray Booths. Rooms, spray booths or other enclosures used for spraying operations shall not alternately be used for drying purposes if such use will cause a substantial increase in the surface temperature of the room, booth, or enclosure. Drying, curing or fusion units with open flame heaters shall not be installed in spraying areas except as specifically permitted in 29 CFR 1910.107(j)(3).

5-4.2.9.2. Automobile Spray Booths. Drying with portable electrical infrared drying apparatus may be done in automobile refinishing spray booths under the conditions specified in 29 CFR 1910.107(j)(4).

5-4.2.10. Automobile Undercoating. Automobile undercoating spray operations in garages, conducted in areas having adequate natural or mechanical ventilation, are exempt from the requirements for spray finishing operations when undercoat

ing materials not more hazardous than kerosene or containing solvents having a flashpoint in excess of 100 degrees Farenheit are used. Undercoating spray operations not conforming to these provisions are subject to all requirements of this chapter applicable to spray finishing operations.

5-4.3. PAINT REMOVING. The removal of paint and other protective coatings by means of solvents involves hazards similar to those involved in painting. The precautions of this section for applying paint shall be followed as applicable in the removal of paint and other surface coatings by solvents. Removal of paint by abrasive blasting shall be in accordance with 29 CFR 1910.94(a). Removal of paint by torch is prohibited.

5-4.4. AIRCRAFT PAINTING AND PAINT REMOVAL. Painting and paint removal operations on aircraft shall be done in accordance with NFPA 410, "Standard for Aircraft Maintenance", (NOTAL), except that concentrations of flammable vapors at floor level, in floor pits and drains, and in aircraft compartments shall not exceed 10 percent of the lower explosive limit.

5-4.5. SHIP PAINTING AND PAINT REMOVAL. Painting and paint removal operations aboard ships shall be done in accordance with 29 CFR 1915, Subpart C and NSTM 631, "Preservation of Ships in Service", (NOTAL).

5-5. DIP TANK OPERATIONS. Dip tanks containing flammable or combustible liquids shall be installed, operated and maintained in accordance with 29 CFR 1910.108.

5-6. REFUELING AND TRANSFER OPERATIONS

5-6.1. MOTOR VEHICLES. This paragraph contains general requirements applicable to the refueling of motor vehicles, materials handling equipment, cranes, construction equipment and similar operations in which fuel is dispensed into a fuel tank or other container. The detailed requirements in 29 CFR 1910.106(g) and, for construction operations, 29 CFR 1926.152(g) shall be complied with.

5-6.1.1. Storage and Handling. Liquids shall be stored in approved closed containers not exceeding a capacity of 60 gallons, or in tanks located underground, or in tanks in special enclosures, or in aboveground tanks. Special enclosures, where used, shall be substantially liquid and vapor-tight. Sides, top, and bottom of the enclosure shall be of reinforced concrete at least 6 inches thick with openings for inspection through the top only. Tank trucks shall comply with the requirements of NFPA 385, "Standard for Tank Vehicles for Flammable and Combustible Liquids", (NOTAL).

5-6.1.2. Storage Inside Buildings. Except where stored in tanks, no Class I liquids shall be stored within any service station building except in closed containers of aggregate capacity not exceeding 60 gallons. Class I liquids may be transferred from one container to another, provided the electrical installation complies with 29 CFR 1910.106(g)(5).

5-6.1.3. Dispensing into Portable Containers. Delivery of Class I liquids shall not be made into portable containers except an approved container that is properly color-coded and marked (subparagraph 3-4.2.11.3), and is fitted with a spout or is so designed that the contents can be poured without spilling.

5-6.1.4. Dispensing Units. Class I liquids shall be transferred from tanks by means of fixed pumps designed and equipped to allow control of the flow and to prevent leakage or accidental discharge. Only listed devices shall be used. Liquids shall not be dispensed by pressure from drums, barrels, or similar containers. Approved pumps or self-closing faucets shall be used.

5-6.1.5. Delivery Nozzles. Only approved manual or automatic-closing type valves may be used in conjunction with an approved latch-open device.

5-6.1.6. Electrical Equipment. Electrical equipment in service stations shall be in accordance with 29 CFR 1910.106(g)(5).

5-6.1.7. Drainage and Waste Disposal. Provision shall be made to prevent spilled liquids from flowing into the interior of service station buildings. Such provision may be by grading driveways, raising door sills, or other equally effective means. Crankcase drainings and flammable or combustible liquids shall not be dumped into sewers. They shall be stored in tanks or drums outside of any building until removed from the premises. Disposal shall be in accordance with subparagraph 5-3.5.4.12.

5-6.1.8. Sources of Ignition. There shall be no smoking or open flames in areas used for fueling, servicing of fuel systems, and receiving or dispensing of flammable or combustible liquids. Appropriate signs shall be posted. Additionally, the motors of all equipment being fueled shall be shut off during the fueling operation.

5-6.1.9. Fire Extinguishers. Each service or fueling area shall be provided with at least one extinguisher having a minimum approved classification of 20 B:C. Location shall be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service room.

5-6.2. AIRCRAFT FUEL SERVICING. Fueling and defueling of aircraft shall be done in accordance with NAVAIR 06-5-502 "Handbook, Aircraft Refueling at Shore Activities", (NOTAL), and NFPA 407, "Standard for Aircraft Fuel Servicing", (NOTAL).

5-6.3. MARINE SERVICE STATIONS. The dispensing area of marine service stations shall be located away from other structures to provide room for safe ingress and egress of craft to be fueled. Dispensing units shall be at least 20 feet from any activity involving fixed sources of ignition. Dispensing shall be by approved dispensing units only. On board the vessel being fueled, portholes on the side from which fuel is being received shall be closed and secured. Tanks, pumps, and piping for marine service stations shall be in conformity with 29 CFR 1910.106(g)(4).

5-6.4. LONGSHORING. Before the start of cargo handling operations, it shall be determined if the cargo includes any flammable or combustible materials. Personnel shall be advised appropriately on the necessity for preventing damage to the flammable or combustible cargo and of any special precautions which need to be taken. If cargo is spilled, or if any containers develop a serious leak, personnel shall be immediately removed from the area. Specific precautions shall be taken, as required, including the use of personal protective equipment, ventilation, etc. Personnel shall be fully instructed on safe methods of disposal before undertaking clean up operations.

5-6.4.1. Precautions in Handling Flammable Cargo. Flammable cargos shall be handled and stowed in accordance with 49 CFR 176, Subpart I.

5-6.4.2. Care of the Wharf. Spilled oil on the wharf shall be immediately cleaned up. Sand may be used to absorb it. Wharf risers shall be kept clean by wiping them with diesel fuel oil.

5-6.4.3. Care of the Area. No open flames, fires, or open lights shall be allowed in the area where flammables are being handled. Under no circumstances shall smoking materials, matches, or other flammable rubbish be thrown overboard or through portholes. All contact with sources of ignition shall be eliminated, both onboard the ship and on the wharf, to a distance of 200 feet for gasoline and at least 50 feet for other flammables. Sources of ignition include not only fires, matches, and smoking, but also motor vehicles, power boats, locomotives and electrical equipment not specifically approved for use in hazardous atmospheres.

5-6.4.4. Discontinuing Loading During Storms. Except during an emergency, the loading or discharging of flammable materials shall be discontinued during electrical storms.

5-6.4.5. Special Precautions Preliminary to Loading Gasoline. Because of the special dangers involved, the following precautions shall be taken when loading or discharging gasoline. The precautions shall be in addition to those previously listed under paragraphs 5-6.4.1 through 5-6.4.4.

a. Adequate firefighting personnel and sentries shall be posted.

b. Gasoline tank pressure limits shall not be exceeded.

c. Accurate records shall be maintained of the amount of gasoline in each of the ship's tanks.

5-6.4.6. Providing a Hose Watch. A product hose watch shall be provided whenever a cargo of flammable materials is being discharged ashore. The product hose watch shall signal the pumper operator should an emergency occur, and shall check the pressures on the gages attached to the wharf risers and ship connections.

5-6.4.7. Use of Firefighting Equipment. During the entire time that bulk or package cargo is being transferred at a fuel pier, sufficient firehose shall be connected to the ship's hydrants and let out ready for use in case of emergency. The ship's firemain shall be connected to the shore firemain, if possible, when there is no steam or other power available in the ship. Before cargo transfer is started, other ship and dock or depot firefighting equipment shall be placed where it will be ready for immediate use.

5-6.4.8. Precautions Against Fires. The following safety rules shall apply in the loading of flammable materials:

a. Frequent inspections shall be made while pumps are operating to ensure that bearings are not overheated.

b. Hammering of dogs and nuts shall be avoided. If hammering is necessary, wooden mallets or other nonsparking tools shall be used.

c. Pressure shall be maintained on the firemain during fueling.

5-6.4.9. Additional Precautions for Night Loading. Night loading of gasoline or other flammable materials shall be undertaken with the greatest possible caution. Personnel shall be provided with approved explosion-proof flashlights or electric lanterns and floodlighting.

5-6.5. BULK PLANTS. Bulk plant operations shall be in accordance with 29 CFR 1910.106(f). Bulk plants are areas in which flammable or combustible liquids are received by

tank vessel, pipelines, tank car, or tank vehicle, and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle or container.

5-6.6. PROCESSING PLANTS. Facilities which contain chemical operations such as oxidation, reduction, halogenation, hydrogenation, alkylation, or polymerization shall be in compliance with 29 CFR 1910.106(h).

5-7. LABORATORIES

5-7.1. PERMISSIBLE QUANTITIES. Only the amount of flammable or explosive material actually required for the day's work shall be brought into a laboratory area. A storage area, separated from the immediate working area, shall be provided for storage purposes. Quantities and locations of such materials shall be approved by the Commanding Officer with the advice of safety and fire protection officials.

5-7.2. FUME HOODS. Experiments involving flammables shall be conducted in fume hoods constructed so that motors, switches, or lights do not provide a source of ignition. Work of a hazardous nature involving flammables or explosives shall not be performed in an area where a resultant fire might block egress. Combustible and toxic gases shall be vented into hoods or the equivalent. Oxidizing gases shall be kept separate from flammable and combustible gases.

5-7.3. STORAGE. Flammable liquids and volatile solvents shall not be stored in a refrigerator unless it is explosion-proof approved for Class I, Groups C or D, hazardous locations. Food storage of any duration is prohibited in refrigerators used for chemical storage; refrigerators shall be so posted. Storage in glass bottles shall be in accordance with subparagraph 5-3.5.3.1. Storage in metal cabinets shall be for very small quantities of flammable liquids and metal cabinets thus used shall be clearly labeled. Storage of combustible materials with flammable liquids in the same cabinet shall be prohibited.

5-7.4. ADDITIONAL REQUIREMENTS. In addition to the requirements of this chapter, detailed requirements for handling flammables in laboratories are in NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals", (NOTAL).

5-8. FUEL GAS SYSTEMS. The installation, use, and maintenance of gas piping and equipment shall be in accordance with NFPA 54, "National Fuel Gas Code", (NOTAL).

5-9. SHIP REPAIRING. The use of flammable and combustible materials in ship repair and shipbuilding operations aboard ship shall be in accordance with 29 CFR 1915.36 and with the Naval Ships Technical Manual (NSTM).

CHAPTER 6

PERSONAL PROTECTIVE EQUIPMENT

6-1. GENERAL

6-1.1. BASIC POLICY. Personal Protective Equipment (PPE) shall be selected, constructed, used and maintained in accordance with the requirements contained in or incorporated by reference in this chapter. PPE shall be provided and shall be used whenever necessary to protect personnel against hazards capable of causing injury or impairment in the function of any part of the body. No unprotected person shall knowingly be subjected to a hazardous environmental condition.

6-1.1.1. Minimum Specifications. PPE shall meet the following minimum specifications:

a. It shall provide adequate protection against the particular hazard for which it is designed.

b. It shall be reasonably comfortable when worn under the designated conditions.

c. It shall fit properly and shall not unduly interfere with the movements of the wearer.

d. It shall be durable.

e. It shall be capable of performing as designed in worst-case-expected situations.

f. It shall be capable of being disinfected if worn repeatedly on or about the head or if it is to be used by more than one person.

g. It shall be easily cleanable.

h. It shall be maintained in good repair.

i. It shall be of safe design and construction for the work to be performed.

6-1.1.2. Determination of PPE Requirements. Qualified safety and health personnel shall evaluate workplaces and operations, including applicable hazardous material data, to determine PPE requirements. Whenever feasible, occupational hazards shall be eliminated through engineering or management controls.

6-1.1.3. Circumstances of Use. PPE shall be provided and used in the following circumstances:

a. Where it has been determined by an industrial hygienist or safety specialist that PPE is necessary to protect the health and safety of employees.

b. Where it has been determined that adequate engineering and/or supervisory controls are not feasible.

c. Where development or installation of engineering controls are pending.

d. During short term, nonroutine operations for which engineering controls are not practical.

e. During emergency situations such as spills, ventilation malfunctions, emergency exit, damage control activities, etc.

6-1.1.4. Personal Attire. When specific items of personal attire are judged to be hazardous to an operation or work environment, their use shall be prohibited. For example, the wearing of long sleeves, jewelry, and loose-fitting or dangling clothing shall not be permitted around moving machinery. Silk, wool or rayon, nylon and other synthetic fiber garments, shall not be worn in any operation in which the generation of static electricity would create a hazard. Provision of everyday suitable attire, including appropriate shoes, normally worn by prudent individuals to avoid unnecessary risk, is the responsibility of the employee and shall be considered a condition of employment.

6-1.1.5. Unique PPE Requirements. Requirements for operations having unique PPE requirements, such as welding, are included in the chapter of this manual applicable to those operations. However, personnel engaged in such operations must also meet the PPE requirements of this chapter; e.g., welders in a noise hazardous environment shall wear suitable hearing protection.

6-1.2. PPE CHECKLIST. Table 6-1 is a checklist for PPE selection in various hazardous situations. The checklist is intended for use as a quick reference and should be used in conjunction with the applicable parts of this chapter. There may be operating conditions in which the use of a listed item of PPE is impractical or would increase the hazard. In such instances, procedures and equipment shall be used to safeguard employee safety and health to the extent practicable.

TABLE 6-1. CHECKLIST FOR THE SELECTION OF PROTECTIVE EQUIPMENT

HAZARDOUS SITUATION	PROTECTIVE EQUIPMENT REQUIRED
Heavy Impact or Falling Object	Head: hard hat Knees, Legs, and Ankles: fiber metal leggings Feet and Toes: steel box toe shoes or foot guards
Moderate Impact	Head: hard hat Feet and Toes: steel box toe shoes
Large Flying Particles or Objects	Head: hard hat Eyes: goggles, spectacles with side shields Face: plastic face shields Fingers, Hands, and Arms: leather gloves or mittens, sleeves Trunk: leather or canvas fiber aprons, coats, or jackets Knees, Legs, and Ankles: leather, fiber metal, or flame-resistant duck pants, knee guards, shin guards, leggings or spats
Small Flying Particles	Head: abrasive blasting hood Eyes: goggles, spectacles with side shields, plastic eye shields Fingers, Hands, and Arms: leather or duck fabric gloves or mittens, sleeves Trunk: leather or canvas fiber aprons, coats, or jackets Knees, Legs, and Ankles: leather, fiber metal, or flame-resistant duck pants, knee guards, leggings, or spats
Dusts	Eyes: goggles, spectacles with side shields, plastic eye shields Face: plastic face shields Respiratory: approved dust, air-line, or abrasive blasting respirator

TABLE 6-1. CHECKLIST FOR THE SELECTION OF PROTECTIVE EQUIPMENT (Continued)

Sparks and Metal Spatter	Head: cotton or wool cap (flame-retardant treated) Eyes: goggles, spectacles with side shields, plastic eye shields Face: plastic face shields Fingers, Hands, and Arms: leather, flame resistant duck or aluminized fabric gloves or mittens, sleeves Trunk: leather aprons, coats, or jackets Knees, Legs, and Ankles: leather, fiber metal, flame-resistant duck pants, knee guards, shin guards, leggings, or spats
Splashing Metal	Eyes: goggles, spectacles with side shields, plastic eye shields Face: wire screen shield Fingers, Hands, and Arms: leather, flame-resistant duck or aluminized fabric gloves or mittens, sleeves Trunk: leather aprons, coats, or jackets Knees, Legs, and Ankles: leather fiber metal or flame-resistant duck pants, knee guards, shin guards, leggings, or spats Feet and Toes: leather shoes, foundry shoes
Splashing Liquids and Chemicals	Head: plastic-rubber hat Eyes: goggles, hoods Face: plastic face shields, hoods Respiratory: chemical-resistant suits with air supply Fingers, Hands, and Arms: rubber, natural rubber, plastics, synthetic fabrics, coated glass fiber, or other chemical-resistant gloves or mittens, sleeves Trunk: rubber, plastic, or other chemical-resistant material Knees, Legs, and Ankles: rubber, plastic, or other chemical resistant material Feet and Toes: nonskid shoes with rubber, neoprene, or wood soles, rubber or neoprene overshoes

TABLE 6-1. CHECKLIST FOR THE SELECTION OF PROTECTIVE EQUIPMENT (Continued)

	Whole Body: coveralls, overalls, or liquid hazard suit of impervious materials
Mists, Vapors, Gases, Fumes, and Smoke	Eyes: goggles Face: plastic face shields for mists Respiratory: Immediately Dangerous to Life: self-contained apparatus Not Immediately Dangerous to Life: air line respirator, hose mask without blower, chemical cartridge respirator with filter for specific contaminant Fingers, Hands, and Arms: rubber, natural rubber, plastic synthetic fiber, coated glass fiber, or other chemical-resistant gloves or mittens, sleeves, protective creams Trunk: rubber, plastic, or other chemical-resistant material Knees, Legs, and Ankles: rubber, plastic, or other chemical resistant material Feet and Toes: conductive shoes (for explosive gases, vapors, or other materials)
Hot Materials	Fingers, Hands, and Arms: leather gloves, mittens, hand pads, or finger cots; leather, or flame resistant duck sleeves Trunk: leather aprons, coats, or jackets Knees, Legs, and Ankles: leather, or flame resistant duck pants, knee guards, shin guards, leggings, or spats Feet and Toes: wood soles
Heat	Head: cotton or wool cap Fingers, Hands, and Arms: leather aluminized fabrics, glass fiber insulated gloves, mittens, or hand pads; flame-resistant duck or reflective fabric (for radiant heat) sleeves

TABLE 6-1. CHECKLIST FOR THE SELECTION OF PROTECTIVE EQUIPMENT (Continued)

	Trunk: flame-resistant fabrics, aluminized fabrics for radiant heat Knees, Legs, and Ankles: flame-resistant duck, aluminized fabrics for radiant heat Feet and Toes: leather or wood soles, thermal insulated shoes Whole Body: aluminized garments for radiant heat, vortex tube with air cooled suits
Moisture and Water	Head: plastic-rubber hat Fingers, Hands, and Arms: rubber, oiled fabrics, plastic, coated glass fiber gloves, mittens or finger cots, rubber oiled fabrics, or plastic sleeves Trunk: rubber or plastic material Knees, Legs, and Ankles: rubber or plastic material Feet and Toes: nonskid shoes, leather or wood soles, rubber or neoprene overshoes Whole Body: garments of rubber, plastic, or other impervious material
Slips and Falls	Feet and Toes: nonskid shoes, wood soles, slip-resistant soles and heels (cord and cork)
Cuts and Abrasions	Head: hard hat Fingers, Hands, and Arms: leather, metal mesh, or cotton canvas gloves, mittens, hand pads, or finger cots, leather sleeves Trunk: leather or canvas fiber aprons, coats, or jackets Knees, Legs, and Ankles: leather or fiber metal pants, knee guards, shin guards, leggings, or spats Feet and Toes: steel box toe, wood soles
Dermatitis	Head: plastic-rubber hat, cotton or wool cap Face: plastic face shield, protective barrier creams

TABLE 6-1. CHECKLIST FOR THE SELECTION OF PROTECTIVE EQUIPMENT (Continued)

	Fingers, Hands, and Arms: rubber, synthetic rubber plastic or cotton gloves, protective barrier creams Trunk: rubber or plastic material Knees, Legs, and Ankles: rubber or plastic material Feet and Toes: rubber boots, wood soles, shower sandals (paper or wood)
Electricity and Electric Shock	Head: plastic-rubber or plastic hats (Class B) Fingers, Hands, and Arms: rubber gloves and sleeves resistant to 10,000 volts for three minutes Trunk: rubber material Knees, Legs, and Ankles: rubber material Feet and Toes: electrical hazard footwear
Explosives	Head: cap (flame retardant) Fingers, Hands, and Arms: gloves Trunk: powder uniform Feet and Toes: conductive shoes
Machinery	Head: cap (long hair), cotton or wool caps Fingers, Hands, and Arms: flame-resistant duck sleeves Trunk: rubber, plastic, or canvas fiber aprons, coats, or jackets Knees, Legs, and Ankles: fiber material or flame-resistant duck pants, knee guards, shin guards, leggings, or spats Feet and Toes: steel box shoes
Reflected Light and Glare	Eyes: goggles, spectacles with side shields with filter lenses
Welding	Head: leather skull cap Eyes: goggles-welders' eyecup, helmets, or hand shields with filter lenses Face: helmets or hand shields with filter lenses, face shield Hands: flame proof guantlet gloves

TABLE 6-1. CHECKLIST FOR THE SELECTION OF PROTECTIVE EQUIPMENT (Continued)

Radiant Energy (intense)	Eyes: helmets (filter lenses) with metal or plastic spectacles, hand shields (filter lenses) with metal or plastic spectacles Face: helmets or hand shields with filter lenses
X and Gamma Radiation	Fingers, Hands, and Arms: leaded rubber or leather gloves Trunk: leaded rubber or leather apron
Laser Radiation	Eyes: protective eyewear
Radioactive Aerosols and Gases	Respiratory: special respiratory devices Whole Body: radiation exposure suits of plastic or paper with special respirators
Noise	Ears: plug or insert, cup or muff, ear protectors, helmet
Liquid Oxygen (LOX)	Eyes: goggles, spectacles with side shields, plastic eye shields Face: plastic face shield Fingers, Hands, and Arms: leather gloves with insulated lining (welders' gloves) Whole Body: coveralls, rubber apron

6-1.3. TRAINING. Personnel shall be trained in the selection, use, inspection, and care of the PPE required for their work. Such training shall include explanations emphasizing the reasons for using the PPE under consideration. Personnel who maintain and/or issue PPE shall be trained in these functions to ensure that PPE users are provided with serviceable equipment designed for the particular hazard. Records of PPE training shall be maintained.

6-1.4. *EMPLOYEE RESPONSIBILITIES.* Employees shall use the provided PPE in accordance with instructions and training received. Employees shall guard against damage to PPE. Any malfunction of PPE shall be reported to supervisory personnel. Disciplinary action should be considered for non-use of required PPE.

6-1.5. MEDICAL EVALUATION. Personnel who are expected to use PPE that may cause physiological stress shall be evaluated by competent occupational health personnel in accordance with NAVMED-derived criteria to ensure that the employees are capable of withstanding such stress.

6-1.6. SPECIAL CLOTHING. Where employees are required to wear special protective clothing that necessitates changing from street clothes, a designated location for changing clothes shall be established and suitable clothing lockers provided. Special protective clothing worn on the job shall not be worn or taken away from the premises by employees, since this may expose both Navy and non-Navy personnel to unnecessary risk caused by contaminated clothing. The activity shall be responsible for cleaning and drying special clothing contaminated with or exposed to hazardous materials. Such cleaning may be accomplished on station or by contract.

6-1.7. MAINTENANCE OF PPE. PPE, including employee-owned PPE, shall be maintained in a sanitary and serviceable condition by qualified personnel.

6-1.7.1. Individual Use. PPE issued for exclusive use by an individual employee shall be visually inspected by the employee before each use. Such PPE shall be inspected frequently by supervisory personnel to ensure its serviceability.

6-1.7.2. Multiple Use. PPE subject to use by more than one individual, such as visitor's PPE or PPE used only occasionally, shall be cleaned and disinfected before being made available for use by subsequent personnel. Such cleaning and disinfecting is mandatory for PPE worn on or about the head and hands.

6-1.7.3. Emergency Use. PPE intended for emergency use shall be cleaned, disinfected, and placed in an operable condition after such use. Such equipment shall be inspected monthly to ensure its serviceable condition. Records shall be kept of these inspections.

6-1.8. STORAGE OF PPE. PPE shall be properly stored to protect against environmental conditions that might reduce the effectiveness of the equipment or result in contamination during storage. PPE having a shelf-life limitation shall be checked periodically to ensure that serviceable units are available.

6-2. EYE AND FACE PROTECTION

6-2.1. GENERAL. Suitable eye and face protectors shall be provided and used where machines or operations present the hazards of flying objects, liquids, injurious energies (glare, radiation, etc.), or a combination of these hazards. The selection, use, and maintenance of eye and face protectors shall be in accordance with ANSI Z87.1, "Practice for Occupational and Educational Eye and Face Protection", (NOTAL).

6-2.1.1. Maintenance. It is essential that eye and face protectors be kept clean. They shall be cleaned and inspected daily. Pitted or scratched lenses or face shields reduce vision and seriously reduce protection. Accordingly, lenses and face shields that are pitted or scratched shall be replaced. Slack, wornout, or sweat-soaked headbands, which may interfere with the proper use of goggles and face shields, shall be replaced.

6-2.2. FACE SHIELDS. Face shields shall be worn to protect the face and front of the neck from flying particles and sprays or splashes of hazardous liquids. Face shields shall not be worn as substitutes for eye protection. When face shields are required, they shall be worn over safety eyewear.

6-2.3. HOODS. Hoods providing face and eye protection by totally enclosing the worker's head are included in respiratory protection (see section 6-4).

6-2.4. SAFETY GLASSES

6-2.4.1. Approved Safety Glasses. Safety glasses (or spectacles) shall meet the impact requirements of ANSI Z87.1 (NOTAL). Eyewear meeting the Food and Drug Administration's criteria for impact resistance does not meet the ANSI requirements and shall not be worn in eye-hazardous areas or operations. Lenses and frames shall be marked with the manufacturer's symbol to indicated compliance with ANSI

Z87.1. The use of approved lenses in unapproved frames is not acceptable. Tinted lenses in safety glasses, including photo-grey lenses, are permissible only when prescribed for corrective purposes or specifically approved by cognizant medical authority.

6-2.4.2. Sideshields. Sideshields should be used on safety glasses worn in buildings or areas designated as eye-hazardous areas. Sideshields should also be used on safety glasses worn in eye-hazardous operations unless it has been specifically determined for a particular operation that it is not possible for injurious objects or energies to enter the wearer's eyes from the side or that the reduced peripheral vision would pose a greater hazard to the employee. Sideshields shall not be easily detachable from the frames; snap-on or slip-on types of sideshields are not acceptable unless secured.

6-2.4.3. Corrective Lenses. Personnel whose vision requires the use of corrective lenses and who are required to wear protective eyewear shall wear one of the following types of goggles or spectacles:

a. Spectacles whose protective lenses provide optical correction.

b. Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles.

c. Goggles that incorporate corrective lenses mounted behind the protective lenses.

6-2.4.4. Contact Lenses. The wearing of contact lenses in industrial environments is discouraged and should be prohibited. Contact lenses are not substitutes for protective eyewear; personnel wearing contact lenses must also wear eye protection when it is required by this manual. Contact lenses are prohibited in areas or operations required to have deluge showers or eye flushes. Contact lenses are further prohibited in areas or operations in which air contaminants are such that personnel must wear respiratory protection.

6-2.4.5. Single Eye Vision. All personnel, regardless of job classification or occupational exposure, who have effective vision in only one eye shall wear safety eyewear at all times while on duty. The wearing of safety eyewear while off duty shall be encouraged.

6-2.5. GOGGLES. Goggles or eyecups shall be worn to protect against impact, dust particles, liquids, splashes, mists, spray, and injurious radiations. They shall be designed to protect the eye sockets and the facial area

around the eyes, thus protecting the wearer from side exposure.

6-2.6. RADIANT ENERGY PROTECTION. Shaded filters for welding and foundry operations are covered in Chapter 12. Eye protection for laser operations shall be in accordance with ANSI Z136.1, "Safe Use of Lasers", (NOTAL).

6-3. HEARING PROTECTION. Hearing protection shall be accomplished in accordance with 29 CFR 1910.95 and with OPNAVINST 5100.23B (see paragraph 4-7.1).

6-4. RESPIRATORY PROTECTION

6-4.1. GENERAL POLICY. Respiratory protection equipment shall be required, provided, and used whenever the oxygen level in an atmosphere is less than 20 percent and/or whenever the airborne concentration of a contaminant or combination of contaminants exceeds the Permissible Exposure Limits (paragraph 4-3.2) as determined by qualified safety or health personnel. The selection and use of respiratory protective devices shall be in accordance with ANSI Z88.2, "Practice for Respiratory Protection", (NOTAL).

6-4.1.1. Control of the Hazard. The general policy for all PPE stated in subparagraph 6-1.1.3. is elaborated here as it applies to respiratory protection: In the control of occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, smokes, sprays, gases, and vapors, or a reduction in oxygen content, the primary objective shall be to prevent or control atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures such as enclosure or confinement of the operation, general and local ventilation, or substitution of less toxic materials.

6-4.1.2. Respiratory Protection Program. An activity Respiratory Protection Program shall be established at each activity where it has been determined by qualified safety or health personnel that respirators are required. The program shall be consistent with the general PPE requirements given in section 6-1 and with 29 CFR 1910.134(b). The following are minimum requirements for an activity Respiratory Protection Program:

a. Written SOPs for the selection and use of respirators shall be established. SOPs shall include procedures for emergency situations.

b. Respirators shall be selected on the basis of hazards to which personnel may be exposed (see subparagraph 6-4.3.3).

c. Where practicable, respirators shall be assigned to individual personnel for their exclusive use.

d. Respirators shall be regularly cleaned and disinfected. Equipment used by the same person shall be cleaned after each day's use or more often if necessary. Equipment used by more than one person shall be thoroughly cleaned and disinfected after each use. Respirators for emergency use shall be inspected monthly and records maintained.

e. Respirators shall be stored in convenient, clean, and sanitary locations.

f. Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced.

g. Appropriate surveillance of work area conditions and degree of employee exposure to stress shall be maintained.

h. Standby personnel and rescue equipment shall be provided in accordance with 29 CFR 1910.134(e)(3).

i. There shall be periodic inspection and evaluation to determine the continued effectiveness of the program.

j. Responsibility for an activity's Respiratory Protection Program shall be vested in one individual who shall have sufficient knowledge and authority to conduct the program properly.

6-4.1.3. Training. It is essential for the safe use of any respirator that the user be properly instructed in its selection, use, and maintenance. Both supervisors and employees shall receive training conducted by a competent person(s) that shall include the following:

a. Instruction in the nature of the hazard and an honest appraisal of what may happen if the respirator is not used or is used improperly.

b. An explanation of why more positive control is not immediately feasible.

c. A discussion of why the respirator selected is the proper type for the particular purpose.

d. A discussion of the respirator's capabilities and limitations.

e. Instruction and training in actual use of the respirator, including close supervision to ensure that the respirator continues to be properly used.

f. Classroom and field training to recognize and cope with emergency situations.

g. Other training as needed for special use.

h. An opportunity to handle the respirator, have it fitted properly, test its facepiece-to-face seal, wear it in normal air for a familiarity period, and wear it in a test atmosphere.

6-4.1.4. Medical Limitations. Personnel shall not be assigned to tasks requiring the use of respirators unless it has been determined that the personnel are physically able to both perform the work and use the equipment. The medical status of personnel using respirators shall be reviewed periodically.

6-4.2. RESPIRATORY HAZARDS. The degree of respiratory hazard, as it refers to the selection and classification of respirators, depends upon the atmospheric oxygen concentration, the contaminant's physical state, toxicity, and concentration; the presence of other contaminants or stress factors in the working environment; and worker exposure time and susceptibility. Respiratory hazards are generally classified, singularly or in combination as gas and vapor contaminants (immediately or not immediately dangerous to life or health), particulate contaminants (immediately or not immediately dangerous to life or health), and oxygen deficiencies. Each classification or combination requires a different degree of respiratory protection.

6-4.3. RESPIRATOR SELECTION

6-4.3.1. Respiratory Classification. Respirators are grouped into the following general classification according to mode of operation:

a. Atmosphere-supplying respirators

(1) Self-contained
(2) Supplied-air
(3) Combination self-contained and supplied-air

b. Air-purifying respirators

(1) Gas mask and chemical cartridge
(2) Particulate
(3) Combination gas mask or chemical cartridge and particulate

c. Combination atmosphere-supplying and air-purifying respirators

6-4.3.2. Respirator Description and Selection. Descriptions of respiratory protective devices and their limitations, and guides for the selection of the proper respiratory protective device for a given hazardous condition are in ANSI Z88.2.

6-4.3.3. Identification of Canisters and Cartridges. The identification of air-purifying canisters and cartridges shall be in accordance with 29 CFR 1910.1134(g) and with ANSI K13.1, "Identification of Air-Purifying Respirator Canisters and Cartridges", (NOTAL).

6-4.3.4. Approved Respirators. No respiratory protective device shall be worn in a respiratory hazard atmosphere unless it has a NIOSH approval for that particular atmosphere.

6-4.3.4.1. Military or Federal Specifications. Respirators (such as rocket propellant gas masks) procured under military or Federal specifications for protection against a contaminant or contaminants for which there is no NIOSH schedule may be used for specific applications with concurrence of the cognizant medical authority.

6-4.3.4.2. Military Masks. Military protective field masks designed and issued for protection against field concentrations of chemical, biological, and radiological warfare agents shall not be used in industrial applications unless they are also approved by NIOSH for such industrial use.

6-4.3.5. Issuance of Respirators. Only properly trained persons shall be permitted to issue respirators. The proper type of respirator for each respiratory hazard shall be listed in written SOPs (see paragraph 6-4.1.2a).

6-4.4. BREATHING AIR. Breathing air supplied to atmosphere-supplying respirators (see subparagraph 6-4.3.1a and c) shall meet the specification requirements for Type II, Grade B, or Type I, Grade D, breathing air as stated in Compressed Gas Association Pamphlet G-7-1, "Commodity Specification for Air", (NOTAL). Industrial compressed air systems which are used to supply breathing air for respirators shall meet the requirements of NAVFACINST 11300.24B, "Utilization of Industrial Compressed Air Systems for Supplying Breathing Air", (NOTAL). Breathing air compressors, cylinders or other containers shall meet the requirements of 29 CFR 1910.134(d).

6-4.5. RESPIRATOR FIT. Respirators shall be fitted to each respirator wearer in accordance with the respirator-fitting tests described in ANSI Z88.2 (NOTAL).

6-4.5.1. Facial Hair. A respirator equipped with a facepiece shall not be worn if facial hair comes between the sealing periphery of the facepiece and the face, or if facial hair interferes with respirator valve function. Additional requirements are in OPNAVINST 6240.6B, Safety and Health Considerations Affecting the Wear of Facial Hair", (NOTAL).

6-4.5.2. Eye and Face Protection. If a spectacle, either protective or corrective, goggle, face shield, or welding helmet must be worn with a respirator facepiece, it shall be worn so as not to adversely affect the seal of the facepiece to the face. The wearing of contact lenses shall not be allowed in atmospheres in which the level of contamination requires the use of respirators.

6-4.6. RESPIRATOR MAINTENANCE. Respirator maintenance shall be performed on a regular basis. A program for the maintenance of respirators shall include cleaning and sanitizing, inspection for defects, repair, and storage. Detailed requirements and procedures for respirator maintenance are in 29 CFR 1910.134(f) and in ANSI Z88.2 (NOTAL), which are incorporated by reference.

6-5. HEAD PROTECTION

6-5.1. HARD HATS. Hard hats shall be constructed, selected, used, and maintained in accordance with ANSI Z89.1, "Requirements for Protective Headwear for Industrial Workers," (NOTAL).

6-5.1.1. Proper Wearing of Hard Hats. A clearance of at least 1-1/4 inches shall be maintained between the top of the wearer's head and the shell of the hard hat.

6-5.1.2. Care of Hard Hats. Both the shell and the suspension of hard hats shall be kept clean and in good repair. Accessories such as chin straps and winter liners shall also be properly maintained. Holes shall not be drilled into the shell.

6-5.1.3. Painting of Hard Hats. Caution shall be exercised in the painting of hard hats. Some paints and thinners may damage the shell and reduce protection. The manufacturer of the hard hat should be consulted about paints. Only paints having high dielectric strength shall be applied to electrical workers' (Class B) hard hats.

6-5.2. BUMP CAPS. A bump cap is lightweight headgear intended to protect the wearer against injury while working in small spaces in which the wearer's movement might cause impact against fixed structures. Because a hard hat can be worn in most spaces in which a bump cap might be worn, the

availability of bump caps is discouraged. Bump caps shall not be worn in situations in which hard hats are required.

6-5.3. HAIR PROTECTION. Long hair, including long facial hair, which is susceptible to becoming entangled in moving machinery or drawn into such machinery by the generation of static electricity, shall be controlled by caps or hair nets. Long hair shall be confined in operations in which static electricity presents an ignition hazard such as atmospheres where explosive dusts or flammable gases and vapors may be present in ignitible concentrations.

6-6. SAFETY FOOTWEAR

6-6.1. GENERAL. Protection built into a shoe, i.e., steel toes, conductivity, nonslip, etc., can also be built into a boot. Unless otherwise noted, the term shoe as used herein includes boots. Procedures for the issue of safety footwear to military and civilian personnel is in OPNAVINST 5100.23B.

6-6.2 SAFETY-TOE FOOTWEAR. All safety footwear incorporating a toe box to protect the wearer's toes aginst impact or compression shall meet the requirements for the 75-pound classification of ANSI Z41, "Personnel Protection-Protective Footwear," (NOTAL). The use of toe caps or instep protectors that fit over shoes is prohibited as a substitute for issuing safety shoes. These caps and protectors are for use pending receipt of shoes for new employees or for use by occasional visitors within designated foot-hazardous operational areas.

6-6.2.1. Metatarsal Guards. Metatarsal guards that cover the instep and do not enclose the outsole of the shoe, or have straps fitting around the outsole, shall be used as necessary to protect the top of the foot from impact or compression. Metatarsal guards shall meet the strength requirements of ANSI Z41 (NOTAL).

6-6.2.2. Safety Toes in Other Safety Footwear. Navy-issued shoes of the types listed in paragraph 6-6.3 below shall include metal toe boxes, when applicable, which meet the requirements of ANSI Z41 (NOTAL).

6-6.3. OTHER SAFETY FOOTWEAR

6-6.3.1. Conductive Shoes. Conductive shoes are worn on grounded conductive floors to prevent the accumulation of static charges on the wearer. Conductive shoes or other conductive footwear shall be used and tested in accordance with NAVSEA OP-5 (NOTAL) or ANSI Z41 (NOTAL).

6-6.3.2. Nonsparking Shoes. Nonsparking shoes have nonferrous construction and are worn on nonconductive surfaces in atmospheres in which sparks would be hazardous.

6-6.3.3. Nonslip Footwear. Protection against slipping can be provided by rubber- or wooden-soled shoes. Wooden soles also protect against hot surfaces.

6-6.3.4. Steel Insoles. Steel insoles protect against punctures from sharp objects on the walking surface.

6-6.3.5. Nonconductive Shoes. Nonconductive shoes protect against electrical hazards. They shall be used and tested in accordance with ANSI Z41 (NOTAL).

6-6.3.6. Congress Shoes. Congress, or gaiter, shoes should be worn by employees exposed to splashes of molten metal. These shoes have no fasteners and can be easily and rapidly removed in an emergency.

6-7. PROTECTIVE CLOTHING

6-7.1. GENERAL. Protective clothing includes coveralls, aprons, sleeves, leggings, gloves, hand pads, finger cots, shoulder capes, and garments that enclose the entire body. These items are intended to protect the wearer against heat, cold, moisture, toxics, acids, corrosives, electricity, and physical hazards such as sharp objects, flying objects, excessive dust, grease, etc. Protective clothing is available in a variety of materials that must be matched to the particular hazard or hazards under consideration. Materials include leather, duck, plastic, rubber, aluminum, and refractory materials. If these materials are treated to provide additional protection, care must be taken to ensure that the treatment does not present a toxic hazard to the wearer. Heat-protective clothing incorporating asbestos shall not be used; other refractory materials shall be substituted for the asbestos.

6-8. OTHER PROTECTIVE EQUIPMENT

6-8.1. SAFETY HARNESSES, LANYARDS, LIFELINES, AND DROP LINES. Safety harnesses, lanyards, lifelines, and drop lines shall be used to protect against falls from elevations where it is impractical to provide standard guardrails or ladder cages. These devices shall meet the requirements of 29 CFR 1926.104. Additional requirements are in ANSI A10.14, "Requirements for Safety Belts, Harnesses, Lanyards, Lifelines, and Drop Lines for Construction and Industrial Use", (NOTAL).

6-8.1.1. Inspection and Care. Each harness and lanyard assembly shall be visually inspected for defects prior to each use. In addition, the assembly shall be inspected according to the manufacturer's recommendations at least semiannually. The date of the latest inspection shall be recorded on a tag permanently attached to the harness.

6-8.1.2. Disposal. Any lifeline, safety harness, or lanyard actually subjected to inservice loading, including impact load testing, shall be immediately removed from service and shall not be used again for personnel safeguarding. Equipment subjected to testing may be used for display and training purposes; others shall be destroyed.

6-8.1.3. Body Belts and Straps. Linemen's body belts and pole straps, window washer's belts or safety ladder belts are not covered by 29 CFR 1926.104 or ANSI A10.14 (see paragraph 6-8.1). These belts differ from the equipment covered in ANSI A10.14 in that they are used to restrain a person in a hazardous work position and to reduce the probability of falls; they are not normally subjected to impact loading caused by arresting a free fall. These belts and straps shall be inspected, tested and used in accordance with the manufacturer's recommendations.

6-8.2. SAFETY NETS. Safety nets shall be used when personnel are working 25 feet or more above ground, water, machinery, or any other solid surface, and when it is not practicable to install standard guardrails or to use safety harnesses, lanyards, lifelines or drop lines. Safety nets shall be certified by the manufacturer and shall have a label of proof test indicating that the net can withstand a 17,500 foot-pounds minimum impact resistance as determined by the manufacturer. Edge ropes shall provide a minimum breaking strength of 5,000 pounds. Safety nets shall be inspected and used in accordance with 29 CFR 1926.105. Additional requirements are in ANSI A10.11, "Minimum Requirements for Safety Nets", (NOTAL).

6-8.2.1. Mesh Sizes. The maximum size of mesh shall not exceed 36 square inches or be longer than 6 inches on any side measured center to center. Personnel shall not be permitted underneath safety nets unless the net has mesh small enough, and of sufficient strength, to prevent tools or materials from passing through the net.

6-8.2.2. Installation. Safety nets shall be installed under the working level as close as practical, but in no case more than 25 feet from the working level. Nets shall be hung with sufficient clearance to prevent contact with the surface or structure below should a load be placed in the net. Safety nets shall extend outward at least 8 feet horizontally from the outermost projection at the working level. When two or more nets are secured together to form a larger unit, they shall be laced at not more than 6-inch intervals with a lacing material equal in strength to the net ropes.

6-8.2.3. Inspection. All safety nets, mesh ropes, perimeter ropes, connectors, etc., shall be completely inspected by a qualified person after each installation, and weekly thereafter. Additional inspections shall be made after alterations, repair, impact loading, and welding or cutting operations above the nets. Nets that show mildew, wear, damage, or significant deterioration shall be immediately removed from service for complete inspection and repair or disposal.

6-8.2.4. Care, Maintenance, and Storage. Care, maintenance, and storage of safety nets shall be in accordance with the manufacturer's recommendations. Debris shall be removed from safety nets at least daily. Combustible materials on nets shall be removed from ignition sources or before welding, cutting, or other operations likely to produce sparks or hot slag. Special precautions shall be taken to shield ropes of 1/2-inch diameter and smaller from the sun's rays, keeping nets as clean and free of sand as possible, and preventing prolonged contact of nets with rusting iron, or steel rods or hooks.

6-8.3. ELECTRICAL PROTECTION. Rubber gloves, insulating blankets, matting, linehose, hoods, and sleeves shall be used to protect personnel against electrical hazards. Rubber insulating devices shall be tested and used in accordance with paragraph 13-2.2.

6-8.4. LIFESAVING EQUIPMENT

6-8.4.1. Personal Flotation Devices. Employees working over or near water where the danger of drowning exists shall wear personal flotation devices approved by the U. S. Coast Guard. Prior to each use, personal flotation devices shall be inspected for dry rot, chemical damage, or other defects that may affect their strength and buoyancy. Defective devices shall be destroyed.

6-8.4.2. Life Rings. At least three 30-inch life rings, with lines at least 90-feet long attached, shall be kept in easily visible and readily accessible places aboard each ship afloat on which work is being performed. The life rings shall be located one forward, one aft, and one at the gangway. At least one life ring with line shall be provided on each staging float, barge, scow, raft, or lighter which is along side a vessel being worked. In addition, on pier and waterfront areas, 30-inch life rings, with lines at least 90-feet long attached, shall be placed at not more than 200-foot intervals.

6-8.4.3. Ladders and Skiffs. A ladder, either portable or permanent, extending below the mean low water level shall be provided in the vicinity of working ships afloat to assist

personnel to reach safety in the event they fall into the water. In lieu of a ladder, a lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

CHAPTER 7

FIRE PREVENTION

7-1. GENERAL. Fire prevention at NAVAIRSYSCOM shore activities shall be accomplished in accordance with NAVMATINST 11320.14, "Naval Shore Activities Fire Prevention Program", (NOTAL). The instruction requires that each Naval shore activity implement a Fire Prevention Program via a Station Fire Bill.

7-1.1. FIRE PREVENTION PROGRAM. NAVMATINST 11320.14 requires the following elements to be included in an activity Fire Prevention Program:

a. Fire hazard identification and abatement

b. Fire safety education

c. First-aid fire suppression training

d. Tests and maintenance of alarm, detection, and suppression systems

e. Issuance of hot work permits

f. Review of structure modification and new construction plans and proposals

g. Fire safety consultations

h. Development of fire bills

i. Conducting evacuation drills

j. Inspection and maintenance of firefighting hydrants and water supply systems.

7-1.2. STANDARDS

7-1.2.1. OSHA Standards. NAVMATINST 11320.14, in accordance with OPNAVINST 5100.23B, adopts OSHA fire protection standards as minimum Navy standards. The OSHA fire-related standards are in the following subparts which are hereby incorporated by reference:

a. 29 CFR 1910 - Subpart E, Means of Egress; Subpart H, Hazardous Materials; Subpart L, Fire Protection; and Subpart Q, Welding, Cutting and Brazing.

b. 29 CFR 1915 - Subpart C, Surface Preparation and Preservation; and Subpart D, Welding, Cutting and Heating.

c. 29 CFR 1926 - Subpart F, Fire Protection and Prevention; and Subpart J, Welding and Cutting.

7-1.2.2. NFPA Codes. In the absence of DOD, Navy or OSHA regulations governing a specific situation, NAVMATINST 11320.14 requires conformity with current National Fire Codes published by the National Fire Protection Association (NFPA).

7-1.2.3. Interpretations. NAVMATINST 11320.14 assigns to Naval Facilities Engineering Command responsibility for providing interpretation of DOD construction criteria, NAVFAC Design Manuals, and NFPA Fire Codes. Initial inquiries should be directed to the servicing Engineering Field Division.

7-1.3. CHAPTER COVERAGE. This chapter contains general, basic requirements from the regulations adopted by NAVMATINST 11320.14. Detailed requirements can be found in specific references made within the chapter or in the publications referenced in paragraph 7-1.2. Fire hazards associated with flammable and combustible materials are discussed in Chapter 5 of this manual; fire hazards from welding and other hot work operations are discussed in Chapter 12. This chapter does not address the following fire protection areas which are covered in NAVMATINST 11320.14:

a. Fire bills

b. Smoking

c. Portable heat producing equipment and open flame devices

d. Vegetation control

e. Open burning

f. Access to/for fire equipment

g. Education and training

h. Vacant structures

i. Fireworks

j. Fire protection equipment

k. Places of assembly

l. Fire safety inspections

m. New construction/modification project review

7-2. GENERAL REQUIREMENTS

7-2.1. NOTIFICATION OF FIRE DEPARTMENT. The Fire Department shall immediately be notified whenever any fire occurs in any building or premises, except for controlled fires which are part of normal operational procedures.

7-2.2. FIREFIGHTING. Arrangements shall be made to permit rapid entry into the premises by the fire department or other authorized and trained firefighting personnel. Other emergency organizations, where provided, shall be trained in the following minimum procedures:

a. Emergency evacuation and summoning outside help in an emergency

b. Using hand extinguishers and hose lines on small fires

c. Operating sprinkler or other fire protection systems

d. Using material handling equipment

e. Monitoring fire protection system valves after system is turned off so that system may be reactivated if rekindling occurs.

7-2.3. FIRE PROTECTION EQUIPMENT. Fire protection equipment appropriate for existing hazards and consistent with 29 CFR 1910, Subpart L, shall be provided in workplaces. The equipment shall be maintained in proper operating condition, and personnel shall be trained in its use. Tampering with fire protection equipment, or creating conditions which adversely affect efficient utilization, shall be prohibited. Specific standards for fire suppression systems and extinguishing agents are contained in NAVFAC DM-8 (NOTAL). The Fire Department shall be immediately notified whenever any fixed fire extinguishing, fire warning, or standpipe system is inoperative. The Fire Department shall also be notified when service is restored.

7-2.4. FIRE DOORS. Fire doors shall be kept closed at all times unless provided with approved automatic closing devices. Nothing shall be placed on or near a fire door which will prevent the door from closing tightly in a fire emergency. Combustible material shall not be stored or placed within three feet of either side of any fire door.

7-3. **FIRE ALARM AND DETECTION SYSTEMS.** Detailed requirements for fire alarm and detection systems are in 29 CFR 1910.164 and 165, and in NAVFAC DM-8, "Fire Protection Engineering", (NOTAL), which are hereby incorporated by reference.

7-4. FIRE SUPPRESSION SYSTEMS AND EXTINGUISHING AGENTS

7-4.1. GENERAL. The selection of proper fire suppression equipment, either fixed or portable, and the extinguishing agents to be employed is dependent on a number of variables. Each system and agent has its characteristic advantages and disadvantages. This section contains general requirements for fire extinguishing systems; more detailed requirements are in the regulations and standards referenced in this section.

7-4.2. PORTABLE FIRE EXTINGUISHERS

7-4.2.1. Classification. Portable fire extinguishers are classified according to the type(s) of fire they are designed to extinguish. Fire classes A, B, C and D are defined in Appendix A.

7-4.2.2. Accessibility. Portable fire extinguishers shall be conspicuously located along normal paths of travel so as to be readily accessible and immediately available in the event of fire. They shall not be obstructed or obscured from view. Portable fire extinguishers which are not in wheeled units shall be properly installed in a cabinet or mounted on a wall.

7-4.2.3. Distribution. The following factors determine the number and placement of fire extinguishers needed to protect a facility:

a. Area and arrangement of the building or occupancy

b. Severity of hazard

c. Anticipated classes of fires

d. Maximum distances to be traveled to reach extinguishers for each class of fire:

(1) Class A - 75 feet from any place in the work area (100 feet for construction/demolition operations);

(2) Class B - 50 feet from Class B hazards;

(3) Class C - Placement based on appropriate pattern for existing Class A and B hazards; and

(4) Class D - 75 feet from any combustible metal working area.

7-4.2.4. Inspection, Maintenance and Testing. Portable fire extinguishers shall be visually inspected monthly. Such inspection shall include serviceability, access, evi-

dence of physical damage, broken seals, gauge pressure, legibility of operating instructions, etc. The inspector shall initial and date the card attached to the extinguisher for this purpose. Annual maintenance checks shall be performed on each extinguisher to assure that it will function as expected in an emergency. Items to be checked include internal fittings, devices and agent supplies. Hydrostatic tests shall be conducted in accordance with 29 CFR 1910.157(f).

7-4.2.5. Training. All personnel shall be trained in the operation of the fire extinguishers in their work areas. Such training shall include the limitations of fire extinguishers and shall emphasize the evacuation of personnel and the notification of the Fire Department.

7-4.2.6. References. Detailed requirements for selection, distribution and installation of portable fire extinguishers are given in 29 CFR 1910.157, and in NFPA 10, "Standard for Portable Fire Extinguishers", (NOTAL), which are hereby incorporated by reference. Requirements for extinguishers for construction operations are in 29 CFR 1926.150, which are also incorporated by reference.

7-4.3. *STANDPIPES. Standpipes and hose systems shall be* installed, maintained and operated in accordance with NAVFAC DM-8, 29 CFR 1910.158, and NFPA 14, "Standard for the Installation of Standpipe and Hose Systems", (NOTAL).

7-4.4. FIXED EXTINGUISHING SYSTEMS. Fixed extinguishing systems shall be installed in accordance with NAVFAC DM-8. They shall be inspected and maintained in accordance with NAVFAC MO-117, "Maintenance of Fire Protection Systems", (NOTAL). Additional requirements and safeguards for the use of fixed systems are in 29 CFR 1910.159 to .163, which are incorporated by reference. The following NFPA publications contain additional details on fixed extinguishing systems and are incorporated by reference (see Appendix B for complete titles):

a. NFPA 11, Foam Extinguishing Systems (NOTAL)

b. NFPA 11A, Medium and High Expansion Foam Systems (NOTAL)

c. NFPA 12, Carbon Dioxide Systems (NOTAL)

d. NFPA 12A, Halon 1301 Systems (NOTAL)

e. NFPA 12B, Halon 1211 Systems (NOTAL)

f. NFPA 13, Sprinkler Systems (NOTAL)

g. NFPA 15, Water Spray Fixed Systems (NOTAL)

h. NFPA 16, Foam-Water Sprinkler and Spray Systems (NOTAL)

i. NFPA 17, Dry Chemical Systems (NOTAL)

7-5. FIRE PROTECTION IN SPECIFIC WORK SITUATIONS

7-5.1. WELDING AND CUTTING OPERATIONS. Fire protection requirements peculiar to welding and cutting operations are given in Chapter 12.

7-5.2. STORAGE AREAS. Storage areas, including those associated with construction operations, shall be maintained in accordance with DOD 4145.19-R-1, "Storage and Materials Handling", (NOTAL).

7-5.3. PAINTING OPERATIONS. The use of paints, cleaners, solvents, and other finishing materials which contain flammable solvents involves a marked fire hazard. Suitable fire extinguishing equipment shall be immediately available in the work area and shall be maintained in a state of readiness for instant use. Fire-preventive measures associated with painting operations are contained in section 5-4.

7-5.4. ELECTRICAL WORK

7-5.4.1. Fire Protection. The following requirements are applicable where work with electricity is being carried on:

a. Gasoline, naphtha, alcohol and similar flammable fluids shall never be used for cleaning either energized or deenergized electrical apparatus or for cleaning near electrical equipment from which a spark might be received.

b. Electrical machinery shall be kept free of oil, grease, and carbon dust.

c. Carbon dioxide or other Class C fire extinguishing equipment shall be maintained at hand and ready for instant use.

7-5.4.2. Firefighting. When a fire occurs, electrical equipment shall be turned off and the line circuits deenergized. In case of cable fires, the burning portion of the cable shall be cut and separated.

7-5.4.3. Fires in Generators or Motors. The following actions shall be taken in the case of fires in generators or motors:

a. Burning equipment shall be deenergized and speed reduced as quickly as possible.

b. Blowers shall be secured (if equipment has motor-driven ventilating blowers).

c. Burning equipment shall not be exposed to steam or water unless approved by the Fire Chief.

7-5.4.4. Firefighting Equipment. Extreme care shall be exercised to select the proper type of equipment to combat electrical fires. Only Class C fire extinguishers are permitted for first-aid firefighting of electrical fires. The stream from such extinguishers is nonconductive and can be directed against energized circuits without danger of shock. Fixed fire extinguishing systems may utilize water spray or fog installations approved for such use. Trained firefighting personnel may use water spray or fog devices when it is deemed necessary.

7-5.4.5. Inspection Before Current is Restored. If electrical wiring or apparatus has been affected by fire, a careful inspection shall be made before current is restored.

7-5.5. LAND TRANSPORTATION ACTIVITIES

7-5.5.1. General Precautions in Railroad Operations. Gasoline and other flammable liquids shall never be used to clean or wipe engines. At no time shall railroad equipment be left standing so that it obstructs the access of fire-fighting apparatus to a fire hydrant.

7-5.5.2. Preventing Fires in Internal-Combustion Locomotives. During any fuel transfer operation, fuel tanks shall be bonded and grounded. At all other times, fuel openings shall be kept closed. Internal-combustion locomotives shall be equipped with firefighting appliances of the type approved for use in Class B and Class C fires (see Fire Classes in Appendix A).

7-5.5.3. Fire Protection of Tank Vehicles. Tank vehicles shall not be operated unless they are in proper repair, devoid of accumulations of grease, oil, or other flammables, and free of leaks. Dome covers shall be closed and latched while the tank vehicle is in transit. Each tank vehicle shall be provided with at least one portable fire extinguisher having at least a 20-B:C rating. When more than one extinguisher is provided, each shall have at least a 10-B:C rating. In lieu of the above, each tank vehicle manufactured after January 1, 1980, shall be provided with at least one portable fire extinguisher having at least a 2-A, 20-B:C rating. Additional details for tank truck operations are in NFPA 385, "Recommended Regulatory Standard for Tank Vehicles

for Flammable and Combustible Liquids", (NOTAL), which is incorporated by reference.

7-5.5.4. Fire Protection at Service Stations. Each service station shall be provided with at least one fire extinguisher having a minimum classification of 20-B:C. Equipment shall be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service room. Emergency power cutoff shall be provided at a location remote from dispensing devices and identified as such.

7-5.5.5. Fire Protection in Property-Carrying Motor Vehicles. Drivers shall be instructed in emergency procedures for fires. A vehicle used to transport hazardous materials shall be equipped with a fire extinguisher having a listed rating of 10-B:C or higher. A vehicle used to transport general cargo shall be equipped with a fire extinguisher having a listed rating of 5-B:C or higher, or two fire extinguishers, each with a listed rating of at least 4-B:C. Extinguishers shall be securely mounted in brackets or stored in suitable compartments. Additional requirements for trucks are in NFPA 512, "Standard for Truck Fire Protection", (NOTAL), which is incorporated by reference.

7-5.6. CONSTRUCTION/DEMOLITION WORK

7-5.6.1. General Requirements. A fire protection program shall be developed and followed throughout all phases of construction and demolition operations. It shall provide for firefighting equipment. The type, amount and distribution of firefighting equipment for construction or demolition projects shall be determined by the station Fire Chief consistent with the station Fire Bill and 29 CFR 1926, Subpart F. Firefighting equipment requirements shall be reviewed as necessary to account for changing conditions as the project progresses.

7-5.6.2. Access to Firefighting Equipment. Access to all available firefighting equipment shall be maintained at all times. Equipment shall be conspicuously located, periodically inspected, and maintained in operating condition (see subparagraph 7-4.2.4). Defective equipment shall be replaced immediately. As specific fire hazards are introduced there shall be no delay in providing the necessary equipment.

7-5.6.3. Water Supply. A temporary or permanent water supply shall be made available as soon as combustible materials accumulate at the worksite. The water supply shall have sufficient volume, duration, and pressure to properly operate the firefighting equipment. Where underground water mains serve this purpose, they shall be installed as soon as practicable.

7-5.6.4. Fixed Firefighting Equipment. Installation of automatic sprinkler systems (if provided in the building being constructed) shall proceed as expeditiously as possible. During demolition operations, existing automatic sprinkler installation shall be retained in service as long as possible. The interruption of service for modification of sprinkler systems shall be of as brief a duration as possible. Sprinkler control valves shall be checked daily to ascertain that protection is in service. Standpipes shall be installed as soon as possible in all structures requiring them. They shall be maintained to ensure full readiness in fire protection. They shall have conspicuously marked Siamese fire department connections at street level and on the outside of structures. There shall be at least one standard hose outlet at each floor for attaching a fire department hose.

7-5.6.5. Fire Alarm Devices. An alarm system (e.g., telephone system, siren, etc.) shall be established at the construction/demolition site. It shall permit immediate notification of the Fire Department in case of emergency. The alarm code and reporting instructions shall be conspicuously posted at phones and at entrances to the site.

7-5.6.6. Fire Cutoffs. Firewalls and exit stairways called for in the completed buildings shall be given construction priority. Fire doors, with approved closing devices, shall be hung on openings as soon as practicable. In buildings undergoing alterations or demolition, fire cutoffs shall be retained until operations necessitate their removal.

7-5.6.7. Temporary Buildings. No temporary building shall be erected where it will adversely affect the means of egress (see section 3-3). When erected within another building or structure, temporary buildings shall be either of noncombustible construction or have a 1-hour fire resistance rating. Outside temporary buildings shall be located no closer than 10 feet from another building or structure.

7-5.6.8. Building Occupancy. No part of any building or structure under construction or undergoing repairs or alterations shall be occupied unless all fire protection devices are operating and all required means of egress are available in the part of the building to be occupied.

7-5.7. AVIATION-RELATED ACTIVITIES. The following general precautions and preventive measures are specific to activities in and around the hangar and shop areas:

a. Lanes suitable for firefighting equipment shall be clearly marked and kept clear.

b. Smoking or open flames shall not be permitted within 50 feet of parked aircraft, hangars, bays, etc.

c. Aircraft fuel trucks (whether loaded or empty) shall be prohibited from entering hangars or other buildings not designated as fueling areas. Aircraft oil trucks may enter hangars during inclement weather provided that fire protection is available.

d. Open flame or element space heaters shall not be used in any part of a hangar. In no case shall heaters be permitted in locations where concentrations of flammable or explosive substances are present.

e. Aircraft shall be electrically grounded during all maintenance evolutions. Tie down chains do not provide adequate ground path and shall not be used to ground aircraft.

f. Whenever possible, aircraft fuel tanks shall be filled, purged or have an inert gas over the fuel in the tanks before storing airplanes in hangars, since this leaves no space for explosive vapors to form.

7-5.7.1. Painting and Dope/Finishing Room Procedures. All equipment shall be grounded by a flexible cable attached to the work at one end, and to an approved ground connection at the other. Solvents and other flammables in the shop shall not exceed the amount necessary for 1 working day within the limitations of subparagraph 5-3.5.4.1. Containers in excess of 1 gallon shall be stowed in approved areas.

7-5.7.2. Fire Precautions During Aircraft Maintenance. All personnel engaged in aircraft maintenance shall be instructed in the basics of fire prevention. They shall also be trained in the operation of portable fire extinguishers and hose line systems provided in the workplace. Selected personnel on each operational shift shall be trained in the operation of fixed fire protection systems. Detailed requirements for aircraft maintenance operations are in NFPA 410, "Standard on Aircraft Maintenance", (NOTAL).

7-5.7.3. Storing Aircraft in Hangars/Buildings During Storm Alerts. Approaching hurricanes/storms demand that aircraft be moved inside to provide proper protection. These emergencies often require the use of all available space. Many of the areas utilized may have open-type motors, generators, lights, switches, and similar electrical devices installed. Care shall be exercised to place aircraft in a manner that will minimize the hazard of fuel leaking from the aircraft into or near the ignition-producing apparatus. During such storage, any open flames shall be extinguished. Appropriate

steps shall be taken to contain and/or prevent the spreading of fuel from known leaks.

7-5.8. SHIP REPAIR AND OVERHAUL. Fire protection for ships undergoing repairs or overhaul shall meet the requirements of 29 CFR 1915 and of NAVSEAINST 5100.16, "Fire Protection Requirements for Surface Ships Overhaul", (NOTAL), or NAVSEA 0902-018-2010, "General Overhaul Specification for Deep Diving Submarines", (NOTAL). Ship repair at private yards shall meet the fire protection requirements of NAVSEA 0900-LP-5010, "Ship Repair Contracting Manual", (NOTAL).

7-5.9. LONGSHORING AND WATERFRONT OPERATIONS. Fire protection facilities on piers and wharves shall be in accordance with 29 CFR 1917 and with NAVFAC DM-25, "Waterfront Operational Facilities", (NOTAL), and NFPA 87, "Standard for the Construction and Protection of Piers and Wharves", (NOTAL). The handling of hazardous cargo requires additional fire protection measures. Such measures shall be in accordance with 49 CFR 176 and 29 CFR 1918.86. Explosives cargo handling shall be in accordance with NAVSEA OP-5, "Ammunition and Explosives Ashore", (NOTAL).

CHAPTER 8

FIRED AND UNFIRED PRESSURE VESSELS AND HEATING AND COOLING EQUIPMENT

8-1. GENERAL. All fired and unfired pressure vessels shall be constructed, tested and maintained in accordance with the American Society of Mechanical Engineers (ASME), "Boiler and Pressure Vessel Code", (NOTAL) which is hereby incorporated by reference. The following National Fire Protection Association standards for fired pressure vessels and heating and cooling systems (see Appendix B for complete titles) are also incorporated by reference:

a. NFPA 31, Oil Burning Equipment (NOTAL).

b. NFPA 85A, Oil and Gas-Fired Single Burner Boiler-Furnaces (NOTAL).

c. NFPA 85B, Furnace Explosions in Natural Gas-Fired Multiple Burner Boiler-Furnaces (NOTAL).

d. NFPA 85D, Fuel Oil-Fired Multiple Burner Boiler-Furnaces (NOTAL).

e. NFPA 85E, Pulverized Coal-Fired Multiple Burner Boiler-Furnaces (NOTAL).

f. NFPA 85F, Pulverized Fuel Systems (NOTAL).

g. NFPA 85G, Implosions in Multiple Burner Boiler-Furnaces (NOTAL).

h. NFPA 86A, Ovens and Furnaces (NOTAL).

i. NFPA 86B, Industrial Furnaces (NOTAL).

j. NFPA 86C, Industrial Furnaces - Special Processing Atmospheres (NOTAL).

k. NFPA 86D, Industrial Vacuum Furnaces (NOTAL).

1. NFPA 90A, Air Conditioning and Ventilation Systems (NOTAL).

m. NFPA 90B, Warm Air Heating and Air Conditioning (NOTAL).

8-2. COMPRESSED AIR

8-2.1. AIR COMPRESSORS. This section includes general information concerning safe operation of air compressors and

specific information on air compressor pipelines. Requirements for compressed air used with respiratory protective devices are in section 6-4.

8-2.1.1. General

a. Intake air shall be cool and free from flammable or toxic gases, vapors, or dusts. The air intake pipe should be installed so that there will be no pockets for the accumulation of oil, water or other foreign matter.

b. Wood or other flammable materials shall not be permitted to remain in contact with the air discharge pipe.

c. A compressor shall be immediately secured if the temperature of the air discharged from any stage rises unduly or exceeds 400 degrees Fahrenheit.

d. A stop or check valve between the compressor and receiver shall not be installed unless a relief valve is also fitted between the compressor and the stop or check valve.

e. Every air receiver shall be equipped with an indicating pressure gauge. Pressure gauges shall never be rendered inoperative except when they are to be removed for a valid reason.

f. Hoses shall not be kinked to stop air flow. Hose clamps shall be kept tight.

8-2.1.1.1. Starting and Running. Personnel shall inspect the safety valves, pressure valves, unloaders, governors, and regulators when starting an air compressor. Operating personnel shall not leave the compressor station after starting the compressor unless the control, unloading, and governing devices are working properly. An air compressor shall not be run faster than the speed recommended by the manufacturer.

8-2.1.1.2. Lubrication. Air compressors shall be lubricated regularly using only the proper grade oil as recommended by the manufacturer. Excessive application of oil shall be avoided. Only oils that have high flash points shall be used to lubricate the air cylinders of air compressors. If the formation of excessive carbon is detected at the discharge pipe, the cylinders, valves, and discharge pipe should be cleaned out.

8-2.1.1.3. Cleaning. Compressors, intake filters, tanks, and piping systems shall be maintained in a clean condition to prevent oil-vapor explosion. Only soapy water or a suitable nontoxic, noncombustible solution shall be used for

cleaning compressor intake filters, cylinders, or air passages.

8-2.1.1.4. Adjustment and Repair. The motor shall be turned off and the motor switch shall be locked in the off position before making adjustments and repairs on an air compressor. Before working on or removing any part of a compressor, personnel shall make certain that the compressor cannot be started automatically or by accident, that air pressure is completely relieved, and that all valves between the compressor and receivers are closed.

8-2.1.1.5. Air-Compressor Pipelines. The following precautions shall be observed to minimize explosion hazards in air-compressor pipelines.

a. Compressed air systems shall be inspected frequently for oil contamination or whenever there is reason to suspect contamination. Contaminated piping or components shall be immediately cleaned in accordance with existing procedures.

b. Moisture separators, interstage separators, air flasks, and receivers shall be drained frequently to prevent moisture and possible lubricant carry-over.

c. Rapid manipulation of manual valves shall be avoided to prevent the sudden compression of air in an empty line or vessel.

d. The compressor discharge shall be inspected for black, sooty deposits. If such conditions are found, measures shall be undertaken to restore the system to an oil-free condition.

e. The application of heat to the system in the vicinity of hot work shall be avoided.

f. Care shall be taken to avoid striking a blow on any pressurized part of the system.

g. The system shall be monitored and gauge readings recorded to ensure that excessive temperatures do not occur.

h. When pressure gauges must be removed for calibration or any other reason, the gauge valve shall be shut and the root valve left open. Before replacing the gauge, the root valve shall be shut off and the gauge installed; then the gauge valve shall be opened followed by the root valve.

i. High-pressure gauges shall never be tested in a dead weight tester that uses oil as a fluid. Gauges shall be tested in a comparator-type tester or in a dead weight tester using distilled water.

j. Air-compressor pipelines through which hot air passes shall be kept cleaned.

k. When shutting down a compressor in freezing weather, all jacket and cooler drains shall be opened.

l. Piping systems shall be painted in accordance with MIL-STD-101B, "Color Code for Compressed Gas Cylinders and Pipelines", (NOTAL).

8-2.1.2. Charging Ship's Air Systems. Charging a ship's air system from a shore system shall be done in accordance with NAVSEA 0901-LP-490-0003 (NSTM 551), "Compressed Air Plants", (NOTAL).

8-2.2. AIR RECEIVERS. An air receiver shall not be operated at a pressure higher than the maximum allowable working pressure. Compressed air shall not be used to accelerate the flow from containers of oil, gasoline, or other fluids.

8-2.2.1. Cleaning and Repairing. All safety valves shall be tested frequently to determine whether they are in good operating condition. Repairs shall never be made while the receiver is under pressure.

8-2.2.1.1. Drain Valve. The drain valve shall be opened and the receiver completely drained at such intervals as to prevent the accumulation of excessive amounts of liquid.

8-2.2.1.2. Precautions When Cleaning. When air receivers are large enough to admit an employee through a manhole opening, the manhole covers shall be completely removed. Personnel entry shall be accomplished in accordance with NAVSEA S6470-AA-SAF-010, (NOTAL). Flammable or combustible liquids shall not be used as solvents to remove deposits.

8-2.2.2. Portable Air Receivers and Other Unfired Pressure Vessels. Portable air receivers and unfired pressure vessels shall be inspected in accordance with NAVFAC MO-322, "Inspection of Shore Facilities", (NOTAL).

8-2.2.2.1. Setting Relief Valves. The relief valves on the portable receivers and vessels shall be set to the safe working pressure of the receivers and vessels or set to the lowest safe working pressure of the systems, whichever is lower.

8-2.2.3. Reference. Additional requirements for air receivers in 29 CFR 1910.169 are incorporated by reference.

8-2.3. OTHER EQUIPMENT. Careful attention to control valves, hose, nozzles, and strict adherence to correct operating procedures shall be maintained. Work areas must

be adequately lighted and have emergency exits. Pneumatic-powered tools shall be designed and operated in accordance with subparagraph 11-3.3.2.

8-2.4. CONSTRUCTION OPERATIONS. Construction operations in tunnels, caissons, and similar environments involving compressed air shall be done in accordance with 29 CFR 1926, Subpart S.

8-3. COMPRESSED GAS

8-3.1. GENERAL. The requirements for compressed gases in this section are general in nature and address the hazards and control measures pertinent to gases under pressure. The handling, storage and utilization of all compressed gases in cylinders, portable tanks, rail tankcars, or motor vehicle tanks shall be in accordance with 29 CFR 1910.101(b), which references Compressed Gas Association Pamphlet P-1, "Safe Handling of Compressed Gases in Containers", (NOTAL). Because most exposures to compressed gases in the Navy are to gases in cylinders, the remainder of this section primarily addresses compressed gas cylinder requirements. Additional safeguards required by the gases themselves are addressed in the following chapters and publications:

Toxics - Chapter 4

Flammables and Combustibles - Chapter 5

Welding Operations - Chapter 12

Medical Use - NAVMED publications

8-3.2. HANDLING COMPRESSED GAS CYLINDERS

a. Cylinders shall not be dropped, struck, or permitted to strike each other or any other object violently. Upright cylinders shall be secured to prevent falling.

b. When transporting cylinders by a crane or derrick, a cradle, boat, or suitable platform shall be used. Slings or electric magnets shall not be used for this purpose.

c. Caps provided for valve protection should be kept on cylinders except when cylinders are in use.

d. Activities shall not fill compressed gas cylinders unless specifically authorized by the Public Works Officer. Gases shall not be mixed in a cylinder.

e. Cylinders shall not be used for any purpose other than to carry gas.

f. Personnel shall not tamper with the safety devices in valves or cylinders.

g. Cylinder valves shall be opened slowly by hand or with tools provided or approved by the gas manufacturer.

h. Thread connections shall not be forced.

i. Regulators and pressure gauges provided for use with a specific gas shall not be used on cylinders containing different gases.

j. Cylinders or valves shall not be altered.

k. Valves clogged with ice shall be thawed with warm, but not boiling, water; boiling water will melt fusible plugs and vent the cylinder. Valves shall not be permitted to be clogged by accumulations of paint or dirt.

l. Cylinders and their components shall be operated and handled in a nonhazardous manner away from sources of ignition and flammable substances, including oily or greasy materials and surfaces.

m. Leaking cylinders shall be taken outdoors and slowly emptied (see paragraph 8-3.6). An appropriate warning shall be provided advising of the ignitability hazard.

n. When the pressure gauge falls below 25 p.s.i., the cylinder shall be marked "EMPTY" or "MT" and shall be removed from service and kept separate from full cylinders.

o. Cylinder valves shall be closed before moving cylinders.

p. Valve-protection caps shall not be used for lifting cylinders from one vertical position to another.

q. Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved.

r. Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while these cylinders are in service.

s. Cylinders in the open shall be secured from the direct rays of the sun.

t. Specific precautions for oxygen and fuel gas cylinders are in paragraph 12-3.2.

8-3.3. INSPECTION OF SYSTEMS. Systems using compressed gas shall be inspected frequently and maintained. All compressed gas cylinders shall be determined to be in safe condition by a visual inspection conducted by a competent person. Cylinders that have been exposed to severe heat or electric arc weld shall be removed from service.

8-3.3.1. Schedule for Inspection. Cylinders shall be inspected upon receipt, periodically while in storage, and when they are selected for issue. Compressed gas distribution systems shall be inspected in accordance with NAVFAC MO-322, "Inspection of Shore Facilities", (NOTAL).

8-3.3.1.1. Receiving Inspection. During the receiving inspection, each cylinder shall be matched to a valid Federal Specification Number (FSN), checked for proper color coding and markings (see paragraph 8-3.5), and classified to its proper condition code.

8-3.3.1.2. Periodic Inspection. Periodic inspections shall be made to determine changes in condition code and to verify the accuracy of the assigned FSN.

8-3.3.1.3. Inspection for Issue. Inspection at the time of issue shall verify the previously assigned FSN and condition code.

8-3.3.2. Inspection Standards. Detailed inspection of compressed gas cylinders should be accomplished by the supplier. However, personnel involved in the storage, issue, handling, and use of compressed gases shall be familiar with the inspection criteria in Compressed Gas Association Pamphlet C-6, "Standards for Visual Inspection of Compressed Gas Cylinders", (NOTAL) so that deficient cylinders can be identified and removed from storage or service and returned to the supplier.

8-3.4. SAFETY RELIEF DEVICES FOR TANKS AND CYLINDERS

8-3.4.1. Cargo and Portable Tanks. Safety relief devices for cargo and portable tanks storing compressed gases shall meet the requirements of 29 CFR 1910.168.

8-3.4.2. Cylinders. Compressed gas cylinders shall have pressure relief devices installed and maintained in accordance with Compressed Gas Association Pamphlet S-1.1, "Safety Relief Device Standards - Cylinders for Compressed Gases", (NOTAL).

8-3.5. COLOR CODING AND MARKING. Personnel who handle compressed gas cylinders shall be familiar with the color coding specifications of MIL-STD-101B (NOTAL). Color coding

is provided as a hazard warning and should not be used by itself to identify the contents of a cylinder.

8-3.5.1. Nomenclature. Exact identification of any material contained in a compressed gas cylinder shall be made only by means of the printed nomenclature. The nomenclature shall appear in two locations diametrically opposite from each other and parallel to the longitudinal axis of the cylinder. On cylinders 4 inches in diameter and larger, the nomenclature shall be in approximately 2-inch high letters. On cylinders less than 4 inches in diameter, they may be reduced in size. Cylinders having a background color of yellow, orange, or buff shall have the nomenclature in black. Cylinders having background colors of red, brown, black, blue, gray, or green shall have the nomenclature in white.

8-3.5.2. Warning of Danger. The appearance of yellow, brown, blue, green, gray, or red on the body, top, or as a band on compressed gas cylinders shall be used to provide a warning of danger from the hazard involved in handling the type of material contained in the cylinder. Also, color bands can be used for convenience in handling, storing, and shipping.

8-3.6. DISPOSAL. Unserviceable compressed gas cylinders shall be discharged in an open area or well-ventilated shed provided that the concentration of toxic gases does not exceed 25 percent of the personnel exposure limits (section 4-3) in the breathing zone of personnel or that the concentration of flammable or combustible gases does not exceed 10 percent of the lower explosive limit beyond 20 feet from the cylinders. Discharge of cylinders shall not violate EPA or local air quality standards. The cylinders should be secured in an upright position while being discharged.

8-3.6.1. Procedure. Cylinders shall be discharged by bleeding off the contents slowly over an extended period of time. The gas should be discharged through an orifice instead of attempting to control the valve opening. For most valves, a dust cap or plug, drilled with a 3/32-inch hole and placed wrench-tight over the valve outlet will suffice. Some valves may require local adaptation of standard brass fittings to provide this control. When a cylinder is emptied, the cylinder valve shall be immediately closed to prevent entrance of air, moisture, or dirt.

8-3.6.1.1. Inoperable Valve. If a valve is inoperable, the contents may be discharged by loosening, but not removing, the safety device on the valve or cylinder. Extreme caution is required in this operation to prevent forceful ejection of the safety cap or plug and subsequent uncontrolled discharge of the gas. For this method of discharge, personnel

shall position themselves opposite the possible ejection path of the safety cap.

8-3.6.1.2. Removal of Restricting Devices. When the discharging gas is no longer audible, restricting devices shall be removed and the cylinder valve (or safety vent) opened fully.

8-4. HEATING AND COOLING SYSTEMS

8-4.1. GENERAL. Prior to performing maintenance or repairs on heating and cooling systems, equipment shall be properly secured and tagged OUT OF SERVICE, and power shall be turned off and locked out (see subparagraph 10-4.1.8).

8-4.2. VENTILATION. Personnel shall not be permitted to work in a fire room in cold iron condition unless adequate ventilation is provided and personnel entry has been authorized by cognizant gas free personnel.

8-4.3. TESTING ELECTRICAL INSTALLATIONS. The entire electrical installation in spaces containing flammable vapors shall be tested for grounds. Defects shall be repaired before sending personnel in to work. Tests for grounds shall be made from a switchboard outside fouled spaces. Repairs shall be made with the circuit(s) de-energized and locked out (see subparagraph 10-4.1.8).

8-5. REFRIGERANT SYSTEMS

8-5.1. DETECTION OF REFRIGERANT LEAKS. Procedures prescribed in NAVFAC MO-115, "Building Maintenance, Air Conditioning and Refrigeration", (NOTAL), shall be used to locate leaking refrigerant. Refer also to ASHRAE 15-78, "Safety Code for Mechanical Refrigeration," (NOTAL).

8-5.2. HANDLING REFRIGERANT CYLINDERS. Refrigerant cylinders shall never be connected to a refrigerating system except when the system is being charged or drained. When charging the system, the cylinder shall be weighed immediately thereafter and the weight of refrigerant remaining in the cylinder recorded. When draining the system into cylinders, care shall be taken to avoid over-charging the cylinders. The cylinders shall be weighed before and after filling and checked against allowable weights stamped on them. If they are over-filled, the excess shall be allowed to escape immediately into a flowing water drain.

8-5.3. SAFETY PRECAUTIONS IN REFRIGERATION PLANTS. When opening valves connected to a gauge glass, workers shall wear goggles or face shields. No one shall stand in front of the cylinder head of a refrigeration system in line with

the piston stroke. Moving parts of all refrigeration systems shall be guarded to prevent possible injury.

8-5.3.1. Types of Refrigerants. Refrigerants are likely to be toxic, flammable, or explosive. Toxic and flammable/explosive refrigerants are listed in ASHRAE 15-78. For information on toxic refrigerants, see Chapter 4. For information on flammable refrigerants, see Chapter 5.

8-5.3.2. Operating Compressors. Personnel shall ascertain that water is flowing through the condensers when the compressor is in operation.

8-5.3.2.1. Brine. Personnel shall ascertain that the brine is circulating through the coolers on which the compressor is working.

8-5.3.2.2. Starting. The compressor shall not be started until after assuring that the discharge valve is open. When starting, the condenser pressure shall be watched carefully for indication of abnormal conditions.

8-5.3.2.3. Appropriate Gas. Workers shall make certain that only the appropriate gas for the particular type of machine is introduced into the system.

8-5.3.2.4. Shut Down. When shutting down a compressor for overhaul or servicing, line fuses must be removed to prevent accidental starting.

8-5.3.3. Inspection of Coils. The brine coils or expansion coil supports shall be inspected for corrosion every defrosting period, or at least annually.

8-5.3.4. Identifying Pipelines and Valves. For shore installations, refrigeration piping should be painted in accordance with MIL-STD-101B, "Color Code Pipelines and Compressed Gas Cylinders", (NOTAL).

8-6. COMPRESSED GASES IN MARITIME SITUATIONS

8-6.1. GENERAL. Compressed gas aboard ship shall be handled and stored in accordance with NAVSEA 0901-LP-230-0002 (NSTM 550), "Industrial Gases, Generating, Handling, and Storage", (NOTAL).

CHAPTER 9

MATERIALS HANDLING AND STORAGE

9-1. GENERAL

9-1.1. SCOPE. The requirements contained in or incorporated by reference in this chapter apply to all materials handling and storage operations at Naval shore activities and on vessels where shore-based personnel may be assigned to work.

9-1.2. PERSONAL PROTECTION. Basic requirements for personal protective equipment are specified in Chapter 6. Standards for specific operations and equipment are provided in the appropriate sections of this chapter. All personnel engaged in materials handling and storage operations shall be provided with and required to wear adequate protective equipment to ensure personal safety.

9-1.2.1. Sharp Edges. Prior to handling, all material shall be examined for sharp edges or other causes of personal injury. Personnel shall be protected against such hazards by sturdy work gloves.

9-1.2.2. Strapping. Defective or broken strapping shall be removed, repaired, or replaced. When removing steel strapping, employees shall wear face and eye protection and gloves. Nearby personnel shall be kept at a safe distance to avoid being hit by the cut strap.

9-1.3. PERSONNEL. Operators and attendant personnel engaged in materials handling operations shall be thoroughly trained in safe operating practices associated with their duties. Operators of powered industrial trucks shall be licensed in accordance with DOD 4145.19-R-1 (NOTAL). Weight handling equipment operators shall be licensed in accordance with NAVFAC P-306, "Testing and Licensing of Weight Handling and Construction Equipment Operators", (NOTAL).

9-1.4. EQUIPMENT. Only standard equipment, approved by the Public Works Officer, in safe, operable condition shall be used. Equipment shall be inspected by competent persons at regular intervals. Defective equipment shall be removed and repaired or replaced before further use.

9-1.5. MANUAL HANDLING. This paragraph applies to all personnel engaged in manual lifting and other manual handling of of materials or equipment.

9-1.5.1. Safe Handling. Personnel shall not do lifting work when in an awkward or unsafe position. No object shall be lifted until sufficient personnel are present to safely

handle the object. Objects should be lifted and lowered with the back straight, bending the knees so that the legs do the lifting. Personnel, assigned to tasks requiring lifting, shall be trained in proper lifting and carrying procedures.

9-1.5.2. Lowering Material. Material shall never be thrown from elevated places to the floor or ground. Suitable lowering equipment or procedures shall be used.

9-1.5.3. Signals. Only one worker shall give signals when lifting or lowering operations are being performed by several persons. Lifting or lowering operations shall start only after everyone's feet, hands, etc., are safely positioned.

9-2. CONVEYORS

9-2.1. STOP CONTROLS

a. Means for stopping the motor or engine shall be provided at the operator's station. Conveyor systems shall be equipped with an audible warning signal to be sounded immediately before starting up the conveyor.

b. If the operator's station is at a remote point, similar provisions for stopping the motor or engine shall be provided at the motor or engine location.

c. Personnel working near conveyors shall be instructed as to location and operation of the emergency stop switches. The emergency stop switches shall remain free of any obstructions.

d. Whenever the operation of any power conveyor requires personnel to work in the immediate vicinity of the conveyor, the conveyor controls shall not be left unattended while the conveyor is in operation.

e. Emergency stop switches shall be arranged so that the conveyor cannot be started again until the actuated stop switch has been reset to running or "on" position.

9-2.2. TRANSFER, LOADING, AND DISCHARGE POINTS. The areas near transfer, loading, and discharge points shall be kept clear of obstructions that could endanger personnel. Free fall of hazardous materials in these areas shall be prevented.

9-2.3. RIDING CONVEYORS. Personnel shall not ride conveyors unless the conveyors are designed to transport personnel.

9-2.4. SCREW CONVEYORS. Screw conveyors shall be guarded to prevent personnel contact with turning flights.

9-2.5. OVERHEAD CONVEYORS. Suitable guards shall be provided on overhead conveyors to protect personnel below.

9-2.6. WARNING SIGNS. All crossovers, aisles, and passageways shall be conspicuously marked by suitable signs in accordance with section 3-3.

9-2.7. MAINTENANCE. Conveyors shall be locked out or otherwise rendered inoperable, and tagged out with a "Do Not Operate" tag during maintenance operations, when operation of the conveyor will endanger maintenance personnel (see subparagraph 10-4.1.8).

9-2.8. DETAILED REQUIREMENTS. Detailed requirements for installation, inspection, testing, maintenance and operation of conveyors are in ANSI B20.1, "Safety Standards for Conveyors and Related Equipment", (NOTAL) which is hereby incorporated by reference.

9-3. POWERED INDUSTRIAL TRUCKS. This section applies to fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines.

9-3.1. REFERENCES

a. Design criteria and operating requirements for powered industrial trucks are in the following publications which are incorporated by reference:

(1) 29 CFR 1910.178

(2) DOD 4145.19-R-1, "Storage and Materials Handling", (NOTAL).

(3) ANSI B56.1, "Safety Standard for Powered Industrial Trucks", (NOTAL), (also available as NFPA 505).

b. Additional guidance is in the following publications:

(1) UL 583, "Safety Standard for Electric-Battery-Powered Industrial Trucks", (NOTAL).

(2) UL 558, "Safety Standard for Industrial Trucks, Internal Combustion Engine-Powered Industrial Trucks", (NOTAL).

(3) ANSI B56.6, "Safety Standard for Powered Industrial Trucks - Rough Terrain Fork Lift Trucks", (NOTAL).

9-3.2. CLEARANCES. Safe clearances shall be allowed for aisles, loading docks, doorways, and wherever turns or passage must occur. Aisles and passageways shall be kept clear and in good repair. Permanent aisles and passageways shall be marked in accordance with NAVFAC P-309, (NOTAL).

9-3.2.1. Aisle Widths. The required aisle widths for using the standard sizes of fork trucks are:

10 feet for a 2,000 pound capacity truck;

12 feet for a 4,000 pound capacity truck;

14 feet for a 6,000 pound capacity truck.

These are not the minimum aisles in which the trucks can operate but are considered the minimum for reasonably fast operation and two-way traffic. The widths are figured on the basis of a 48-inch load length. Aisle widths for trucks not listed above should be determined using these criteria. The aisle widths should be increased if tractors and trailers are used in conjunction with fork trucks in order to provide space for the removal of pallet loads from trailers.

9-3.2.2. Restricted Clearances. Where normal clearance is reduced or otherwise obstructed, signs shall be posted to warn of the restricted clearance. Such signs shall be "CAUTION" signs posted in accordance with section 3-4.

9-3.3. FUELING. Fueling trucks with gasoline or diesel fuel shall be in accordance with section 5-6. Fueling with liquified petroleum gas shall be in accordance with 29 CFR 1910.110.

9-3.4. CARBON MONOXIDE. Carbon monoxide poisoning is a potential hazard whenever internal combustion engines are operated in enclosed spaces. Frequency and methods of monitoring carbon monoxide shall be determined by the Gas Free Engineer.

9-3.5. FORKTRUCKS

9-3.5.1. Overhead Guards. Overhead guards must be capable of withstanding, without evidence of damage, a minimum drop of 5 feet of a wood box or container of one cubic foot of volume, weighing 100 pounds. Open spaces between steel bars or tubes must not exceed 6 inches. Requirements for using overhead guards and conditions of exemption are in DOD 4145.19-R-1 (NOTAL).

9-3.5.2. Hoisting Personnel. Forktrucks shall be used to hoist personnel only under the following conditions:

a. This is the only feasible method of elevating personnel.

b. The supervisor shall authorize all raising and lowering of personnel by forktrucks.

c. Special "personnel pallets" with guardrails and toeboards on all four sides shall be used (see 29 CFR 1910.23(e)).

d. During actual raising and lowering operation, all personnel shall face away from the mast and keep hands clear of the hoisting mechanism.

e. Personnel shall never be transported while elevated.

f. Only skilled personnel shall be asked to perform tasks requiring elevation by forktrucks.

g. Personnel hoisted 4 or more feet shall wear belts attached by lanyards to the pallet railing.

9-3.6. TRACTOR-TRAILER TRAINS. No more than 8 trailers shall compose any one train.

9-4. WEIGHT HANDLING EQUIPMENT

9-4.1. GENERAL

9-4.1.1. Types of Weight Handling Equipment. Weight handling equipment includes the following cranes, derricks, hoists and winches as described in NAVFAC P-307.

9-4.1.1.1. Cranes. Cranes include overhead traveling, gantry, portal, hammerhead, level luffing, fixed (pillar), mobile (locomotive, crawler, truck, cruiser), floating, wall, and storage bridge.

9-4.1.1.2. Derricks. Derricks include A-frame, breast, gin-poled, guyed, stiff leg, and floating.

9-4.1.1.3. Hoists. Hoists include suspension (clevis, hook, trolley, monorail), simple drum, and overhead (electric, hydraulic, pneumatic).

9-4.1.1.4. Winches. Winches include hand operated, power operated, capstan, and windlass.

9-4.1.2. Inspection and Testing. The equipment listed in subparagraph 9-4.1.1 shall be inspected, tested and certified in accordance with NAVFAC P-307 (NOTAL).

9-4.1.3. Design, Installation and Operation. Detailed requirements for the design, installation and safe operation of the equipment listed in subparagraph 9-4.1.1 are in the following publications:

9-4.1.3.1. Incorporated By Reference. The following publications are hereby incorporated by reference:

a. 29 CFR 1910.179, "Overhead and Gantry Cranes".

b. 29 CFR 1910.180, "Crawler, Locomotive and Truck Cranes".

c. 29 CFR 1910.181, "Derricks".

d. 29 CFR 1915.115, "Hoisting and Hauling Equipment".

e. 29 CFR 1917.45, "Cranes and Derricks".

f. 29 CFR 1918.74, "Cranes and Derricks Other Than Vessel's Gear".

g. 29 CFR 1926.550, "Cranes and Derricks".

h. ANSI B30.2, "Safety Standard for Overhead and Gantry Cranes (Top Running Bridge, Single and Multiple Girder Top Running Trolley Hoist)", (NOTAL).

i. ANSI B30.5, "Safety Code for Crawler, Locomotive, and Truck Cranes", (NOTAL).

j. ANSI B30.6, "Safety Code for Derricks", (NOTAL).

9-4.1.3.2. Additional Guidance. Additional guidance on weight handling equipment is in the following publications:

a. ANSI B30.3, "Hammerhead Tower Cranes", (NOTAL).

b. ANSI B30.4, "Safety Standard for Portal, Tower, and Pillar Cranes", (NOTAL).

c. ANSI B30.7, "Safety Code for Base Mounted Drum Hoists", (NOTAL).

d. ANSI B30.8, "Safety Code for Floating Cranes and Floating Derricks", (NOTAL).

e. ANSI B30.11, "Monorails and Underhung Cranes", (NOTAL).

f. ANSI B30.13, "Controlled Mechanical Storage Cranes", (NOTAL).

g. ANSI B30.16, "Safety Standard for Overhead Hoists (Underhung)", (NOTAL).

h. ANSI B30.17, "Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)", (NOTAL).

9-4.1.4. Other Weight Handling Equipment. The following equipment is not addressed in NAVFAC P-307.

9-4.1.4.1. Helicopter Cranes. Materials handling operations involving helicopter cranes shall be accomplished in accordance with 29 CFR 1910.183 and ANSI B30.12, "Safety Standard for Handling Loads Suspended From Rotorcraft", (NOTAL).

9-4.1.4.2. Ship's Gear. Weight handling equipment permanently installed aboard Navy vessels shall be tested and operated in accordance with NAVSEA 0901-LP-573-0000 (NSTM Chapter 573), "Cranes and Booms", (NOTAL). Ship's cargo handling gear aboard commercial vessels shall meet the requirements of 29 CFR 1918, Subpart F; such gear shall be certified in accordance with 29 CFR 1918.12.

9-4.1.4.3. Miscellaneous. Weight handling equipment not specifically addressed in this section shall be installed, tested, and operated in accordance with the manufacturer's recommendations or as otherwise determined by the Public Works Officer.

9-4.2. OPERATORS. Operators of weight handling equipment shall be licensed in accordance with NAVFAC P-306, "Testing and Licensing of Weight-Handling and Construction Equipment Operators", (NOTAL).

9-4.3. SIGNALS

9-4.3.1. Signalman. Only one person should be designated as the signalman for any one weight handling operation. Both the signalman and the equipment operator shall be thoroughly familiar with the standard signals as given in the applicable ANSI standard listed in subparagraph 9-4.1.3.1. The signalman should be provided with some distinguishing article of clothing, such as a safety helmet colored differently from other riggers. The signalman must be in plain sight of the equipment operator at all times. If this precludes the signalman from seeing all members of the rigging crew, intermediate signalmen shall be used.

9-4.3.2. Emergency Stop. The emergency stop signal is the only signal that may be given by any person to the equipment

operator. The operator shall immediately respond to the emergency stop signal.

9-4.4. OPERATING REQUIREMENTS

9-4.4.1. Operating Instructions. Rated load capacities, recommended operating speeds, and special instructions shall be conspicuously posted on all weight handling equipment. Instructions or warnings shall be visible to the operator at the control station.

9-4.4.2. Operator Responsibility. Weight handling equipment shall not be operated in an unsafe manner nor operated when in an unsafe condition. Crane operators shall perform a daily inspection of their assigned equipment in accordance with NAVFAC P-307 (NOTAL). Any malfunctioning or defective equipment shall be promptly reported. Operators shall have the authority to stop operations and to refuse to handle loads until safety has been assured. Operators shall never leave the controls when a load is suspended. Operators shall not carry loads over people. Personnel are responsible for moving from the path of a load being transported overhead when so instructed by members of the rigging crew.

9-4.4.3. Capacity. The rated load capacity shall be plainly marked on each side of the equipment. This marking shall be clearly visible and legible from the ground or floor. If a piece of equipment has more than one hoisting unit, each hoist shall have its rated load marked on it or on its load block. Weight handling equipment shall not be loaded beyond its rated load except when specifically authorized by the Public Works Officer (see subparagraph 9-4.4.19).

9-4.4.4. Hooks. The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use. A record shall be kept of the dates and results of such tests. All hooks on weight handling equipment shall be latched or moused unless the design of the hook is such that closing off the throat opening is impracticable. Hooks shall be inspected daily and immediately prior to any full-capacity lift. Hooks which show evidence of cracks or which are bent to the extent that the throat opening is increased more than 5% or the point is more than 10 degrees out of place shall be discarded. They shall not be returned to service. Hooks shall be additionally inspected and tested in accordance with NAVFAC P-307 (NOTAL). Additional requirements for hooks are in ANSI B30.10, "Safety Standard for Hooks", (NOTAL).

9-4.4.5. Attaching Load. The load shall be attached to the load block hook by slings or other approved devices. Loads shall be applied to the throat of the hook to avoid overstressing and bending or springing the hook by point loading. Care shall be taken to make certain that the sling clears all obstacles.

9-4.4.6. Moving the Load. The load shall be well-secured and properly balanced in the sling or lifting device before being lifted more than a few inches. Before starting to hoist, the following conditions shall be noted:

a. Multiple pat lines shall not be twisted around each other.

b. The hook shall be brought over the load in such a manner as to prevent swinging.

c. Hoist ropes shall not be kinked.

d. Tag lines shall be attached whenever it is necessary to prevent the load from swinging such as when operating in close quarters.

e. The operator shall test the hoist brakes each time a load approaching near capacity is handled. The brakes shall be tested by raising the load a few inches and applying the hoist brakes.

9-4.4.7. Hoisting Line Vertical. Before lifting any load, the hoisting line must be vertical. It is prohibited to lift tied-down loads or to pull pipes or other objects out of the ground. Cranes or derricks shall not be used for side pulls except when authorized by competent supervision. Bulling cargo aboard ship shall be done only when there is no other feasible means for positioning the cargo for hoisting in which case bulling cargo shall be done in accordance with 29 CFR 1918.84.

9-4.4.8. Lowering Boom. Lowering the boom under load shall be done with greatest caution. The radius-load capacity chart and radius indicator shall be checked where necessary. The boom and hoist line shall not be lowered simultaneously.

9-4.4.9. Lowering Loads. When lowering loads, the speed shall not exceed the hoisting speed of the equipment for the same load. For example, the normal hoisting speed of a 30-ton motor-operated crane is 18 feet per minute with rated load. Stopping the load at such speeds within a short distance causes excessive stress on the slings and equipment. The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.

9-4.4.10. Dual Lifts. Dual lifts are extremely dangerous and should be attempted only under competent supervision. Before making a dual lift, the weight handling equipment and slings shall be positioned correctly to properly balance the load. Cranes or derricks shall not be used for side pulls except when authorized by competent supervision.

9-4.4.11. Lifting Load From Water. Contained water, or water in a waterlogged structure shall be carefully computed as part of the weight. When the load leaves the water, the lifting equipment takes the added load because the buoyancy of the water is lost. The operator shall stop the load when it clears the water to assure that the equipment can safely handle the unsupported weight of the load before proceeding with the lift. Unknown weights should never be lifted from water. Water-logged loads or loads from water or mud shall be handled only when authorized by a competent supervisor.

9-4.4.12. Hoisting Personnel. Cranes may be used to hoist personnel only when other less hazardous means of access and egress are not available or practical. The following requirements apply to the hoisting of personnel by means of cranes.

9-4.4.12.1. Work Platform. The work platform shall have a standard guardrail and toeboard (see subparagraph 2-2.1.1). The platform and its components shall be capable of supporting four times the maximum intended load.

9-4.4.12.2. Lifting Bridle. The lifting bridle used to suspend the platform from the crane shall consist of 4 legs and shall be so attached as to ensure the stability of the platform. The bridle shall be secured by a shackle or attached to a latched hook.

9-4.4.12.3. Crane Requirements. The rated capacity of the crane at the radius at which the lift will be made shall be divided by four, and this limit shall not be exceeded. The load line on which the platform is suspended should have control load lowering. A "free fall option" should not be used with suspended work platforms. A firm footing, uniformly level within one percent, should be provided for cranes. Outriggers shall be used during hoisting of personnel.

9-4.4.12.4. Prelift Plans and Tests. Prelift plans showing boom angle and maximum intended load should be prepared for each lift or group of similar lifts. A full cycle operational test should be made prior to lifting personnel. The platform should carry twice the intended load during the test lift. The stability of the crane's footing should be verified during the full cycle operational test.

9-4.4.12.5. Personnel. The number of employees hoisted on a work platform should be kept to a minimum and shall never exceed four. For purposes of determining loads, each worker using the platform shall be considered as weighing 250 pounds.

9-4.4.12.6. Adverse Weather. Personnel should not be hoisted by cranes during high winds, electrical storms, snow or other adverse weather conditions which could endanger employees on the platform.

9-4.4.12.7. Communications. Unless communications equipment such as telephone, radio or their equivalent is present, standard hand signals shall be used to communicate to the crane operator (see paragraph 9-4.3). The signals shall be visible or audible to the operator at all times.

9-4.4.13. Barricades. Accessible areas within the swing radius of the rear of the superstructure of weight handling equipment, either permanently or temporarily mounted, shall be barricaded in such a manner as to prevent personnel from being struck or crushed by the equipment.

9-4.4.14. Boarding Equipment. Operators shall enter and leave weight handling equipment by means of the ladders, steps, or walkway provided for this purpose. Such means of access shall meet the requirements of Chapter 2.

9-4.4.15. Personnel Restrictions. No personnel except operators and, as necessary, inspectors, supervisors, trainees or repair personnel, shall be permitted on weight-handling equipment while it is in operation. No more than 3 such persons shall be permitted in the cab during operations. No personnel shall board the equipment until permission has been received from the operator. Personnel shall not climb on or off moving equipment.

9-4.4.16. Outriggers. When lifting any load, outriggers should be set on all sides. The use of outriggers is mandatory when the load exceeds the rated load at that radius without outriggers. Where floats are used, they shall be securely attached to the outriggers. The use of wooden blocks to support outriggers should be discouraged. When it is necessary to use wooden blocks, they shall:

a. Be strong enough to prevent crushing.

b. Be free from defects.

c. Be of sufficient width and length to prevent shifting or toppling under load.

9-4.4.17. Multiple Loads. Two or more separately rigged loads shall not be hoisted in a single lift even though the total load is within the load capacity of the weight handling equipment.

9-4.4.18. Riding the Load. No one shall ride the load unless specifically authorized by the master rigger. Safety belts and life lines or other precautions shall be used as directed by the master rigger. No one shall ever be authorized to ride the hoist block or hook. See subparagraph 9-4.4.12 for approved procedures for hoisting personnel.

9-4.4.19. Overloads. The load shall always be carefully calculated in advance of lifting and no attempt shall be made to lift a load greater than the rated capacity of the crane except that loads up to weights equal to the last recorded test weight may be lifted with the specific authorization of Naval Facilities Engineering Command and under the direction of the activity's Public Works Officer.

9-4.5. CHAIN FALLS AND PULL-LIFTS

9-4.5.1. Inspection. Chain falls shall be inspected periodically to ensure that they are safe, particular attention being given to the lift chain, pinion, sheaves and hooks for distortion and wear. Pull-lifts shall be inspected periodically to ensure that they are safe, particular attention being given to the ratchet, pawl, chain and hooks for distortion and wear. The capacity and date of test (or expiration of test) shall be indicated on chain falls and pull-lifts.

9-4.5.2. Overhead Attachment. Straps, shackles, and the beam or overhead structure to which a chain fall or pull-lift is secured shall be of adequate strength to support the weight of load plus gear. The upper hook shall be moused or otherwise secured against coming free of its support. Scaffolding shall not be used as a point of attachment for lifting devices, such as tackles, chain falls, and pull-lifts unless the scaffolding is specifically designed for that purpose.

9-4.6. RIGGING - GENERAL. This paragraph applies to all chains, ropes, slings, shackles, and hooks that are used to attach the load to the hook of the prime lifting gear.

9-4.6.1. Inspection. Rigging equipment for weight handling shall be inspected prior to use on each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed immediately from service.

9-4.6.2. Safe Working Load. Rigging equipment shall not be loaded in excess of its recommended safe working load, as

prescribed in Tables N-184-1 through N-184-22 of 29 CFR 1910.184. Higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products.

9-4.6.3. Special Gear. Special custom design grabs, hooks, clamps, spreaders, strong backs, or other lifting accessories, for such units as modular panels, prefabricated structures and similar materials, shall be marked to indicate the safe working loads and shall be proof-tested prior to use to 125 percent of their rated load. Ordnance handling equipment shall meet the requirements of NAVSEA OP-5 (NOTAL).

9-4.6.4. Safe Methods. Riggers and other personnel using slings to attach lifts to weight handling equipment shall use only approved safe methods for attaching the slings to the load and to the hook. Personnel performing this task must be trained as to safe procedures. All loads shall be secured against slipping.

9-4.7. SLINGS

9-4.7.1. General. Whenever any sling is used, the following practices shall be observed:

a. All slings shall be inspected and tested in accordance with NAVSEA OP-5 (NOTAL).

b. Slings shall never be dragged along the ground or over rough or dirty surfaces.

c. Slings shall be stored in a dry, well-ventilated space and shall be supported on slats or hung in loose coils.

d. Slings shall not be shortened with knots or bolts or other makeshift devices.

e. Sling legs shall not be kinked or knotted.

f. Slings used in a basket hitch shall have the loads balanced to prevent slippage.

g. Slings shall be padded or protected from the sharp edges of their loads.

h. Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.

i. Shock loading is prohibited.

j. A sling shall not be pulled from under a load when the load is resting on the sling.

k. Slings shall be securely attached to their loads.

l. Only qualifed rigger shall fabricate rope end attachments. End attachments shall be made in accordance with NAVFAC P-307 (NOTAL).

m. Only those slings registered in the Public Works Office shall be authorized for use on an activity.

9-4.7.2. Specific Requirements. The criteria for the care, use and removal from service of slings in 29 CFR 1910.184 shall be complied with. 29 CFR 1910.184 addresses chains, wire rope slings, natural and synthetic fiber rope slings, metal mesh slings and synthetic web slings. Slings not covered by 29 CFR 1910.184 shall be used, inspected and tested in accordance with the manufacturer's recommendations. Additional requirements are in ANSI B30.9, "Safety Standard for Slings", (NOTAL). Wire rope end attachments made at Navy shore activities shall be made in accordance with NAVSEA S9086-BK-STM-000/CH 613 (NSTM 613), "Wire and Fiber Rope and Rigging", (NOTAL).

9-5. STORAGE. Storage operations shall be conducted in accordance with DOD 4145.19-R-1, "Storage and Materials Handling", (NOTAL), except that storage at construction sites may be done in accordance with 29 CFR 1926.250. Requirements for the safe storage of hazardous materials are in DOD 4145.19-R-1. Storage information on specific hazardous materials will also be found in the Material Safety Data Sheets and the Hazardous Material Information System discussed in chapter 4.

9-6. TRANSPORTATION. General requirements for motor vehicle operations are in section 3-7. NAVFAC P-300 contains requirements for vehicle maintenance and inspection as well as criteria for placement of the payload on a truck or trailer. Safe practices for railroad operations are in NAVFAC P-301, "Navy Railway Operating Handbook", (NOTAL). Procedures for loading and unloading material to and from transportation equipment are in DOD 4145.19-R-1 (NOTAL). Loading and offloading of ships shall be in accordance with 29 CFR 1918. Transportation of hazardous materials shall be in accordance with 49 CFR 171 to 179.

CHAPTER 10

MACHINERY AND MACHINE GUARDING

10-1. GENERAL

10-1.1. SCOPE. The requirements contained in or incorporated by reference in this chapter are intended to protect personnel against traumatic injury or death from contact with machinery or from the impact of objects projected or thrown out by the machinery during operation. Noise and ventilation standards applicable to machine operations are given in Chapter 4. Requirements for personal protective equipment, including proper attire, for machine operations are in Chapter 6.

10-1.2. REFERENCES. The requirements of the standards listed in subparagraph 10-1.2.1 shall be complied with for machines addressed in these standards. If a machine is not addressed in the standards in 10-1.2.1, the publications in subparagraph 10-1.2.2, in addition to those in 10-1.2.1, should be consulted for guidance in developing machine guards and safe operating procedures.

10-1.2.1. Standards. Most of the machines and machinery operations in the Naval shore establishment are common to the private sector and are covered in the OSHA and ANSI standards listed below. The listed standards are incorporated by reference as part of this manual. As stated in Chapter 1 of this manual, each activity should obtain, or, as a minimum, have ready access to, those standards which are applicable to the activity's machines and operations.

10-1.2.1.1. OSHA Standards

a. 29 CFR 1910, Subpart O, "Machinery and Machine Guarding".

b. 29 CFR 1915, Subpart J, "Ship's Machinery and Piping Systems".

10-1.2.1.2. ANSI Standards

a. ANSI B7.1, "Safety Code for the Use, Care, and Protection of Abrasive wheels", (NOTAL).

b. ANSI B11.1, "Safety Requirements for the Construction, Care, and Use of Mechanical Power Presses", (NOTAL).

c. ANSI B11.3, "Safety Requirements for the Construction, Care, and Use of Power Press Brakes", (NOTAL).

d. ANSI B11.4, "Safety Requirements for the Construction, Care, and Use of Shears", (NOTAL).

e. ANSI B11.5, "Safety Requirements for the Construction, Care, and Use of Iron Workers", (NOTAL).

f. ANSI B11.6, "Safety Requirements for the Construction, Care, and Use of Lathes", (NOTAL).

g. ANSI B11.7, "Safety Requirements for the Construction, Care, and Use of Cold Headers and Cold Formers", (NOTAL).

h. ANSI B11.8, "Safety Requirements for the Construction, Care, and Use of Drilling, Milling, and Boring Machines", (NOTAL).

i. ANSI B11.9, "Safety Requirements for the Construction, Care, and Use of Grinding Machines", (NOTAL).

j. ANSI B11.10, "Safety Requirements for the Construction, Care, and Use of Metal Sawing Machines", (NOTAL).

k. ANSI B11.13, "Safety Requirements for the Construction, Care, and Use of Single and Multiple-Spindle Automatic Screw/Bar and Chocking Machines", (NOTAL).

l. ANSI B15.1, "Safety Standards for Mechanical Power Transmission Apparatus", (NOTAL).

m. ANSI B24-1, "Safety Requirements for Forging", (NOTAL).

n. ANSI B28.1, "Safety Specifications for Mills and Calendars in the Rubber and Plastics Industries", (NOTAL).

o. ANSI 01.1, "Safety Requirements for Woodworking Machinery", (NOTAL).

p. ANSI 02.1, "Safety Requirements for Sawmills", (NOTAL).

q. ANSI Z8.1, "Safety Requirements for Commercial Laundry and Drycleaning Equipment and Operations", (NOTAL).

r. ANSI Z50.1, "Safety Code for Bakery Equipment", (NOTAL).

10-1.2.1.3. Naval Ships' Technical Manual (NSTM). Ship's machinery shall be guarded and operated in accordance with the NSTM. Personnel exposed to hazards of ship's machinery not addressed in the NSTM shall be provided protection consistent with the requirements of this chapter.

10-1.2.2. General Guidance. For machines or parts of machines not specifically addressed in the standards incorporated in subparagraph 10-1.2.1, activities should consult general references on machine guarding. The National Safety Council (NSC) has a number of publications which, although not enforceable as standards, do provide excellent guidance on machine guarding which will meet the requirements of section 10-4. The NSC's Industrial Data Sheets (NOTAL) include specific guidance for various types of machines as does Accident Prevention Manual for Industrial Operations (NOTAL). A third NSC publication, Guards Illustrated; Ideas for Mechanical Safety (NOTAL), is a well-illustrated guide for machine guarding as is OSHA Publication 3067, Concepts and Techniques of Machine Safeguarding (NOTAL). Recommendations of the machine's manufacturer or supplier are other sources of guidance on machine guarding.

10-2. GENERAL REQUIREMENTS

10-2.1. PROTECTION AGAINST HAZARDS. Activities shall install, safeguard, operate and maintain machinery in a manner which protects machine operators and other personnel from traumatic injury or death resulting from the hazards discussed in section 10-3. One or more of the methods discussed in section 10-4 shall be used to protect personnel from machinery hazards. Safeguards shall be affixed to the machine where possible or secured elsewhere if for any reason attachment to the machine is not possible. The safeguard should be such that it does not present an accident hazard in itself. Safeguards shall be properly adjusted so that no part of the hazard is unnecessarily exposed.

10-2.2. TRAINING. Operators, inspectors, and maintenance personnel shall be trained in the hazards of their machines and in the safe use, care, and inspection of the machines. Such training shall be accomplished before personnel may use, service, or inspect machinery.

10-2.3. INSPECTION. A program for the regular inspection of machinery shall be established to assure that all parts, auxiliary equipment, and safeguards are in a safe operating condition. Maintenance and repair necessary to provide a safe operating condition shall be performed and completed before a machine is operated.

10-2.4. ANCHORING MACHINERY. Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

10-2.5. MACHINE CONTROLS

10-2.5.1. Power Cut Off. A means for cutting off the power to a machine shall be provided on each powered machine. The

cut-off switch or device shall be located so that it can be safely operated from the operator's normal position.

10-2.5.2. Location of Controls. Power controls and operating controls shall be located within easy reach of the operator while at the normal work location without having to reach past the point of operation or other hazardous areas. This requirement does not apply to constant pressure controls used only for set up purposes.

10-2.5.3. Power Failures. On machines where injury to personnel might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.

10-2.5.4. Accidental Operation. Operating controls shall be protected by recessing, guarding, location or other effective means against unexpected or accidental activation of the machine.

10-2.5.5. Belts and Shafting. On machines driven by belts and shafting, a locking-type belt shifter or an equivalent positive device shall be used.

10-2.6. DEFECTIVE EQUIPMENT. Machinery and attachments which are hazardous because of defects shall be tagged out, locked out, or removed from the area to prevent operation or use. Safeguarding requirements for maintenance operations are in subparagraph 10-4.1.8. Cutting tools and attachments shall be maintained sharp and in proper adjustment.

10-2.7. DUST CONTROL. Each shop area containing four or more woodworking machines whose operations create dust, shaving, chips or slivers shall be equipped with an exhaust system of sufficient strength and capacity to remove such refuse, as it is generated, from the point of operation and the immediate vicinity of the machine and workplace. The exhaust dusts shall be readily accessible for cleaning. The exhaust system shall empty into a dust-tight settling chamber so constructed that dust cannot be discharged into adjoining areas. The settling chamber shall be of fire-resistant construction and shall be so designed and operated as to reduce to a minimum the danger of dust explosions. The volume of accumulated refuse in the chamber shall be held to a practical minimum.

10-3. HAZARDS OF MACHINES. The following are hazards which may cause traumatic injury or death. Personnel shall be protected against these hazards in accordance with section 10-4.

10-3.1. MOVING PARTS. Hazards from moving parts include rotating, reciprocating, in-running, cutting, punching,

shearing, sawing, bending, or any other moving machine parts, actions, accessories, workpieces, or mechanical power transmission apparatus.

10-3.2. FLYING OR FALLING MATERIAL. Hazards from flying material include flying chips, sparks, workpieces, workpiece fragments, fragments of machine parts or accessories, substances in a vacuum or under pressure, or substances under constraint or tension which may be released in an uncontrolled manner. Falling material includes elevated workpieces, machine parts, or machine accessories.

10-3.3. INHERENTLY HAZARDOUS MATERIAL. Inherently hazardous material includes sharp or pointed machine parts or workpieces; extremely hot or cold machine parts or workpieces; or workpieces or substances used in machine operations which are hazardous materials (see section 4-2).

10-4. SAFEGUARDING THE POINT OF HAZARD. Methods of safeguarding are classified into two groups, primary methods (paragraph 10-4.1) and secondary methods (paragraph 10-4.2). Primary methods of safeguarding are sufficient when used alone and shall be used to protect personnel against machine hazards. Secondary methods of safeguarding may be used only if it is not feasible to use any of the primary methods. The references in paragraph 10-1.2 shall be used in determining the best method for safeguarding a point of hazard.

10-4.1. PRIMARY METHODS OF SAFEGUARDING

10-4.1.1. Barrier Guard. Safeguarding by barrier guard is accomplished when the machinery is equipped with an enclosure which prevents hands, fingers, or other parts of the employee's body from reaching through, over, under, or around the enclosure into the point of hazard.

10-4.1.2. Shield. Safeguarding by shield is accomplished when machinery is equipped with a fixture which prevents chips, sparks, coolants, fluids, hazardous materials, workpieces, workpiece fragments, or fragments of machine parts or accessories from flying out in the direction of the operator or other personnel. Shielding is required whenever there is a hazard from flying objects.

10-4.1.3. Interlock. Safeguarding by interlock is accomplished when machinery is equipped with a device which prevents or immediately stops all motion at the point of hazard whenever:

a. Any employee opens or removes an enclosure, barrier, or shield; or

b. Any part of an employee's body comes in contact with a bar, rod, or wire; or

c. Any part of an employee's body interrupts a photoelectric beam, magnetic or electrical field, pressure sensor, or similar presence-sensing device. The interlock device shall be such that it will prevent the resumption of motion at the point of hazard until some deliberate action is taken to reset the machinery or equipment.

10-4.1.4. Automatic Device. Safeguarding by automatic device is accomplished when machinery is equipped with a device which, through a system of linkages connected to the operating mechanism, pushes or pulls an operator or any part of the operator's body away from the point of hazard. Sweep devices shall not be used.

10-4.1.5. Two-Hand Devices

10-4.1.5.1. Two-Hand Trip. Safeguarding by two-hand trip is accomplished when:

a. Concurrent pressure of both hands on the actuating device is necessary to initiate or trip the machine; and

b. The activating device is a sufficient distance from the point of hazard to prevent the operator's hands from entering the point of hazard while the hazard exists; and

c. If more than one employee is exposed to the hazard, additional two-hand trips are installed so that all exposed employees must activate the starting mechanism concurrently.

10-4.1.5.2. Two-Hand Control. Safeguarding by two-hand control is accomplished when:

a. The requirements of paragraph 10-4.1.5.1 are met; and

b. The machine brake, power disconnect, and/or clutch systems are adjusted to stop all machine motion if any of the controls are released while the hazard exists; and

c. The machine is adjusted to prevent resumption of motion until the machine has been reset.

10-4.1.6. Automatic or Semi-Automatic Feed, Stripping, Ejection, or Removal. Safeguarding by automatic or semi-automatic feed, stripping, ejection, or removal is accomplished when the workpiece or material is fed into the machine by chutes, hoppers, conveyors, movable dies, dial feed rolls, strippers, or other similar devices; and when

barrier guards prevent entry into the point of hazard and/or shields prevent exposure to flying material.

10-4.1.7. Location. Safeguarding by location is accomplished when any of the following conditions exist:

a. The machinery is located so as to protect against inadvertent contact with or entry into a point of hazard.

b. The machinery is located in an enclosed area, employees are prevented from entering the enclosed area or having access to the machinery when the machinery is operating, and the machine controls have lockout capability.

c. The operator controls the operation from an enclosure which protects against inadvertent contact with, or entry into, a point of hazard; and the machine controls have lockout capability. Additional safeguards are required if other employees may be exposed to the point of hazard.

10-4.1.8. Lock Out. Safeguarding by locking out is accomplished when all energy sources, including stored and potential energy sources, are neutralized and the mechanism for reinstating the energy source is controlled by the exposed worker(s). Hazardous energy sources include mechanical, electrical, hydraulic, pneumatic, chemical, nuclear, and thermal. Operations which may necessitate locking out include installing, constructing, repairing, adjusting, inspecting and maintaining. Locking out as a primary safeguard method shall be accomplished in accordance with ANSI Z244.1, "Safety Requirements for the Lock Out/Tag Out of Energy Sources", (NOTAL).

10-4.2. SECONDARY METHODS OF SAFEGUARDING. The following safeguards may be used with primary safeguards to provide additional protection. They may be used alone only when it can be established by safety personnel, in consultation with operating personnel, that it is not feasible to use any of the primary methods of safeguarding set forth in paragraph 10-4.1 or while awaiting implementation of primary methods of safeguarding. When secondary methods are used alone, exposed personnel shall be thoroughly trained in the procedures to be followed in using the safeguards provided.

10-4.2.1. Awareness Barrier or Device. Safeguarding by awareness barrier or device is accomplished when machinery is equipped with an enclosure or with an audio or visual device that warns an employee that the point of hazard is being approached.

10-4.2.2. Hand-Feeding Tools or Devices. Safeguarding by hand-feeding tools or devices is accomplished when specially designed hand-feeding tools are utilized for placing mater-

ial into, manipulating material at, or removing material from the point of hazard.

10-4.2.3. Safety Blocks. Safeguarding by the use of safety blocks is accomplished when blocks are manually or mechanically placed into the point of hazard to prevent machine movement.

10-4.2.4. Tag Out. Safeguarding by tag out is accomplished when warning tags are placed on machine controls clearly indicating that machinery is not to be operated. Tag out procedures aboard ship shall be in accordance with OPNAVINST 3120.32A, "Standard Organization and Regulations of the U.S. Navy", (NOTAL).

10-4.2.5. Personal Protective Equipment. Safeguarding by personal protective equipment is accomplished when personnel are protected in compliance with the requirements of Chapter 6.

CHAPTER 11

PORTABLE TOOLS

11.1. GENERAL. The diversity of portable tools and their uses in the Naval shore establishment precludes the provision of detailed requirements for all tools. This chapter contains or incorporates by reference requirements for portable tools including hand tools and portable power tools. In the absence of specific requirements for a portable tool, the specified references and manufacturer's literature shall be followed. The safe use of common hand tools shall follow recognized industrial practice.

11-1.1. SAFE CONDITION. Activities are responsible for the safe condition and use of tools used by personnel including those tools provided by employees. Tools shall be in a safe, operable condition before being issued to employees. Tools which develop defects during use shall be turned in for repair or disposition. Cutting tools shall be kept sharp.

11-1.2. INTENDED USE. Tools shall be used only in the manner for which they are intended by design to be used. For example, wrenches shall not be used as hammers and screwdrivers shall not be used as chisels or crowbars. Tools shall be used within their rated capacity with required guards and attachments securely in place.

11-1.3. SECURE POSITIONING. Both the piece being worked on and the employee using the tools shall be secured against unexpected movement. Movable workpieces should be secured by clamps or vise so that the employees can control the tool with both hands. Employees shall have secure footing and proper balance while operating tools.

11-1.4. STORAGE. Tools and attachments shall be properly stored when not in use in order to protect the tools from damage or to prevent them from becoming tripping hazards or otherwise interfering with the work in progress.

11-1.5. PERSONAL PROTECTIVE EQUIPMENT. Because the use of portable tools normally places the user in close proximity of the point of operation of the tool, it is imperative that exposed personnel be provided with and required to wear personal protective equipment in accordance with Chapter 6.

11-1.6. TRAINING. Personnel shall be trained in the safe use and proper care of tools used by them. Such training may be informal instruction by a supervisor on the use of hand tools or it may be the more formal process of explo-

sives qualification and certification required for powder-actuated fastening tools.

11-2. HAND TOOLS. This section is applicable to all non-powered tools and devices that are normally operated by hand.

11-2.1. HANDLES. Handles shall be securely attached to the tool. Handles shall be kept free of grease, oil, or other slippery materials. Wooden handles shall be free of cracks or splinters.

11-2.2. IMPACT TOOLS. Impact tools such as drift pins, wedges and chisels shall be kept free of mushroomed heads, chips or cracks. The hammer being used to strike an impact tool shall have a diameter larger than the face of the impact tool.

11-2.3. SHARP-EDGED TOOLS. Sharp-edged or pointed tools shall not be carried unsheathed in tool bags, tool boxes or clothing pockets. Files and rasps shall not be used or carried about without a handle on the tang.

11-2.4. CUTS AND STROKES. Cuts and strokes should be made away from the body as much as possible and should not be made toward other personnel. Adequate room shall be provided for the safe swing of such tools as hammers and axes.

11-2.5. ELECTRICAL WORK. Only hand tools with insulated handles shall be used for electrical work (see subparagraph 13-2.2.5).

11-2.6. STANDARDS. Hand tools are addressed in the following standards which are hereby incorporated into this manual. The standards are listed separately in Appendix B.

11-2.6.1. Wrenches. Requirements for wrenches are in ANSI B107.1 through ANSI B107.9, except B107.4, (NOTAL).

11-2.6.2. Striking Tools. Striking tools, such as hammers, axes and hatchets, are covered by ANSI B173.1 through B173.7, except B173.6, (NOTAL).

11-2.6.3. Impact Tools. Impact tools, such as chisels and punches are covered by ANSI B209.1 through B209.4, (NOTAL).

11-3. POWER TOOLS

11-3.1. CONTROLS. Portable power tools shall be provided with controls and switches in accordance with 29 CFR 1910.243(a)(2) and, for abrasive blast cleaning nozzles, with 29 CFR 1910.244(b).

11-3.2. INSPECTION. Portable power tools shall be visually inspected before each use. In addition, a schedule of regular thorough inspections shall be established. The inspection interval shall be no more than annually and shall be based on applicable standards, manufacturer's recommendations, and the activity's experience with the tool(s) in question. The inspection interval shall be established by the activity safety officer. Each tool shall be marked to assure inspection at the required interval.

11-3.3. POWER SOURCE REQUIREMENTS. The requirements of this paragraph address the hazards presented by the various power sources of portable powered tools. Hazards presented by the tools are addressed in paragraph 11-3.4.

11-3.3.1. Electric-Powered Tools. General provisions for electrical safety are in Chapter 13.

11-3.3.1.1. Hazardous Environments. Electric-powered tools should not be exposed to dampness, rain, or other wet environments. When such exposure is unavoidable, only approved tools and equipment shall be used. Electric tools used in flammable or explosive atmospheres shall be approved for such locations (see paragraph 13-3.5).

11-3.3.1.2. Cords. Power tools shall not be carried by their connecting cords or disconnected by yanking on the cord. Electrical cords shall be protected against damage from crushing, burning, or corrosion. Damaged cords shall be replaced rather than patched or spliced. Electric cords shall be placed so as not to present a tripping hazard. Extension cords used outdoors shall be approved for such use.

11-3.3.1.3. Grounding. The casing of electric powered tools shall be grounded or double-insulated. Tools with grounded casings shall be equipped with 3-pronged plugs; extension cords shall be similarly equipped. Two-pronged grounding adapters may be used for tools rated at less than 150 volts provided that the ear or leg of the adapter is connected to a known permanent ground such as a properly grounded outlet box. Grounding adapters with flexible "pigtails" shall not be used. Ground-fault protection at construction sites shall be provided in accordance with 29 CFR 1915.132.

11-3.3.1.4. Plugging In. Tools shall be switched off before being plugged in. A plugged-in tool shall not be carried with a finger on the switch or trigger.

11-3.3.1.5. Standard. Additional requirements for electric powered tools are in UL 45, "Safety Standard for Portable Electric Tools", (NOTAL).

11-3.3.2. Pneumatic-Powered Tools

11-3.3.2.1. Air Pressure. Pneumatic-powered tools are normally designed to operate with air supplied at 90 pounds per square inch gauge (psig). Tools must be clearly marked when their rated air pressure is other than 90 psig. Pneumatic tools shall never be operated at any pressure other than their rated pressure.

11-3.3.2.2. Disconnecting. Air pressure shall be shut off and exhausted from the line before disconnecting any line from the tools unless there is an automatic closing valve at the joint being separated.

11-3.3.2.3. Hose. Air supply hoses and assemblies shall have a minimum working pressure rating of 150 psig, or 150 percent of the maximum pressure produced in the system, whichever is greater. Air hoses shall never be subjected to pressures greater than their rating. Leaking or defective hose shall be removed from service. Hoses shall never be laid over ladders, steps, scaffolds, or walkways in such a way as to create a tripping hazard or to expose the hose to possible damage. Where hose is run through doorways, the hose shall be protected against damage from the door edge. Hoses shall never be used for hoisting or lowering tools. Hoses exceeding 1/2-inch inside diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

11-3.3.2.4. Safety Clip. Safety clips or retainers shall be securely installed and maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled.

11-3.3.2.5. Inspection. Tools shall be inspected before each use with particular attention to control and exhaust valves, hose connection guide clips on hammers, and the chucks of reamers and drills.

11-3.3.2.6. Cleaning With Compressed Air. Compressed air shall not be used to clean clothing being worn or to blow particles from the body. Compressed air may be used for blowing particles from machinery only when all of the following conditions are met:

a. The machinery cannot be adequately or safely cleaned by brushing, wiping, or vacuuming.

b. Pressure is reduced to 30 psi or less.

c. Chip guarding is used to contain flying particles.

d. Face shield and goggles are worn by exposed personnel.

11-3.3.2.7. Standard. Additional requirements for pneumatic powered tools are in ANSI B186.1, "Safety Code for Portable Air Tools", (NOTAL).

11-3.3.3. Fuel Powered Tools

11-3.3.3.1. Refueling. The tools shall be shut off and the motor cooled before refueling. Refueling shall be accomplished at least 50 feet from ignition sources. Fuel shall be handled and stored in accordance with paragraph 5-3.5.

11-3.3.3.2. Ventilation. Fuel powered tools shall be used only in well-ventilated areas. When used in confined or enclosed areas, the atmosphere shall be monitored in accordance with NAVSEA S6470-AA-SAF-010 (NOTAL).

11-3.3.4. Hydraulic Powered Tools. Personnel shall ensure that hydraulic equipment is maintained in a clean condition, that the fluid level is properly maintained, that filters function and are correctly adjusted and that design limits of the system are not exceeded. Hydraulic fluid shall be handled and stored in accordance with paragraph 5-3.5.

11-3.4. GUARDING PORTABLE POWERED TOOLS. The principles of guarding portable powered tools are the same as those for guarding machines as stated in Chapter 10. The OSHA standards which specifically address portable circular saws, portable belt sanding machines, and portable abrasive wheels in 29 CFR 1910.243 are incorporated by reference as are the guarding requirements for chain saws in ANSI B175.1, "Safety Specifications for Gasoline Powered Chain Saws", (NOTAL). Portable powered tools not specifically addressed shall be guarded in accordance with the provisions of Chapter 10. Combination tools, such as portable drills which can be converted by adding or removing attachments, shall be guarded by a guard(s) which satisfies the requirements for the tool in use.

11-4. OTHER PORTABLE TOOLS

11-4.1. EXPLOSIVE ACTUATED FASTENING TOOLS. Explosive (or powder) actuated fastening tools are within the scope of the Navy Explosive Safety Program in OPNAVINST 8023.2B, (NOTAL). Personnel using explosive actuated fastening tools shall be explosives qualified and certified in accordance with OPNAVINST 8023.2B. Further requirements for these tools are in 29 CFR 1910.243(d) and ANSI A10.3, "Safety Requirements for Powder Actuated Fastening Systems", (NOTAL) which are hereby incorporated by reference.

11-4.2. LAWN MOWERS. Power lawn mowing equipment shall be used in accordance with 29 CFR 1910.243(e) and ANSI B71.1, "Safety Specifications for Power Lawn Mowers, Lawn and Garden Tractors, and Lawn Tractors", (NOTAL).

11-4.3. JACKS. Jacks shall be used in accordance with 29 CFR 1910.244(a) and ANSI B30.1, "Safety Standard for Jacks", (NOTAL).

CHAPTER 12

WELDING AND HOT WORK

12-1. GENERAL. This chapter contains or incorporates by reference safety requirements for welding, cutting, brazing, and all other hot work operations. It applies to all work involving the use of open-flame equipment and to all work in which materials are heated up to or above 400 degrees Fahrenheit (205 degrees Celsius). This chapter also applies to any cold work where there is a possibility of striking sparks in the presence of flammable or combustible atmospheres, residues or materials.

12-2. GENERAL REQUIREMENTS

12-2.1. SAFE EQUIPMENT. Welding equipment shall be chosen for safe application to the work and shall be installed properly. Welding apparatus such as torches, regulators, hose, valves, electric welding machines and accessories, or specialized apparatus shall be approved or listed by a nationally recognized testing laboratory such as Factory Mutual Engineering Corporation or Underwriter's Laboratories, Inc. Only approved apparatus in good working order shall be used.

12-2.2. RULES AND INSTRUCTIONS. Rules and instructions covering the operation and maintenance of welding equipment shall be readily available to welding and other cognizant personnel. As a minimum these rules and instructions shall be based upon the standards of:

a. 29 CFR 1910, Subpart Q;

b. 29 CFR 1926, Subpart J (Subpart Q and Subpart J contain the same information);

c. this chapter, including applicable referenced material and;

d. those of ANSI 249.1, "Safety in Welding and Cutting", (NOTAL).

Welding operations aboard ship shall be in accordance with NSTM, Chapter 074, Volume 1, "Welding and Allied Processes", (NOTAL), and 29 CFR 1915, Subpart D. Welding and hot work operations aboard aircraft shall be in accordance with NFPA 410, "Standard on Aircraft Maintenance", (NOTAL).

12-2.2.1. Ancillary Instructions. The recommendations of the equipment manufacturer and additional safeguards neces

sitated by local operating conditions shall be included in the rules and instructions.

12-2.2.2. Hot Work in Confined Spaces. Rules and instructions for hot work on or in confined spaces, containers, or hollow structures shall be in accordance with NAVSEA S6470-AA-SAF-010 (NOTAL).

12-2.3. QUALIFIED PERSONNEL. Personnel designated to operate welding equipment shall be properly instructed and qualified to operate it.

12-2.4. LOCATION

12-2.4.1. Designated Location. Welding and other hot work should be conducted in locations specifically designated for that purpose.

12-2.4.2. Other Locations Ashore. Before welding or other hot work is done in shore locations not designated for such operations, the location shall be inspected and specifically approved for the hot work operation to be performed in accordance with NAVMATINST 11320.14, "Naval Shore Activities Fire Protection Program", (NOTAL), and the Station Fire Bill.

12-2.4.2.1. Authorizing Personnel. Personnel authorized to approve locations for hot work shall be designated by the Station Fire Bill. Hot work in or on confined spaces shall be specifically authorized by the activity gas free engineering personnel. Personnel authorizing welding or cutting operations shall be thoroughly familiar with the requirements of 29 CFR 1910.252(d) and of NFPA 51B, "Standard for Fire Prevention in Use of Cutting and Welding Processes", (NOTAL).

12-2.4.2.2. Location Approval. The location approval shall be in writing and shall include any precautions (i.e., fire watches, shielding of combustibles, ventilation, etc.) deemed necessary by the approving official and others signing the approval. A copy of the approval shall be kept at the location for the duration of the operation.

12-2.4.3. Locations Aboard Ship. Approvals for welding and other hot work aboard ship shall be issued in accordance with NAVSEA S6470-AA-SAF-010 (NOTAL).

12-3. OXYGEN-FUEL GAS SYSTEMS

12-3.1. GENERAL

12-3.1.1. Flammable Mixture. Mixtures of fuel gases and air or oxygen are potentially explosive and shall be guarded

against. No equipment shall be used that permits air or oxygen to mix with flammable gases in an unsafe manner.

12-3.1.2. Qualified Personnel. Personnel in charge of the oxygen or fuel-gas supply equipment, including generators and oxygen or fuel-gas distribution piping systems, shall be qualified and competent.

12-3.2. CYLINDERS AND CONTAINERS. General requirements applicable to all compressed gas cylinders are given in section 8-3. The requirements for cylinders and containers in 29 CFR 1910.252(a)(2) are in addition to those of Chapter 8 and shall be complied with except that the reference in 29 CFR 1910.252(a)(2)(i)(b) shall be to MIL-STD-101B (NOTAL).

12-3.3. MANIFOLDS. The manifolding of cylinders for use in welding operations shall be accomplished in accordance with 29 CFR 1910.252(a)(3).

12-3.4. SERVICE PIPING SYSTEMS. The piping systems for oxygen and fuel-gas shall be designed, installed, equipped, and safeguarded in accordance with 29 CFR 1910.252(a)(4) and (5).

12-3.5. *WELDING HOSE*

12-3.5.1. Specifications. Hose for oxygen and fuel-gas service shall comply with IPF-7, "Specifications for Rubber Welding Hose", (NOTAL), issued by the Compressed Gas Association and the Rubber Manufacturers Association.

12-3.5.2. Color. Fuel-gas hose shall be red; oxygen hose shall be green. Inert gas and air hoses should be black.

12-3.5.3. Twin Hose Lines. A single hose with two or more passages shall not be used. Twin hose lines, which are actually two hoses held together by webbing or other means, are permissible. When parallel lengths of welding hoses are taped together for convenience or to prevent tangling, not more than 4 inches in every 12 inches shall be covered with tape.

12-3.5.4. Metal Clad Hose. Metal clad or armored hose should not be used.

12-3.5.5. Inspection. Welding hose shall be visually inspected daily for wear spots, burns, leaks, or other defects which may render the hose unserviceable. Hose which has been subject to flashback or which shows evidence of severe wear or damage, shall be tested to twice the normal pressure to which it is subject, but in no case less than 300 psi. Defective hose or hose in doubtful condition shall not be used.

12-3.6. TORCHES

12-3.6.1. Inspection and Cleaning. Torches shall be inspected at the beginning of each shift for leaking shut-off valves, hose couplings, and tip connections. Clogged torch tip openings shall be cleaned with cleaning wires, drills, or other devices designed for such purpose. Defective torches shall not be used.

12-3.6.2. Lighting. Torches shall be lighted by friction lighters or other approved devices. They shall not be lighted by matches or from hot work.

12-3.7. ADDITIONAL STANDARDS. The standards for oxygen-fuel gas welding and cutting operations in 29 CFR 1910.252(a) and in ANSI Z49.1 (NOTAL), shall be complied with.

12-4. ARC WELDING AND CUTTING

12-4.1. GENERAL. Equipment used in arc welding operations shall be in compliance with the National Electrical Manufacturers Association's Publication EW-1, "Requirements for Arc-Welding Apparatus", (NOTAL), or UL 551, "Safety Standard for Transformer-Type Arc-Welding Machines", (NOTAL).

12-4.2. VOLTAGE. Open circuit (no load) voltage or arc welding and cutting machines should be as low as possible consistent with satisfactory welding or cutting being done.

12-4.2.1. Alternating-Current Machines. The maximum AC open circuit (no load) voltages should be 80 volts for manual arc welding and cutting and 100 volts for automatic (machine or mechanized) arc welding and cutting. Under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls is recommended to reduce the shock hazard.

12-4.2.2. Direct-Current Machines. The maximum DC open circuit (no load) voltage should be 100 volts for both manual and automatic (machine or mechanized) arc welding and cutting.

12-4.2.3. Protection. When special welding and cutting processes require values of open circuit voltages higher than the above, means shall be provided to prevent the operator from making accidental contact with the high voltage by adequate insulation or other means.

12-4.3. DESIGN. Arc welding equipment shall meet the design requirements of 29 CFR 1910.252(b)(2)(iii) and (iv).

12-4.4. INSTALLATION. Installation (including power supply and grounding) shall conform to 29 CFR 1910.252(b)(3).

12-4.5. OPERATION AND MAINTENANCE. The operation and maintenance of arc welding equipment shall be in accordance with 29 CFR 1910.252(b)(4). If cables are to be carried some distance from the machine, they should be supported overhead. If overhead placement is not practicable, cables shall be safeguarded from damage and shall not impede the movement of personnel. Cables shall not be placed in the vicinity of power supply cables or other high voltage conductors.

12-5. RESISTANCE WELDING. Resistance welding equipment shall be installed and operated in accordance with 29 CFR 1910.252(c).

12-6. FIRE PROTECTION

12-6.1. NATURE OF FIRE HAZARDS. Anything which is combustible or flammable is susceptible to ignition by welding and other hot work operations. The most common materials likely to become involved in fire are combustible building construction such as floors, partitions, and roofs; combustible contents such as wood, paper, textiles, plastics, chemicals, and flammable liquids; and combustible ground cover such as grass and brush. Preventing fires generated by hot work can best be achieved by separating the combustibles from ignition sources or by shielding the combustibles. The requirements of NFPA 51B, "Standard for Fire Prevention in Use of Cutting and Welding Processes", (NOTAL), shall be complied with.

12-6.2. DESIGNATED SAFE LOCATION. Objects to be welded, cut, or heated should be moved to a safe location. If this is not possible, a written approval must be obtained in accordance with subparagraph 12-2.4.2, provided that all combustible material in the work area is removed to a safe place, or, if immovable, is protected by shielding from heat, sparks, and slag. If the combustible material cannot be removed or shielded, the hot work shall not be performed.

12-6.3. FLOOR AND WALL PROTECTION

a. Floors in the immediate area of cutting and welding operations shall be swept clean for a radius of 35 feet. Combustible floors shall be kept wet, covered with damp sand, or protected by fire-resistant shields. If the floor is wet, care shall be exercised to protect personnel from possible electric shock.

b. Fire-resistant shields or guards shall be used to prevent fire when cutting or welding is done near combustible walls, partitions, ceilings, or roofs.

c. Openings or cracks in the walls, floors, or ducts within 35 feet of the welding site shall be tightly covered to prevent the passage of sparks (see subparagraph 12-6.6.1).

12-6.4. DUCTS. Ducts and conveyor systems that might carry sparks to distant combustible material shall be protected or shut down.

12-6.5. AVAILABILITY OF FIRE EXTINGUISHING EQUIPMENT. Suitable fire extinguishing equipment shall be immediately available in the hot-work area (see section 7-4). It shall be maintained in a state of readiness for instant use.

12-6.6. FIRE WATCH

12-6.6.1. Requirements Ashore. Fire watches shall be required ashore whenever welding or other hot work is performed in locations in which the requirements of paragraph 12-6.3 cannot be met or where in the opinion of the approving authority (see subparagraph 12-2.4.2.1), a fire might develop. Fire watches shall be stationed on both sides of floors, walls, or ceilings being worked on if heat or sparks might be generated on the side opposite to which work is being performed.

12-6.6.2. Responsibilities Ashore

a. Fire watches shall have appropriate fire extinguishing equipment readily available and shall be trained in its use and limitations.

b. Fire watches shall be familiar with facilities and procedures for sounding an alarm in the event of fire.

c. Fire watches shall have continuous communications capability with the welder. If conditions are such that voice communication is not reliable, an appropriate system of signals or other effective means shall be used.

d. Fire watches shall first attempt to extinguish only those fires which are obviously within the capacity of the equipment available; otherwise the alarm shall be sounded immediately.

e. Fire watches shall remain at their stations at least one-half hour after the completion of the job to ensure that there are no smoldering fires.

12-6.6.3. Responsibilities Aboard Ship. Fire watches aboard ship shall be posted and shall perform their duties as specified in NSTM, Chapter 074, Volume 1, (NOTAL).

12-7. PERSONAL PROTECTION

12-7.1. GENERAL. The personal protection requirements of this section are included herein because they protect against hazards generated by welding and related operations. It is emphasized that these are not the only personal protective requirements applicable to welders; hearing protection, foot protection, etc., must also be worn by welders as required in Chapter 6. It is further emphasized that the requirements of this section are not limited to welders only; any employee, regardless of trade, who is exposed to welding-generated hazards, must be protected. Whenever possible, welding operations should be scheduled so as not to unnecessarily expose other trades working in the area.

12-7.2. EYE PROTECTION

12-7.2.1. Selection

a. Helmets or hand shields shall be used during all arc welding or arc cutting operations, excluding submerged arc welding. Goggles shall also be worn as necessary to provide protection from injurious rays and flying objects from adjacent work while the helmet or hand shield is not in place. The goggles may have either clear or colored glass, depending upon the amount of exposure to adjacent welding operation. Helpers or attendants shall be provided with proper eye protection.

b. Goggles or other suitable eye protection shall be used during all gas welding or oxygen cutting operations. Spectacles with suitable filter lenses are permitted for use during gas welding operations on light work, for torch brazing, or for inspection.

c. All operators and attendants of resistance welding or resistance brazing equipment shall use transparent face shields or goggles, depending on the particular job, to protect their faces or eyes, as required.

d. Eye protection in the form of suitable goggles shall be provided where needed for brazing operations not covered in the preceding subparagraphs.

12-7.2.2. Specifications for Eye Protectors. Specifications for the design and construction of helmets, hand shields, goggles, and their component parts shall meet the requirements of ANSI Z87.1 (NOTAL). Additionally, the following standards shall govern the use of eye protectors.

a. Helmets and hand shields shall be arranged to protect the face, neck, and ears from direct radiant energy emanating from the arc.

b. Table 12-1 shall be used for the proper selection of shade numbers of filter lenses or plates used in welding and related operations. Shades more dense than those listed may be used according to individual need.

c. In gas welding or oxygen cutting, where the torch produces a high yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.

12-7.2.3. Protection From Arc Welding Rays. Where the work permits, arc welding shall be enclosed in an individual booth painted with a finish of low reflectivity such as zinc oxide and lamp black, or shall be enclosed with noncombustible screens similarly painted. Booths and screens shall permit circulation of air at floor level. Workers or other persons in the vicinity shall be protected from the rays by noncombustible or flameproof screens or shall be required to wear appropriate goggles.

12-7.3. PROTECTIVE CLOTHING. Material containing asbestos shall not be used in flame-resistant protective clothing.

12-7.3.1. Gloves. Gloves shall be worn for welding and cutting operations. For light work, durable flame-resistant cotton gloves should be used. For heavier work, gauntlet gloves of leather or other suitable durable flame-resistant materials shall be used. Insulated linings should be used to protect areas exposed to high radiant energy. Where electric arc welding under wet conditions is unavoidable, electrician's rubber gloves should be worn under leather gloves.

12-7.3.2. Aprons. Flameproof aprons or jackets made of leather or other suitable material shall be worn as protection against radiated heat and sparks.

12-7.3.3. Outer Clothing. Outer clothing shall be kept reasonably free from oil or grease. Sleeves and collars shall be kept buttoned, and pockets shall be eliminated from the front of overalls and aprons as a protection against the lodging of sparks.

12-7.3.4. Leggings. Fire-resistant leggings or high boots shall be worn for heavy work. When possible a sheet metal screen should be placed in front of welders' legs to protect against sparks and molten metal from heavy work.

Table 12-1. WELDING FILTER SHADE SELECTION

No.	Welding Operation	Shade
	Shielded metal-arc welding - 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	10
	Gas-shielded arc welding (nonferrous) - 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	11
	Gas-shielded arc welding (ferrous) - 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	12
	Shielded metal-arc welding:	
	3/16-, 7/32-, 1/4-inch electrodes	12
	5/16-, 3/8-inch electrodes	14
	Atomic hydrogen welding	12 to 14
	Carbon arc welding	14
	Soldering	2
	Torch brazing	3 or 4
	Light cutting, up to 1 inch	3 or 4
	Medium cutting, 1 inch to 6 inches	4 or 5
	Heavy cutting, 6 inches and over	5 or 6
	Gas welding (light) up to 1/8 inch	4 or 5
	Gas welding (medium) 1/8 inch to 1/2 inch	5 or 6
	Gas welding (heavy) 1/2 inch and over	6 or 8
	Spray light from welding and cutting	1.7 to 4
	Metal pouring and furnace work	1.7 to 4

12-7.3.5. Sleeves and Shoulder Covers. Cape sleeves or shoulder covers with bibs made of leather or other suitable flame-resistant material shall be worn during overhead welding and cutting operations.

12-7.3.6. Caps. Leather caps should be worn under helmets to prevent head burns during overhead welding and cutting operations.

12-8. WORK IN CONFINED SPACES. In addition to the confined space entry and hot work requirements of NAVSEA S6470-AA-SAF-010 (NOTAL), the standards of this section also apply to welding and related hot work operations performed in confined spaces ashore.

12-8.1. VENTILATION. Ventilation shall be in accordance with the requirements of paragraph 12-9.3.

12-8.2. PLACING EQUIPMENT. Gas cylinders and welding machines shall be left on the outside of confined spaces. Portable equipment mounted on wheels shall be securely blocked to prevent accidental movement.

12-8.3. WARNING SIGN. After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning other workers.

12-8.4. GAS WELDING AND CUTTING.

a. The gas supply shall be shut off at a point outside the confined area whenever the torch is not being used or is left unattended for substantial periods of time such as breaks or lunch periods.

b. Overnight and at the change of shifts, the hose and torch shall be removed from the confined space or person to person turnover shall be accomplished.

c. Open end fuel-gas and oxygen hoses shall be immediately removed from confined spaces when they are disconnected from the torch or other gas consuming device.

12-8.5. ELECTRODE REMOVAL. When arc welding is suspended for any substantial period of time such as break or lunch periods, all electrodes shall be removed from holders, and the holders shall be safely positioned. The machine shall also be disconnected from the power source.

12-9. ENVIRONMENTAL SAFETY. Special ventilation and respiratory precautions for welding and hot work operations are in addition to the general requirements of Chapters 4 and 6.

12-9.1. GENERAL. Many variables are involved in determining ventilation and respiratory requirements for welding operations. Among these variables are the following:

a. Dimensions of the space, especially ceiling height.

b. Number of welders working in the space.

c. Evolution of hazardous fumes, gases, or dusts.

d. Location of the welder's breathing zone with respect to the rising plume of welding fumes.

e. Atmospheric conditions.

f. Heat generated.

Whenever there is a change in any of these variables, the operation should be reevaluated to determine the need for changing the ventilation/respiratory safeguards for the operation.

12-9.2. LABELS. Caution or warning labels as given in 29 CFR 1910.252(f)(1)(v) shall be placed on tags, boxes, or other containers of filler metals, fusible granular materials, and materials containing cadmium or fluorine compounds.

12-9.3. VENTILATION. Ventilation for welding and other hot work operations shall meet the general ventilation requirements of section 4-4 in addition to the specific ventilation requirements for welding and allied processes in 29 CFR 1910.252(f). Toxic levels shall be kept below the permissible exposure limits of paragraph 4-3.2. Required respiratory equipment shall meet the requirements of section 6-4.

12-10. PIPELINES. Welding or cutting operations on transmission pipeline or mechanical piping systems shall be accomplished in accordance with 29 CFR 1910.252(g).

CHAPTER 13

ELECTRICAL AND ELECTRONICS

13-1. GENERAL. Detailed discussion of the requirements for electrical and electronics safety is not practicable for this manual. There is an extensive body of electrical/electronics safety standards. The standards contained in or incorporated by reference in this chapter provide general requirements for working safely with electricity. Many items of electrical/electronics equipment have manufacturer's operating or maintenance manuals which include specific safety criteria. The following publications and standards are hereby incorporated by reference.

13-1.1. NAVY PUBLICATIONS

a. NAVFAC DM-4, "Electrical Engineering", (NOTAL).

b. NAVFAC MO-200, "Electric Power Distribution Systems Maintenance", (NOTAL).

c. NAVELEX 0101.110A, "Naval Shore Electronics Criteria; Installation Standards and Practices", (NOTAL).

d. NAVSEA S9086-KC-STM-000/CH-300 R1, "Electrical Plant; General" (NSTM Chapter 300), (NOTAL).

13-1.2. OSHA PUBLICATIONS.

a. 29 CFR 1910, Subpart S, "Electrical"; and 29 CFR 1910.268, "Telecommunications".

b. 29 CFR 1915, Subpart L, "Electrical Machinery".

c. 29 CFR 1926, Subpart K, "Electrical".

d. 29 CFR 1926, Subpart V, "Power Transmission and Distribution".

13-1.3. NATIONAL CONSENSUS STANDARDS

a. NFPA 70, "National Electrical Code", (NEC), (NOTAL).

b. NFPA 70E, "Electrical Safety Requirements for Employee Workplaces", (NOTAL).

c. ANSI C2, "National Electrical Safety Code", (NOTAL).

13-2. GENERAL REQUIREMENTS

13-2.1. PERSONNEL REQUIREMENTS

13-2.1.1. Electrical Personnel. Only trained and competent personnel shall be permitted to work on electrical equipment and systems. Personnel engaged in electrical work shall be fully informed of the hazards involved in their tasks. All electrical personnel shall be trained and certified in approved methods of first aid, including cardiopulmonary resuscitation (CPR), rescue techniques, and fire extinguishment. Telecommunications personnel shall receive additional training in accordance with 29 CFR 1910.268(c).

13-2.1.2. All Personnel. All personnel shall know and understand warning signs and signals and shall warn others who are in danger near energized equipment or lines. Personnel shall promptly report any of the following conditions:

a. Line or equipment defects.

b. Accidentally energized objects, such as conduits, light fixtures, guys, etc.

c. Other defects that may cause a dangerous condition.

13-2.2. *PERSONAL PROTECTION*

13-2.2.1. Clothing. The following requirements are for the personal attire of employees while working on energized circuits.

13-2.2.1.1. Dry Clothing. Clothing, as well as hands, shall be dry.

13-2.2.1.2. Metal Fasteners and Jewelry. Exposed metal zippers, buttons, buckles or other fasteners, and rings, wrist watches, bracelets, earrings, metal-framed eyewear or similar metal items shall not be worn within 4 feet of exposed live electrical equipment.

13-2.2.1.3. Shoes. Thin-soled shoes (or boots) or shoes with exposed metal parts or hobnails shall not be worn. Nonconductive shoes meeting the requirements of ANSI Z41 (NOTAL) shall be worn when working on live electrical circuits of 30 volts or more. The Navy standard stock electrical hazard safety shoe (8430-00-611-8314) is designated for electrical and electronic repair work.

13-2.2.2. Special Protective Equipment. The specialized items of personal protective equipment (PPE) for electrical protection discussed below shall be used when required in

addition to any general item of personal protective equipment required by Chapter 6.

13-2.2.2.1. Standards. Rubber insulating equipment shall meet the requirements of the following standards:

a. ANSI/ASTM D120, "Rubber Insulating Gloves", (NOTAL).

b. ANSI/ASTM D1048, "Rubber Insulating Blankets", (NOTAL).

c. ANSI/ASTM D1049, "Rubber Insulator Hoods", (NOTAL).

d. ANSI/ASTM D1050, "Rubber Insulating Line Hose", (NOTAL).

e. ANSI/ASTM D1051, "Rubber Insulating Sleeves", (NOTAL).

13-2.2.2.2. Gloves. Rubber insulating gloves shall be worn where necessary to protect personnel working on live electrical equipment in excess of 30 volts. Rubber insulating gloves shall not be used for any purpose except live electrical work. If the nature of the work requires that one hand be free of covering, it is permissible to do so, however, a glove shall be worn on the other hand (see subparagraph 13-2.2.5).

a. Before each use, gloves shall be checked by the user for punctures, tears, or abrasions. The glove cuffs should be rolled up forcing air into the fingers and palms of the glove. If there is evidence of any leakage or thin spots, the glove shall be replaced.

b. Leather protectors shall always be worn over rubber insulating gloves. Leather protectors shall not be used for any purpose other than with rubber gloves.

c. Rubber gloves or sleeves shall never be rolled down or worn inside out.

d. Under no circumstances shall two pairs of rubber gloves be worn at the same time.

13-2.2.2.3. Testing Rubber Insulating Equipment. In addition to the user test for gloves required in 13-2.2.2.2a, rubber insulating equipment shall be tested in accordance with the criteria and intervals of the following standards:

a. ANSI/ASTM F478, "Specifications for In-Service Care of Insulating Line Hose and Covers", (NOTAL).

b. ANSI/ASTM F479, "Specifications for In-Service Care of Insulating Blankets", (NOTAL).

c. ANSI/ASTM F496, "Specifications for In-Service Care of Insulating Gloves and Sleeves", (NOTAL).

13-2.2.2.4. Insulating Floor Covering. On all circuits where the voltage is in excess of 30 volts, workers shall be insulated from accidental grounding by the use of approved insulating material on the floor. Rubber matting shall meet the specifications of ANSI/ASTM D178, "Rubber Matting for Use Around Electrical Apparatus", (NOTAL). Although the use of approved rubber matting is preferred, dry wood or at least two layers of dry canvas, sheets of phenolic material or unapproved rubber mats may be used for voltages below 600 volts. The use of approved rubber matting is mandatory for voltages at or above 600 volts. Moisture, dust, metal chips, etc., shall be removed at once from insulating floor covers.

13-2.2.3. Climbing Equipment

13-2.2.3.1. Belts, Straps, and Lanyards. Lineman's body belts, safety straps and lanyards shall be used as necessary by personnel working more than 4 feet above the ground on poles or towers. In addition to meeting the requirements of paragraph 6-8.1, the equipment shall be capable of withstanding an AC dielectric test of not less than 25,000 volts per foot "dry" for 3 minutes without visible deterioration. Cushion parts of body belts shall have no exposed rivets on the inside. The requirements of 29 CFR 1926.954 shall be complied with.

13-2.2.3.2. Pole Climbers. Pole climbers shall be inspected before each day's use. Fractured or cracked gaffs or leg irons, loose or dull gaffs, and broken straps or buckles, shall be immediately corrected. Pole climbers shall not be used if the gaffs are less than 1-1/4 inches in length. They shall not be worn when working in trees, on ladders, or in aerial lifts. Pole climbers shall not be worn when walking on rocky, hard or frozen ground, or when driving a vehicle.

13-2.2.4. Platforms. Whenever it is necessary to work on electrical circuits or equipment in wet or damp locations, dry wooden (or similar nonconducting material) platforms shall be provided.

13-2.2.5. Metal Tool Handles. Only tools with insulated handles may be used on live electrical equipment. Plastic handles are preferred, otherwise metal handles of hand held tools shall be insulated by one of the following methods:

13-2.2.5.1. Taping Method. The handle and as much of the shaft as is practicable is covered with two layers of rubber or vinyl plastic tape half-lapped, followed with a layer of friction tape half-lapped.

13-2.2.5.2. Coating Method. Handle and shaft is dipped in a nonconductive plastisol solution.

13-2.2.5.3. Sleeve Method. In an emergency, where time does not permit using one of the previous methods, handles and shafts may be covered with a cambric sleeving, flexible plastic tubing, or insulating tubing removed from scraps of electrical cable.

13-2.2.6. Fuse Box Covers. The covers on fuse boxes and other types of wiring equipment and accessories shall be kept securely closed except when work is being done on them. The boxes shall be kept locked unless emergency access is needed for the equipment. Unauthorized personnel should be kept at least four feet away and warning signs posted to keep clear. If equipment must be left exposed and unattended, adequate safeguards such as a temporary nonconductive covering shall be installed.

13-2.2.7. Warning Signs. Danger or caution signs or tags shall be posted to alert personnel to actual or potential hazardous conditions involving electricity (see section 3-4).

13-2.2.8. Protection of Personnel Other Than Electricians. Where work is being performed within 4 feet from the exposed parts of electrical or electronic equipment by painters, carpenters or other trades, an insulating barrier shall be erected or the circuits shall be deenergized. This procedure shall be employed regardless of voltage. The electrician in charge shall instruct the nonelectrical personnel of the hazards involved and he shall provide and erect the appropriate insulating barriers or deenergize and lock out the circuits.

13-2.2.9. Work Near Overhead Power Lines. Personnel and equipment, such as cranes, derricks, aerial lifts, ladders, scaffolds, etc., shall maintain a distance of at least 10 feet from energized overhead power lines rated at 50,000 volts or less. Minimum clearance for lines rated at more than 50,000 volts shall be 10 feet plus 0.4 inch for each 1,000 volts over 50,000 volts or twice the length of the line insulator (but no less than 10 feet). Any overhead wire shall be considered energized until competent authority certifies it is deenergized or it is visibly grounded. These clearance requirements do not apply when qualified personnel using approved equipment and procedures are working on the lines in question.

13-2.2.10. Fire Safety

13-2.2.10.1. Fire Prevention. Gasoline, benzene, ether, and similar flammable fluids shall never be used on either energized or deenergized electrical aparatus. Alcohol shall not be used for cleaning near electrical equipment from which a spark might be received. Machinery shall be kept absolutely clean and free of oil, grease, carbon dust, etc., to prevent ignition by electrical arcing. Warning signs shall be displayed where explosive vapors are present in any compartment or space. Electrical or electronic equipment shall not be energized within such areas while these signs are posted.

13-2.2.10.2. Firefighting. In the event of electrical fire, the following procedures shall be performed:

a. The circuits or equipment affected shall be immediately deenergized.

b. The fire department shall be notified.

c. The fire shall be controlled through the use of approved fire control equipment until the fire department arrives.

d. In case of cable fires, the only positive method of preventing the fire from running the length of the cable is to cut the cable and to separate the two ends. The cable shall be deenergized before being cut.

13-2.2.10.3. Firefighting Equipment. Class C extinguishers shall be used to extinguish electrical fires. The stream from those extinguishers is nonconductive and can be directed against energized circuits without danger of shock.

13-2.3. WORKING ON ENERGIZED CIRCUITS. Repairs are not to be made on energized circuits except in an emergency. A circuit must be considered energized until it has been checked and the switch opened, tagged, and locked. A qualified supervisor shall be in charge of testing for voltage and installing grounds.

13-2.3.1. Personnel Requirements. Repair work on an energized circuit shall be performed only by personnel fully aware of the dangers involved. All work shall be supervised by qualified technicians or experienced communications or electronics material officers. Personnel should be stationed by circuit breakers or switches. Telephones should be manned so that circuits can be immediately deenergized in case of emergency. A person qualified to administer first aid and CPR for electric shock shall stand by during the entire period the work is being performed.

13-2.3.2. Precautions for Specific Voltages. Although many of the precautions listed for work with specific voltages relate to line work, the over-all safety measures relate to all work on live circuits and for that reason are included here with other general working rules.

13-2.3.2.1. Low voltage Work, 0 to 600. Live conductors and equipment operating at 600 volts or less may be worked upon under the following conditions:

a. Adjacent live or grounded conductors and equipment shall be covered with insulating material or approved rubber protective equipment (see subparagraph 13-2.2.2).

b. Two employees shall work together when work is done on energized parts carrying more than 30 volts. When working on energized lines, employees should not change positions on a pole without first informing others working nearby.

c. Bare or exposed places on one conductor must be taped or covered before another conductor is exposed.

13-2.3.2.2. Intermediate Voltage Work, 600 to 5,000 Volts

a. All conductors and equipment must be considered as energized until it has been determined beyond doubt that they are deenergized. Positive proof as to whether a conductor or a piece of equipment is deenergized must be established by the use of an approved voltage detector. Before being used, the detector must be checked on a conductor that is known to be energized and a positive indication noted. This check on a known energized conductor must be repeated after the test on a deenergized conductor has been made. When it is not possible to recheck the voltage detector on an energized conductor, two voltage detectors shall be used, one as a check against the other.

b. When work is to be done on or within reach of conductors or equipment operating between 600 and 5,000 volts, energized and grounded conductors or equipment within reach must be isolated with suitable barriers or covered with rubber hose line, insulator hoods, line protectors (pigs), or blankets (see subparagraph 13-2.2.2). If it becomes necessary for workers to change working positions they must cover or barricade any energized or grounded conductors or equipment that will be within reach in the new position.

c. When conditions permit, the section of the line being worked on shall be deenergized by opening the sectionalizing switches, and grounded.

13-2.3.2.3. High Voltage Work, 5,000 Volts and Over. Lines and equipment operating at 5,000 volts or over must be de-

energized and grounded before work is started, except in emergency repairs on overhead lines, which may be worked on live with approved live-line tools.

a. Work on deenergized circuits must be done between two sets of grounds, one set to be placed on the first pole or structure toward the source of energy and the other on the first pole toward the load. When grounds are to be attached, the ground connection must be made first. When grounds are to be removed, the ground connection must be broken last.

b. Work with live-line tools shall not be performed when rain or snow is imminent or falling, or when heavy fog, dew, or any form of excessive moisture is present. No more than one conductor may be worked on at a time with live-line tools.

c. A minimum body clearance from energized lines and equipment shall be maintained by personnel working on or around electrical equipment of high voltage, as shown in the following table:

Operating Voltage (Kilovolts)	Minimum Distance (Feet)
5 to 7.5	1
7.5 to 12	2
12 to 33	3
33 to 66	4
66 to 132	5
132 to 220	8

13-2.3.3. Live-Line Barehand Work. Live-line barehand work shall not be performed by Navy personnel (see NAVFACINST 5100.10A, "Electric Power Distribution System Maintenance, Live-Line Bare-Hand Work", (NOTAL).

13-2.4. BATTERIES. Storage batteries shall be changed and charged in accordance with 29 CFR 1910.178(g) and NAVELEX 0101.110A, (NOTAL).

13-2.4.1. Eye-Wash and Shower. Deluge showers and eye-wash fountains shall be provided in the immediate vicinity of all battery maintenance and electrolyte handling operations.

13-2.4.2. Ventilation. Ventilation in charging facilities shall be such that the hydrogen concentration is below 3 percent at 6 inches above the cells.

13-2.5. INSPECTIONS. Electrical appliances and equipment shall be periodically inspected for adequacy and functioning of safety features and for damaged insulation and loose connections (the exact periods of time should be determined

by the safeety officer or other qualified person). Appliances and equipment found to be defective shall be removed from service.

13-2.6. SUPPLY STATIONS AND LINES. The installation, operation, and maintenance of conductors and equipment in electric-supply stations, and in electric-supply and communication lines and equipment shall be in accordance with ANSI C2, "National Electrical Safety Code", (NOTAL).

13-3. ELECTRICAL SYSTEMS. The standards listed in paragraph 13-3.1 through 13-3.6 are incorporated by reference. These are general electrical standards; additional detailed standards are in NFPA 70, "National Electrical Code", (NOTAL), which is also incorporated by reference.

13-3.1. GENERAL REQUIREMENTS. Requirements for marking equipment, splicing, disconnect means, guarding live parts, enclosures, and work spaces are in 29 CFR 1910.303, "General Requirements".

13-3.2. WIRING DESIGN AND PROTECTION. Standards for grounding, clearances, and overcurrent protection are in 29 CFR 1910.304, "Wiring Design and Protection".

13-3.3. WIRING METHODS, COMPONENTS, AND GENERAL USE EQUIPMENT. Requirements for wiring, cabinets, switches, flexible cord, and general equipment are in 29 CFR 1910.305, "Wiring Methods, Components, and General Use Equipment".

13-3.4. SPECIFIC PURPOSE EQUIPMENT AND INSTALLATIONS. Requirements for electric signs, cranes and hoists, elevators, escalators, electric welders, data processing systems, industrial X-ray equipment, heating equipment, electrolytic cells, and swimming pools, are in 29 CFR 1910.306, "Specific Purpose Equipment and Installation". The brief discussion of this equipment by OSHA is directed to electrical requirements only. Operational safeguards for the equipment listed above and for most other electrically-powered equipment and appliances are contained elsewhere in this manual or are included in consensus standards specific to the equipment. The Underwriters' Laboratories, in cooperation with the American National Standards Institute, has developed detailed safety standards for over 100 separate items of electric equipment. These standards are in the ANSI C33 series and should be consulted whenever information is required on specific items of equipment. Many of these UL/ANSI standards are listed in section B8 of Appendix B.

13-3.5. HAZARDOUS LOCATIONS. Requirements for electrical equipment and wiring used in locations classified as hazardous because of the presence or potential presence of flammable or explosive concentration of gases, vapors, dusts and fibers, are in 29 CFR 1910.307, "Hazardous (Classified)

Locations". The determination of whether or not a location is hazardous shall be made by the activity safety office based on the criteria in the NEC and in 29 CFR 1910, Subpart H.

13-3.6. SPECIAL SYSTEMS. Requirements for systems over 600 volts, emergency power systems, signaling systems, and communication systems are in 29 CFR 1910.308, "Special Systems".

13-4. ELECTRONICS

13-4.1. GENERAL. The electrical safety standards of this manual and the OSHA standards in 29 CFR 1910.268 and Subpart S of 29 CFR 1910 apply to all electronics installations. However, the use of electronics in communications, command and control systems, radar, lasers, sonar, television, electronic warfare, security and other electronic systems requires additional safety precautions; especially in poorly accessible areas such as those aboard ship or in electronic equipment vans. Most electronic equipment has accompanying technical manuals issued by the Navy or provided by the manufacturer. The safety requirements of such manuals shall be complied with. In the absence of such specific requirements, the requirements of this manual and of NAVELEX 0101.110A, "Naval Shore Electronics Criteria; Installation Standards and Practices", (NOTAL), shall be complied with.

13-4.2. TAG OUT/LOCK OUT. Before performing corrective or routine maintenance on any electronic equipment, the main supply switches or cut out switches in each circuit from which power can be supplied shall be secured in the open or "safety" position and, as a minimum, tagged; locking out is the preferred method of safeguarding against inadvertent operation of the switch. When more than one party is checking a circuit, a tag or lock for each party shall be placed on the supply switch. Each party shall remove only its own tag or lock upon completion of work (see subparagraph 10-4.1.8).

13-4.3. PRECAUTIONS DURING SHIP OVERHAUL AND REPAIR. Although local safety officials of a shipyard or repair facility will normally notify the Commanding Officer when electronic safety measures are required, ship's transmitting equipment shall be secured when:

a. Overhead cranes are operating in the close proximity of the transmitting antennas.

b. Personnel are placing or removing rigging or structures aloft.

c. Flammable, combustible or explosive materials are being loaded or offloaded on the adjacent dock or on other ships or barges in the near vicinity.

13-4.4. ENERGIZING WHEN SHIP IS IN DRY DOCK. The electronic equipment of a ship may be energized only with the express permission of the Docking Officer. The hull must be adequately grounded. Excitation is not to be applied to sonar transducers unless properly immersed. Sonar hoist mechanisms are to be operated only after it has been definitely ascertained that adequate clearance exists for the moving elements within their full limit of travel and that no mechanical damage will be incurred by such operation. This determination is to be made as soon as practicable after the dock is emptied. If sufficient clearance does not exist, positive steps shall be taken to prevent lowering of the transducer by gravity, manual, or power operation.

13-4.5. RADIO FREQUENCY (RF) AND MICROWAVE HAZARDS. The control of radio frequency and microwave hazards shall be accomplished in accordance with 29 CFR 1910.97 and with NAVSEA OP 3565, "Electromagnetic Radiation Hazards", (NOTAL) (also issued as NAVAIR 16-1-524 and NAVELEX 0967-LP-626010).

13-4.6. LASER HAZARDS. Lasers for industrial and military operations shall be used in accordance with NAVELEXINST 5100.12, "Navy Laser Hazard Prevention Program", (NOTAL) and ANSI Z136.1, "Safe Use of Lasers", (NOTAL).

13-4.7. HAZARDOUS MATERIAL. Some hazardous materials commonly encountered when maintaining electronic equipment are cleaning solvents, cryogenics, inert gases, toxic paints and toxic or nuisance dusts from drilling, sanding or abrasive cleaning. Appropriate workplace design, procedures, respiratory protection and personal protective equipment shall be provided to protect personnel as required in Chapters 4 and 6.

13-5. CONSTRUCTION. Standards for electrical safety in construction operations are in 29 CFR 1926, Subparts K and V.

13-6. SHIPS. The basic document for electrical safety aboard ship is NAVSEA S9086-KC-STM-000/CH-300 R1 (NSTM Chapter 300), "Electric Plant, General", (NOTAL). This document lists other chapters of the NSTM which pertain to specific electrical equipment and operations aboard ship.

APPENDIX A

DEFINITIONS

Approved. Equipment or materials which have been tested, evaluated and determined to be acceptable by a recognized testing laboratory or inspection agency according to the requirements of a particular code or specification and the requirements of a specific purpose, environment or application. For example, Underwriters Laboratory tests and labels electrical equipment for use in hazardous locations, and NIOSH tests and approved respiratory protective equipment for various types of exposures. If "approved" equipment meeting this definition is not available, the appropriate Navy authority having jurisdiction may approve equipment. The Navy authority having jurisdiction for safety equipment ashore is the Chief of Naval Operations designated official.

Combustible Liquid. The term "combustible liquid" denotes any liquid having a flash point at or above 100 degrees Fahrenheit (37.8 degrees Celsius). Combustible liquids are divided into the following four categories:

a. Class II liquids include those with flash points at or above 100 degrees Fahrenheit (37.8 degrees Celsius) and below 140 degrees Fahrenheit (60 degrees Celsius), except any mixture having components with flash points of 200 degrees Fahrenheit (93.3 degrees Celsius) or higher, the volume of which make up 99 percent or more of the total volume of the mixture.

b. Class III liquids (which are further divided into Class IIIA and Class IIIB subcategories) include those with flash points at or above 140 degrees Fahrenheit (60 degrees Celsius).

c. Class IIIA liquids include those with flash points at or above 140 degrees Fahrenheit (60 degrees Celsius) and below 200 degrees Fahrenheit (93.3 degrees Celsius), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

d. Class IIIB liquids include those with flash points at or above 200 degrees Fahrenheit (93.3 degrees Celsius).

Combustible and Flammable Solids. Combustible and flammable solids are materials, other than those classified as explosive, which can be ignited readily or which are liable to cause fire through friction and retained heat from manufacturing or processing.

Competent Person. The term "competent person" signifies one who is cognizant of existing and predictable hazards in the equipment, environment or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Confined Space. A space which by design, has limited and restricted openings for entry and exit, and a lack of natural ventilation and which could contain or produce hazardous contaminants or oxygen deficiencies or enrichment. Confined spaces are not intended for normal continuous personnel occupancy. In non-maritime activities this includes spaces such as fuel storage tanks, process vessels, boilers, furnaces, sewers, utility tunnels, vaults and similar spaces. In maritime activities this includes spaces such as fuel tanks, cofferdams, double bottoms, etc.

Enclosed Space. A space, which by its nature or design, is of such a shape, depth, or other feature that natural ventilation or the natural movement of air is restricted. Such spaces include open top storage tanks, degreasers, dip tanks, pits, trenches and similar spaces.

Explosive or Flammable Limits. The range of concentration of a material, expressed in percent in air, which will burn or explode if ignited. Limiting concentrations are termed the Lower Explosive (flammable) Limit (LEL) and the Upper Explosive Limit (UEL). Concentrations below the LEL are too "lean" to react, while concentrations above the UEL are too "rich" to react.

Explosion-Proof. An apparatus, device or equipment that is tested and approved for use in hazardous atmospheres (flammable/explosive) as defined in the National Electrical Code.

Fire Classes.

Class A - a fire involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials.

Class B - a fire involving flammable or combustible liquids, flammable gases, greases and similar materials and some rubber and plastic materials.

Class C - a fire involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media.

Class D - a fire involving combustible metals such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

Fire Point. The temperature at which sufficient vapor is given off to continue burning after ignition.

Flammable Gas. A flammable gas is a gas which, in a mixture of 13 percent or less (by volume) with air, forms a flammable mixture or has a flammable (explosive) range with air wider than 12 percent as determined at atmospheric temperature and pressure.

Flammable Liquids. The term "flammable liquid" denotes any liquid having a flash point below 100 degrees Fahrenheit (37.8 degrees Celsius), except any mixture having components with flash points of 100 degrees Fahrenheit (37.8 degrees Celsius) or higher, the total of which make up 99 percent or more of the total volume of the mixture. Flammable liquids are known as Class I liquids and are divided into the following three classes:

a. Class IA includes liquids having flash points below 73 degrees Fahrenheit (22.8 degrees Celsius) and having a boiling point below 100 degrees Fahrenheit (37.8 degrees Celsius).

b. Class IB includes liquids having flash points below 75 degrees Fahrenheit (22.8 degrees Celsius) and having a boiling point at or above 100 degrees Fahrenheit (37.8 degrees Celsius).

c. Class IC includes liquids having flash points at or above 73 degrees Fahrenheit (22.8 degrees Celsius) but below 100 degrees Fahrenheit (37.8 degrees Celsius).

Flash Point. The lowest temperature at which a sufficient amount of vapor is given off by a liquid to form an ignitible mixture with air.

Frequent. As an inspection or reporting interval, frequent, as used in this manual, means at least once a month. The actual interval should be established by the safety officer or other competent authority.

Gas Freeing. Operations performed in testing, evaluating, removing or controlling hazardous materials or conditions within or related to a confined or enclosed space which may present hazards to personnel entering or working in, on, or adjacent to the space.

Hazardous Material. A hazardous material is a material having one or more of the following characteristics:

a. Has a flash point below 200 degrees Fahrenheit (93.3 degrees Celsius) closed cup, or is subject to spontaneous heating or to polymerization with release of large amounts

of energy when handled, stored, and shipped without adequate control;

b. Has a permissible exposure limit equal to or below 1,000 ppm for gases and vapor, below 500 mg/m^3 for fumes, and equal to or below 30 mppcf or 10 mg/m^3 for dusts;

c. A single oral dose which will cause 50 percent fatalities to test animals when administered in doses of less than 500 mg per kilogram of test animal weights;

d. Is a flammable solid as defined in 49 CFR 173.150, or is an oxidizer as defined in 49 CFR 173.151, or is a strong oxidizing or reducing agent with a half cell potential in acid solution of greater than $\pm$1.0 volt as specified in Latimer's table on the oxidation-reduction potential;

e. Causes first-degree burns to skin in short time exposure, or is systemically toxic by skin contact;

f. In the course of normal operations, may produce dusts, gases, fumes, vapors, mists or smokes with one or more of the above characteristics;

g. Produces sensitizing or irritating effects;

h. Is radioactive;

i. The item has special characteristics which in the opinion of the manufacturer could cause harm to personnel if used or stored improperly;

j. The item is hazardous in accordance with 29 CFR, Part 1910;

k. The item is hazardous in accordance with 49 CFR, Parts 171-179 or the International Maritime Dangerous Goods Code of the Inter-Governmental Maritime Consultative Organization (IMCO) or the Dangerous Goods Regulations of the International Air Transport Association (IATA); or

l. Is regulated by the Environmental Protection Agency under 40 CFR.

Hot Work. Hot work includes all flame heating, welding, torch cutting, brazing, carbon-arc gouging, or any work which produces heat, by any means, of 400 degrees Fahrenheit or more; or in the presence of flammables or flammable atmospheres, other ignition sources such as spark- or arc-producing tools or equipment, static discharges, friction, impact, open flames or embers, smoking materials, non-explosionproof lights, fixtures, motors or equipment, etc.

Ignition Temperature (Point). The minimum temperature required to initiate self-sustained combustion independent of external ignition sources or heat.

Immediately Dangerous to Life or Health (IDLH). Atmospheres or conditions which may reasonably be expected to become immediately dangerous to life or health due to the presence of flammable or explosive vapors at or in excess of 10 percent of the Lower Flammable Limit, oxygen content less than 16 percent or greater than 22 percent, toxics which exceed a level from which a person could escape within 30 minutes without impairing symptoms or irreversible health effects or any combination thereof.

Incorporation By Reference. A procedure whereby a referenced standard or document is made an integral part of the basic manual. The purpose is to include essential safety and health requirements without reproducing information which is readily available to the user of the manual. It is emphasized that matter incorporated by reference has equal standing with matter enumerated in the manual. (See section 1-6).

Means of Egress. A means of egress is a continuous and unobstructed way of exit travel from any point in a building or structure to a public way and consists of three separate and distinct parts: the way of exit access, the exit, and the way of exit discharge. A means of egress comprises the vertical and horizontal ways of travel and shall include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts, and yards.

Periodic. As an inspection or reporting interval, periodic, as used in this manual, means at least once a year. The actual interval should be established by the safety officer or other competent authority.

Point of Hazard. The zone or area of or near any machine, machine part, or workpiece, including the point of operation and power transmission, which, if entered or contacted by an employee, may subject the employee to danger of traumatic injury or death. A point of hazard may be associated with machine motions or actions, such as: rotating, reciprocating, and transverse motions; in-running nip points; cutting actions; and pressing, punching, shearing, and bending actions. A point of hazard may also be associated with machines at rest, for example: the cutting edge of saws or shears, hot dies, electrical tools subject to release, and pressurized systems.

Point of Operation. The point of operation is the area on a machine where work is actually performed upon the material being processed.

APPENDIX B

REFERENCES

B1. GENERAL. This appendix contains all the publications referenced in this manual. This is by no means an all-inclusive list of the publications which impact on occupational safety and health. See section 1-6 for requirements on the use of referenced publications.

B2. NAVAL PUBLICATIONS AND FORMS CENTER. The publications and instructions in this section are available from the U.S. Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120; Autovon 442-3321, Commercial (215) 697-3321. Publications must be ordered in accordance with NAVSUP P-2002, "Navy Stock List of Publications and Forms".

B2-1. SECRETARY OF THE NAVY

SECNAVINST 5100.10E; Department of the Navy Safety and Occupational Health Policy, Implementation of.

SECNAVINST 5100.14A; Military Exempt Lasers.

B2-2. CHIEF OF NAVAL OPERATIONS

OPNAVINST 3120.32A; Standard Organization and Regulations of the U.S. Navy.

OPNAVINST 5090.1; Environmental and Natural Resources Protection Manual.

OPNAVINST 5100.8F; Navy Safety and Occupational Health Program, Implementation of.

OPNAVINST 5100.12B; Navy Traffic Safety Program, Promulgation of.

OPNAVINST 5100.19A; Navy Safety Precautions for Forces Afloat.

OPNAVINST 5100.20B; Shipboard Heat Stress Control and Personnel Protection.

OPNAVINST 5100.23B; Navy Occupational Safety and Health (NAVOSH) Program Manual.

OPNAVINST 6240.6B; Safety and Health Considerations Affecting the Wear of Facial Hair.

OPNAVINST 8023.2B; U. S. Navy Explosives Safety Policies, Requirements, and Procedures.

OPNAVINST 9640.1; Shipboard Habitability Program.

B2-3. CHIEF OF NAVAL MATERIAL

NAVMATINST 11320.14; Naval Shore Activities Fire Prevention Program.

B2-4. BUREAU OF MEDICINE AND SURGERY

BUMEDINST 6250.6B; Navy Medical Vector and Pest Management Program, Assignment of Responsibilities for.

BUMEDINST 6250.12A; Vector Control Certification for Medical Department Personnel.

BUMEDINST 6260.2B; Water and Salt Requirements in Hot Environments and Climates.

BUMEDINST 6260.16A; Isocyanates, Measures for Control of Health Hazards Related to.

BUMEDINST 6270.6; Potentially Toxic Materials, Precautions Against.

BUMEDINST 6470.13A; Microwave and Radiofrequency Health Hazards.

NAVMED P-117; Manual of the Medical Department.

NAVMED P-5010-1; Food Service Sanitation.

NAVMED P-5010-3; Manual of Naval Preventive Medicine.

NAVMED P-5055; Radiation Health Protection Manual.

B2-5. NAVAL AIR SYSTEMS COMMAND

NAVAIRINST 5103.1; Naval Air Systems Command Supplement to the Navy Occupational Safety and Health (NAVOSH) Program Manual.

NAVAIR 06-5-502; Handbook, Aircraft Refueling at Shore Activities.

NAVAIR 06-30-501; Technical Manual of Oxygen/Nitrogen Cryogenic Systems.

NAVAIR 16-1-529; Technical Manual Electromagnetic Radiation Hazards.

B2-6. NAVAL ELECTRONICS SYSTEMS COMMAND

NAVELEX 0101-110A; Naval Shore Electronics Criteria, Installation Standards and Practices.

NAVELEX 0967-LP-624-6010; Technical Manual Electromagnetic Radiation Hazards.

NAVELEXINST 5100.12; Navy Laser Hazards Prevention Program.

B2-7. NAVAL FACILITIES ENGINEERING COMMAND

NAVFAC DM-2; Structural Engineering.

NAVFAC DM-4; Electrical Engineering.

NAVFAC DM-8; Fire Protection Engineering.

NAVFAC DM-25; Waterfront Operational Facilities.

NAVFAC MO-115; Building Maintenance, Air Conditioning and Refrigeration.

NAVFAC MO-117; Maintenance of Fire Protection Systems.

NAVFAC MO-200; Electric Power Distribution Systems Maintenance.

NAVFAC MO-322; Inspection of Shore Facilities.

NAVFAC P-300; Management of Transportation Equipment.

NAVFAC P-301; Navy Railway Operating Handbook.

NAVFAC P-306; Testing and Licensing of Weight Handling and Construction Equipment Operators.

NAVFAC P-307; Management of Weight Handling Equipment: Maintenance and Certification.

NAVFAC P-309; Color for Naval Shore Facilities.

NAVFACINST 5100.12; Electric Power Distribution System Maintenance, Live-Line Bare-Hand Work.

NAVFACINST 5100.15; Radiological Affairs Support Program, Standards, Requirements, and Information for.

NAVFACINST 6250.5A; Pest Control Personnel Certification.

NAVFACINST 11300.24B; Utilization of Industrial Compressed Air Systems for Supplying Breathing Air.

B2-8. NAVAL SEA SYSTEMS COMMAND

NAVSEA 0900-LP-5010; Ship Repair Contracting Manual.

NAVSEA 0901-LP-230-0002; Industrial Gases: Generating, Handling, and Storage (NSTM Chapter 550).

NAVSEA 0901-LP-490-0003; Compressed Air Plants (NSTM Chapter 551).

NAVSEA 0901-LP-573-0000; Cranes and Booms (NSTM Chapter 573).

NAVSEA 0902-018-2010; General Overhaul Specification for Deep Diving Submarines.

NAVSEA 0994-LP-001-9010; U. S. Navy Diving Manual.

NAVSEA S6470-AA-SAF-010; NAVSEA Gas Free Engineering Program.

NAVSEA S9086-BK-STM-000/CH-613; Wire and Fiber Rope and Rigging (NSTM Chapter 613).

NAVSEA S9086-CH-STM-010/CH-074 V1; Welding and Allied Processes (NSTM Chapter 074, Volume 1).

NAVSEA S9086-CH-STM-030/CH-074 V3; Gas Free Engineering (NSTM Chapter 074, Volume 3).

NAVSEA S9086-KC-STM-000/CH-300 R1; Electric Plant General (NSTM Chapter 300).

NAVSEA S9086-VD-STM-000; Preservation of Ships in Service (NSTM Chapter 631).

NAVSEA OP 5; Ammunition and Explosives Ashore, Safety Regulations for Handling, Storing, Production, Renovation and Shipping.

NAVSEA OP 3565; Technical Manual Electromagnetic Radiation Hazards.

NAVSEAINST 5100.16; Fire Protection Requirements for Surface Ship Overhauls, Standardization of.

NAVSEAINST 9310.1A; Naval Lithium Battery Safety Program, Responsibilities and Procedures for.

B2-9. NAVAL SUPPLY SYSTEMS COMMAND

NAVSUPINST 5100.27; Hazardous Materials.

NAVSUP P-2002; Navy Stock List of Publications and Forms.

B2-10. DEPARTMENT OF DEFENSE

DOD 4145.19-R-1 of 1 September 1979; Storage and Materials Handling.

DOD 4160.21-M of 1 September 1982; Defense Utilization and Disposal Manual.

DODINST 6050.5M of May 1979; DOD Hazardous Materials Information System Procedures.

DODINST 6055.1 of 30 September 1981; DOD Occupational Safety and Health (OSH) Program.

DD Form 2272; DOD Occupational Safety and Health Protection Program Poster.

B2-11. FEDERAL STANDARD

FED-STD-313B; Material Safety Data Sheets, Preparation and Submission of.

B2-12. MILITARY STANDARDS

MIL-STD-101B; Color Code for Pipelines and for Compressed Gas Cylinders.

MIL-STD-1472C; Human Engineering Design Criteria for Military Systems, Equipment and Facilities.

B3. OSHA PUBLICATIONS. The following publications are available from the U. S. Department of Labor, OSHA Publications, 200 Constitution Avenue NW, Room S-1212, Washington, DC 20212; Telephone (202) 523-6138. These publications are also available from OSHA Regional and Area Offices and from the Superintendent of Documents (see B6).

B3-1. OSHA STANDARDS

29 CFR 1910; Occupational Safety and Health Standards (General Industry).

29 CFR 1915; Occupational Safety and Health Standards for Shipyard Employment.

29 CFR 1917; Safety and Health Standards for Marine Terminals.

29 CFR 1918; Safety and Health Regulations for Longshoring.

29 CFR 1919; Gear Certification.

29 CFR 1926; Safety and Health Regulations for Construction.

B3-2. OSHA PUBLICATION

OSHA Publication 3067; Concepts and Techniques of Machine Safeguarding.

B4. NIOSH CRITERIA DOCUMENTS. NIOSH Criteria Documents are available from NIOSH Publications, 4676 Columbia Parkway, Cincinnati, OH 45226; Telephone (513) 684-4287.

B5. DEPARTMENT OF TRANSPORTATION. DOT-P 5800.3, "Hazardous Material; Emergency Response Guidebook", is available from Information Services Division, DMT-11, Material Transportation Bureau, Department of Transportation, 400 7th Street SW, Washington, DC 20590; Telephone (202) 426-2301.

B6. SUPERINTENDENT OF DOCUMENTS. The following publications are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402; Telephone (202) 783-3238.

32 CFR 7; Armed Services Procurement Regulations.

U. S. Army Corps of Engineers, EM-385-1-1; Safety and Health Requirements Manual.

The following Department of Transportation regulations on hazardous materials are also available from the Association of American Railroads (see section B11).

46 CFR 146; Transportation or Storage of Military Explosives on Board Vessels.

49 CFR 171; General Information, Regulations, and Definitions.

49 CFR 172; Hazardous Materials Tables and Hazardous Materials Communications Regulations.

49 CFR 173; Shippers-General Requirements for Shipments and Packagings.

49 CFR 174; Carriage by Rail.

49 CFR 175; Carriage by Aircraft.

49 CFR 176; Carriage by Vessel.

49 CFR 177; Carriage by Public Highway.

49 CFR 178; Shipping Container Specifications.

49 CFR 179; Specifications for Tank Cars.

B7. AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH).

B7-1. ACGIH, "TLV's; Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment", is available from the Publications Office, ACGIH, 6500 Glenway Avenue, Bldg. D-5, Cincinnati, OH 45211; Telephone (513) 661-7881.

B7-2. ACGIH, "Industrial Ventilation: A Manual of Recommended Practices", is available from ACGIH, Committee on Industrial Ventilation, P. O. Box 16153, Lansing, MI 48401.

B8. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI). The following standards are available from American National Standards Institute, 1430 Broadway, New York, NY 10018; Telephone (212) 354-3300.

ANSI A10.3; Safety Requirements for Powder Actuated Fastening Systems.

ANSI A10.4; Safety Requirements for Personnel Hoists.

ANSI A10.5; Safety Requirements for Material Hoists.

ANSI A10.6; Safety Requirements for Demolition.

ANSI A10.7; Safety Requirements for Transportation, Storage, Handling, and Use of Commercial Explosives and Blasting Agents in the Construction Industry.

ANSI A10.8; Safety Requirements for Scaffolding.

ANSI A10.9; Safety Requirements for Concrete Construction and Masonry Work.

ANSI A10.10; Safety Requirements for Temporary and Portable Space Heating Devices and Equipment Used in the Construction Industry.

ANSI A10.11; Safety Nets Used During Construction, Repair, and Demolition Operations.

ANSI A10.13; Safety Requirements for Steel Erection.

ANSI A10.14; Requirements for Safety Belts, Harnesses, Lanyards, Lifelines, and Drop Lines for Construction and Industrial Use.

ANSI A10.15; Safety Requirements for Dredging.

ANSI A10.17; Safe Operating Practice for Asphalt Pavement Construction.

ANSI A10.18; Construction Safety Requirements for Temporary Floor and Wall Openings, Flat Roofs, Stairs, Railings and Toeboards.

ANSI A10.20; Safety Requirements for Ceramic Tile, Terrazzo, and Marble Work.

ANSI A10.22; Safety Requirements for Rope-Guided and Non-Guided Workmen's Hoists.

ANSI 12.1; Safety Requirements for Floor and Wall Openings, Railings and Toeboards.

ANSI A14.1; Safety Requirements for Portable Wood Ladders.

ANSI A14.2; Safety Requirements for Portable Metal Ladders.

ANSI A14.3; Safety Requirements for Fixed Ladders.

ANSI A14.4; Safety Requirements for Job-Made Ladders.

ANSI A14.5; Safety Requirements for Portable Reinforced Plastic Ladders.

ANSI A17.1; Elevators, Dumbwaiters, Escalators, and Moving Sidewalks.

ANSI A92.2; Vehicle Mounted Elevating and Rotating Aerial Devices.

ANSI A92.3; Manually Propelled Elevating Work Platforms.

ANSI A92.6; Self-Propelled Elevating Work Platforms.

ANSI B7.1; Safety Code for the Use, Care, and Protection of Abrasive Wheels.

ANSI B11.1; Safety Requirements for the Construction, Care, and Use of Mechanical Power Presses.

ANSI B11.3; Safety Requirements for the Construction, Care, and Use of Power Press Brakes.

ANSI B11.4; Safety Requirements for the Construction, Care and Use of Shears.

ANSI B11.5; Safety Requirements for the Construction, Care, and Use of Iron Workers.

ANSI B11.6; Safety Requirements for the Construction, Care, and Use of Lathes.

ANSI B11.7; Safety Requirements for the Construction, Care, and Use of Cold Headers and Cold Formers.

ANSI B11.8; Safety Requirements for the Construction, Care, and Use of Drilling, Milling, and Boring Machines.

ANSI B11.9; Safety Requirements for the Construction, Care, and Use of Grinding Machines.

ANSI B11.10; Safety Requirements for the Construction, Care, and Use of Metal Sawing Machines.

ANSI B11.13; Safety Requirements for the Construction, Care, and Use of Single and Multiple-Spindle Automatic Screw/Bar and Chucking Machines.

ANSI B15.1; Safety Standards for Mechanical Power Transmission Apparatus.

ANSI B20.1; Safety Standards for Conveyors and Related Equipment.

ANSI B24.1; Safety Requirements for Forging.

ANSI B28.1; Safety Specifications for Mills and Calendars in the Rubber and Plastics Industries.

ANSI B30.1; Safety Standard for Jacks.

ANSI B30.2; Safety Standard for Overhead and Gantry Cranes (Top Running Bridge, Single and Multiple Girder Top Running Trolley Hoist).

ANSI B30.3; Hammerhead Tower Cranes.

ANSI B30.4; Safety Standards for Portal, Tower, and Pillar Cranes.

ANSI B30.5; Safety Code for Crawler, Locomotive and Truck Cranes.

ANSI B30.6; Safety Code for Derricks.

ANSI B30.7; Safety Code for Base Mounted Drum Hoists.

ANSI B30.8; Safety Code for Floating Cranes and Floating Derricks.

ANSI B30.9; Safety Standard for Slings.

ANSI B30.10; Safety Standard for Hooks.

ANSI B30.11; Monorails and Underhung Cranes.

ANSI B30.12; Safety Standard for Handling Loads Suspended From Rotorcraft.

ANSI B30.13; Controlled Mechanical Storage Cranes.

ANSI B30.16; Safety Standard for Overhead Hoists (Underhung).

ANSI B30.17; Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist).

ANSI B56.1; Safety Standard for Powered Industrial Trucks-Low Lift and High Lift Trucks.

ANSI B56.6; Safety Standard for Powered Industrial Trucks-Rough Terrain Fork Lift Trucks.

ANSI B71.1; Safety Specification for Power Lawn Mowers, Lawn and Garden Tractors and Lawn Tractors.

ANSI B107.1; Hand Socket Wrenches (Inch Series).

ANSI B107.2; Power Drive Socket Wrenches (Impact) (Inch Series).

ANSI B107.3; Power Drive Socket Wrenches (Non-Impact) (Inch Series).

ANSI B107.5; Hand Socket Wrenches (Metric Series).

ANSI B107.6; Box, Open End, Combination and Flare Nut Wrenches (Inch Series).

ANSI B107.7; Splined Socket Wrenches, Square Drive, High Strength, Thin Wall; Box Wrench, High Strength, Thin Wall (Inch Series).

ANSI B107.8; Adjustable Wrenches.

ANSI B107.9; Box, Open End, Combination and Flare Nut Wrenches (Metric Series).

ANSI B173.1; Safety Requirements for Nail Hammers.

ANSI B173.2; Safety Requirements for Hand Tools - Ball Peen Hammers.

ANSI B173.3; Safety Requirements for Heavy Striking Tools.

ANSI B173.4; Safety Requirements for Axes.

ANSI B173.5; Safety Requirements for Body Repair Hammers and Dolly Blocks.

ANSI B173.7; Safety Requirements for Hatchets.

ANSI B175.1; Safety Specifications for Gasoline Powered Chain Saws.

ANSI B186.1; Safety Code for Portable Air Tools.

ANSI B209.1; Safety Requirements for Metal Chisels.

ANSI B209.2; Safety Requirements for Metal Punches and Drift Pins.

ANSI B209.3; Safety Requirements for Wood Splitting Wedges.

ANSI B209.4; Safety Requirements for Nail Sets.

ANSI C2; National Electrical Safety Code.

ANSI D6.1; Manual for Uniform Traffic Control Devices for Streets and Highways.

ANSI K13.1; Identification of Air-Purifying Respirator Canisters and Cartridges.

ANSI MH14.1; Loading Dock Levelers and Dockboards.

ANSI O1.1; Safety Requirements for Woodworking Machinery.

ANSI O2.1; Safety Requirements for Sawmills.

ANSI Z8.1; Safety Requirements for Commercial Laundry and Drycleaning Equipment and Operations.

ANSI Z35.1; Specifications for Accident Prevention Signs.

ANSI Z35.2; Specifications for Accident Prevention Tags.

ANSI Z41; Personnel Protection - Protective Footwear. This standard includes the following standards:

ANSI Z41.1; Men's Safety-Toe Footwear.

ANSI Z41.2; Metatarsal Safety-Toe Footwear.

ANSI Z41.3; Conductive Safety-Toe Footwear.

ANSI Z41.4; Electrical Hazard Safety-Toe Footwear.

ANSI Z49.1; Safety in Welding and Cutting.

ANSI Z50.1; Safety Code for Bakery Equipment.

ANSI Z87.1; Practice for Occupational and Educational Eye and Face Protection

ANSI Z88.2; Practice for Respiratory Protection.

ANSI Z89.1; Requirements for Protective Headwear for Industrial Workers.

ANSI Z133.1; Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and for Cutting Brush.

ANSI Z136.1; Standard for the Safe Use of Lasers.

ANSI Z241.1; Safety Requirements for Sand Preparation, Molding, and Coremaking in the Sand Foundry Industry.

ANSI Z244.1; Safety Requirements for the Lock Out/Tag Out of Energy Sources.

ANSI Z358.1; Emergency Eyewash and Shower Equipment.

B9. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS. The ASHRAE publication 15-78 "Safety Code for Mechanical Refrigeration" is available from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1791 Tullie Circle, NE, Atlanta, GA 30329; telephone (404) 636-8400.

B10. AMERICAN SOCIETY FOR TESTING AND MATERIALS. The following publications are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103; Telephone (215) 299-5585. These publications are also available from ANSI (see B8).

ASTM D1048; Rubber Insulating Blankets.

ASTM D1049; Rubber Insulator Covers.

ASTM D1050; Rubber Insulating Line Hose.

ASTM D1051; Rubber Insulating Sleeves.

ASTM F478; Specifications for In-Service Care of Insulating Line Hose and Covers

ASTM F479; Specifications for In-Service Care of Insulating Blankets

ASTM F496; Specifications for In-Service Care of Insulating Gloves and Sleeves.

ASTM STP310; Handbook of Vapor Degreasing.

B11. **AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).** The ASME "Boiler and Pressure Vessel Code" is available from the American Society of Mechanical Engineers, United Engineering Center Building, 345 East 47th Street, New York, NY 10017; Telephone (212) 705-7722.

B12. **ASSOCIATION OF AMERICAN RAILROADS.** The Bureau of Explosives Tariff, BOE-6000-B, "Hazardous Materials Regulations of the Department of Transportation by Air, Rail, Highway, Water and Military Explosives by Water", is available from Bureau of Explosives, Association of American Railroads, 1920 L Street NW, Washington, DC 20036; Telephone (202) 835-9500. This publication is the same as 46 CFR 146 and 49 CFR 171 to 179 which is available from the Superintendent of Documents (see section B6).

B13. **COMPRESSED GAS ASSOCIATION.** The following publications are available from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202; Telephone (703) 979-0900.

CGA C-6; Standards for Visual Inspection of Compressed Gas Cylinders.

CGA G-1; Acetylene.

CGA G-1.3; Acetylene Transmission for Chemical Synthesis.

CGA G-8.1; Standard for the Installation of Nitrous Oxide Systems at Consumer Sites.

CGA P-1; Safe Handling of Compressed Gases in Containers.

CGA S-1.1; Safety Relief Device Standards-Cylinders for Compressed Gases.

CGA S-1.2; Safety Relief Device Standards-Cargo and Portable Tools for Compressed Gases.

B14. **ILLUMINATING ENGINEERING SOCIETY.** The following standards are available from the Illuminating Engineering Society of North America, 345 East 47th Street, New York, NY 10017; Telephone (212) 705-7913.

RP-1; Practice for Office Lighting.

RP-7; Practice for Industrial Lighting.

B15. **NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA).** The following standard is available from the National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, DC 20037; Telephone (202) 457-8400.

EW-1; Requirements for Electric Arc-Welding Apparatus.

B16. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA). The following standards are available from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269; Telephone (617) 770-3000.

NFPA 10; Standard for Portable Fire Extinguishers.

NFPA 11; Standard for Foam Extinguishing Systems.

NFPA 11A; Standard for Medium and High Expansion Foam Systems.

NFPA 12; Standard on Carbon Dioxide Extinguishing Systems.

NFPA 12A; Standard on Halogenated Fire Extinguishing Agent Systems; Halon 1301.

NFPA 12B; Standard on Halogenated Extinguishing Agent Systems; Halon 1211.

NFPA 13; Standard for the Installation of Sprinkler Systems.

NFPA 14; Standard for the Installation of Standpipe and Hose Systems.

NFPA 15; Standard for Water Spray Fixed Systems for Fire Protection.

NFPA 16; Standard for the Installation of Foam-Water Sprinkler Systems and Foam-Water Spray Systems.

NFPA 17; Standard for Dry Chemical Extinguishing Systems.

NFPA 30; Flammable and Combustible Liquids Code.

NFPA 31; Standard for the Installation of Oil Burning Equipment.

NFPA 33; Spray Application Using Flammable and Combustible Liquids.

NFPA 45; Standard on Fire Protection for Laboratories Using Chemicals.

NFPA 49; Hazardous Chemicals Data.

NFPA 50; Standard for Bulk Oxygen Systems at Consumer Sites.

NFPA 51B; Standard for Fire Prevention in Use of Cutting and Welding Processes.

NFPA 54; National Fuel Gas Code.

NFPA 70; National Electrical Code.

NFPA 70E; Electrical Safety Requirements for Employee Workplaces.

NFPA 85A; Standard for Prevention of Furnace Explosions in Fuel Oil-Fired and Natural Gas-Fired Watertube Boiler-Furnaces with One Burner.

NFPA 85B; Standard for Prevention of Furnace Explosions in Natural Gas-Fired Multiple Burner Boiler-Furnaces.

NFPA 85D; Standard for Prevention of Furnace Explosions in Fuel Oil-Fired Multiple Burner Boiler-Furnaces.

NFPA 85E; Standard for Prevention of Furnace Explosions in Pulverized Coal-Fired Multiple Burner Boiler-Furnaces.

NFPA 85F; Standard for the Installation and Operation of Pulverized Fuel Systems.

NFPA 85G; Standard for the Prevention of Furnace Implosions in Multiple Burner Boiler-Furnaces.

NFPA 86A; Standard for Ovens and Furnaces - Design, Location, and Equipment.

NFPA 86B; Standard for Industrial Furnaces - Design, Location, and Equipment.

NFPA 86C; Standard for Industrial Furnaces Using a Special Processing Atmosphere.

NFPA 86D; Standard for Industrial Furnaces Using Vacuum as an Atmosphere.

NFPA 87; Standard for the Construction and Protection of Piers and Wharves.

NFPA 90A; Air Conditioning and Ventilation Systems.

NFPA 90B; Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

NFPA 101; Code for Safety to Life From Fire in Buildings and Structures (Life Safety Code).

NFPA 385; Recommended Regulatory Standard for Tank Vehicles for Flammable and Combustible Liquids.

NFPA 407; Standard for Aircraft Fuel Servicing.

NFPA 410; Standard for Aircraft Maintenance.

NFPA 505; Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Maintenance, and Operation.

NFPA 512; Standard for Truck Fire Protection.

NFPA 704M; Identification of the Fire Hazards of Materials.

B17. NATIONAL SAFETY COUNCIL. The following references are available from the National Safety Council, 444 North Michigan Avenue, Chicago, IL 60611; Telephone (312) 527-4800.

Industrial Data Sheets.

Accident Prevention Manual for Industrial Operations.

Guards Illustrated; Ideas for Mechanical Safety.

B18. RUBBER MANUFACTURERS ASSOCIATION. The following publication is available from Rubber Manufacturers Association, 1901 Pennsylvania Avenue NW, Washington, DC 20006; Telephone *(202) 828-7700*.

IPF-7; Specifications for Rubber Welding Hose.

B19. SOCIETY OF AUTOMOTIVE ENGINEERS. The following publication is available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096; Telephone (412) 776-4841.

SAE J943; Slow-Moving Vehicle Identification Emblem.

B20. UNDERWRITERS LABORATORIES. The following standards are available from Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062; Telephone (312) 272-8800. These publications are also available from ANSI (see section B8).

(The number in parentheses is the ANSI standard number.)

UL 1; Safety Standard for Flexible Metal Conduit (C33.92).

UL 3; Safety Standard for Flexible Nonmetallic Conduit (C33.15).

UL 4; Safety Standard for Armored Cable (C33.9).

UL 5; Safety Standard for Surface Metal Raceways and Fittings (C33.50).

UL 20; Safety Standard for General-Use Snap Switches (C33.40).

UL 44; Safety Standard for Rubber-Insulated Wires and Cables (C33.6).

UL 45; Safety Standard for Portable Electric Tools (C33.49).

UL 48; Safety Standard for Electric Signs (C33.35).

UL 50; Safety Standard for Cabinets and Boxes (C33.65).

UL 62; Safety Standard for Flexible Cord and Fixture Wire (C33.1).

UL 65; Safety Standard for Electric Wired Cabinets (C33.71).

UL 67; Safety Standard for Panelboards (C33.38).

UL 73; Safety Standard for Motor-Operated Appliances (C33.36).

UL 83; Safety Standard for Thermoplastic-Insulated Wires and Cables (C33.80).

UL 98; Safety Standard for Enclosed and Dead-Front Switches (C33.64).

UL 114; Safety Standard for Office Appliances and Business Equipment (X4.12).

UL 115; Safety Standard for Wires with Asbestos or Asbestos and Varnished Cloth or Tape Insulation (C33.66).

UL 133; Safety Standard for Wires and Cables with Varnished-Cloth Insulation (C33.73).

UL 153; Portable Electric Lamps.

UL 187; Safety Standard for X-Ray Equipment (C33.67).

UL 197; Safety Standard for Commercial Electric Cooking Appliances (C33.103).

UL 198B; Safety Standard for Class H Fuses (C33.114).

UL 198F; Safety Standard for Plug Fuses (C33.113).

UL 209; Safety Standard for Cellular Metal Floor Raceways and Fittings (C33.58).

UL 231; Safety Standard for Power Outlets (C33.85).

UL 351; Safety Standard for Rosettes (C33.20).

UL 353; Safety Standard for Limit Controls (B136.1).

UL 355; Safety Standard for Cord Reels (C33.18).

UL 363; Safety Standard for Knife Switches (C33.31).

UL 368; Safety Standard for Electrically Illuminated Frames (C33.19).

UL 399; Safety Standard for Drinking-Water Coolers (C33.82).

UL 414; Safety Standard for Meter Sockets.

UL 430; Safety Standard for Waste Disposers (C33.54).

UL 452; Safety Standard for Antenna Discharge Units (C33.39).

UL 466; Safety Standard for Electric Scales (C33.16).

UL 467; Safety Standard for Grounding and Bonding Equipment (C33.8).

UL 471; Safety Standard for Commercial Refrigerators and Freezers.

UL 474; Safety Standard for Dehumidifiers (Z253.1).

UL 478; Safety Standard for Information Processing and Business Equipment (C33.107).

UL 484; Safety Standard for Room Air Conditioners (C33.14).

UL 486; Safety Standard for Wire Connectors and Soldering Lugs (C33.5).

UL 493; Safety Standard for Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables (C33.60).

UL 496; Safety Standard for Edison-Base Lampholders (C33.17).

UL 497; Safety Standard for Protectors for Communication Circuits (C33.22).

UL 498; Safety Standard for Attachment Plugs and Receptacles (C33.77).

UL 499; Safety Standard for Electric Heating Appliances (C33.11).

UL 505; Safety Standard for Powered Industrial Trucks.

UL 506; Safety Standard for Specialty Transformers (C33.4).

UL 507; Safety Standard for Electric Fans (C33.54).

UL 508; Safety Standard for Industrial Control Equipment (C33.76).

UL 510; Safety Standard for Insulating Tape (C33.74).

UL 511; Safety Standard for Porcelain Cleats, Knobs, and Tubes (C33.21).

UL 512; Safety Standard for Fuseholders (C33.10).

UL 514; Safety Standard for Metallic Outlet Boxes (C33.84).

UL 541; Safety Standard for Refrigerated Vending Machines (B159.1).

UL 542; Safety Standard for Lampholders, Starters, and Starter Holders for Fluorescent Lamps (C33.32).

UL 543; Safety Standard for Impregnated-Fiber Electrical Conduit (C33.37).

UL 547; Safety Standard for Thermal Protectors for Motors (C33.26).

UL 551; Safety Standard for Transformer-Type Arc-Welding Machines (C33.2).

UL 558; Safety Standard for Industrial Trucks, Internal Combustion Engine-Powered.

UL 561; Safety Standard for Floor Finishing Machines.

UL 563; Safety Standard for Ice Makers (C33.118).

UL 574; Safety Standard for Electric Oil Heaters (C33.44).

UL 583; Safety Standard for Electric-Battery-Powered Industrial Trucks.

UL 588; Safety Standard for Christmas Tree and Decorative Lighting Outfits (C33.25).

UL 632; Safety Standard for Electrically Actuated Transmitters (C33.41).

UL 651; Safety Standard for Rigid Nonmetallic Conduit (C33.91).

UL 674; Safety Standard for Electric Motors and Generators for Use in Hazardous Locations, Class I, Groups C and D, Class II, Groups E, F and G (C33.72).

UL 676; Safety Standard for Underwater Lighting Fixtures for Swimming Pools.

UL 705; Safety Standard for Power Ventilators (C33.89).

UL 719; Safety Standard for Nonmetallic-Sheathed Cables (C33.56).

UL 731; Safety Standard for Oil-Fired Unit Heaters (Z95.2).

UL 732; Safety Standard for Oil-Fired Water Heaters (Z95.3).

UL 751; Safety Standard for Vending and Amusement Machines (C33.81).

UL 781; Safety Standard for Portable Electric Lighting Units for Use in Hazardous Locations, Class I, Groups C and D, and Class II, Group G (C33.79).

UL 796; Safety Standard for Printed-Wiring Boards (C33.46).

UL 797; Safety Standard for Electrical Metallic Tubing (C33.98).

UL 817; Safety Standard for Cord Sets and Power-Supply Cords (C33.3).

UL 823; Safety Standard for Electric Heaters for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G (C33.48).

UL 844; Safety Standard for Electric Lighting Fixtures for Use in Hazardous (Classified) Locations (C33.28).

UL 854; Safety Standard for Service-Entrance Cables (C33.51).

UL 857; Safety Standard for Busways and Associated Fittings (C33.34).

UL 859; Safety Standard for Electrical Personal Grooming Appliances (C33.33).

UL 863; Safety Standard for Time-Indicating and -Recording Appliances (C33.63).

UL 870; Safety Standard for Wireways, Auxiliary Gutters and Associated Fittings (C33.45).

UL 877; Safety Standard for Circuit Breakers and Circuit Breaker Enclosures for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G (C33.120).

UL 879; Safety Standard for Electrode Receptacles for Gas Tube Signs (C33.24).

UL 884; Safety Requirements for Under Floor Raceways and Fittings (C33.62).

UL 917; Safety Standard for Clock-Operated Switches (C33.130).

UL 921; Safety Standard for Commercial Electric Dishwashers (C33.96).

UL 924; Safety Standard for Emergency Lighting Equipment.

UL 935; Safety Standard for Fluorescent Lamp Ballasts (C33.68).

UL 977; Safety Standard for Fused Power-Circuit Devices (C33.128).

UL 987; Safety Standard for Stationary and Fixed Electric Tools (C33.86).

UL 1002; Safety Standard for Electrically Operated Valves for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G (C33.83).

UL 1008; Safety Standard for Automatic Transfer Switches (C33.122).

UL 1010; Safety Standard for Receptacle-Plug Combinations for Use in Hazardous Locations (C33.97).

UL 1017; Safety Standard for Vacuum Cleaning Machines and Blower Cleaners (C33.36.1).

UL 1025; Electric Air Heaters.

UL 1028; Safety Standard for Hair Clipping and Shaving Appliances.

UL 1029; Safety Standard for High-Intensity-Discharge Lamp Ballasts (C33.131).

UL 1030; Safety Standard for Sheathed Heating Elements (C33.108).

UL 1042; Safety Standard for Electric Baseboard Heating Equipment (C33.95).

UL 1053; Safety Standard for Ground-Fault Sensing and Relaying Equipment (C33.125).

UL 1054; Safety Standard for Special-Use Switches.

UL 1063; Safety Standard for Machine-Tool Wires and Cables (C33.124).

UL 1081; Safety Standard for Swimming Pool Pumps, Filters and Chlorinators.

UL 1096; Safety Standard for Electric Central Air-Heating Equipment (C33.104).

B21. FACTORY MUTUAL SYSTEM. There are no Factory Mutual publications referenced in this manual. However, Factory Mutual is given as an agency which approves or lists equipment for specific applications. Information on approved or listed equipment is available from Factory Mutual Systems, 1151 Boston-Providence Turnpike, Norwood, MA 02062; Telephone (617) 762-4300.

APPENDIX C

ABBREVIATIONS

AC	Alternating Current
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BOE	Bureau of Explosives
BUMED	Bureau of Medicine and Surgery
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CHIL	Consolidated Hazardous Items List
CNO	Chief of Naval Operations
CPR	Cardiopulmonary Resuscitation
CRT	Cathode-Ray Tube
DC	Direct Current
DM	Design Manual
DOD	Department of Defense
DOL	Department of Labor
DOT	Department of Transportation
EPA	Environmental Protection Agency
ETS	Emergency Temporary Standard
FED STD	Federal Standard
FSN	Federal Specification Number
GSA	General Services Administration
HMIS	Hazardous Material Information System
IDLH	Immediately Dangerous to Life or Health
IES	Illuminating Engineering Society of North America
INST	Instruction
LEL	Lower Explosive Limit

mg	Milligram
mg/m^3	Milligram per Cubic Meter
MIL STD	Military Standard
MO	Maintenance and Operations
MPE	Maximum Permissible Exposure
mppcf	Million Parts per Cubic Foot
MSDS	Material Safety Data Sheet
NAVAIR	Naval Air Systems Command
NAVELEX	Naval Electronics Systems Command
NAVFAC	Naval Facilities Engineering Command
NAVFACENGCOM	Naval Facilities Engineering Command
NAVOSH	Navy Occupational Safety and Health
NAVSEA	Naval Sea Systems Command
NAVSUP	Naval Supply Systems Command
NEC	National Electrical Code
NESO	Navy Environmental Support Office
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NOTAL	Not to Nor Needed by All
NRMC	Naval Regional Medical Center
NSC	National Safety Council
NSTM	Naval Ships' Technical Manual
OP	Ordnance Publication
OPNAV	Office of the Chief of Naval Operations
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
ppm	Parts per Million
psi	Pounds per Square Inch
psia	Pounds per Square Inch Absolute
psig	Pounds per Square Inch Gauge
SOH	Safety and Occupational Health
SOP	Standard Operating Procedure

TLV	Threshold Limit Value
UEL	Upper Explosive Limit
USC	United States Codes
ZMS	Zero Mechanical State

APPENDIX D

NAVAIROSH REQUIREMENTS FOR SHORE ACTIVITIES CROSS-REFERENCE WITH DOL, OSHA STANDARDS

SECTION 1: DOL, OSHA STANDARD TO NAVAIROSH REQUIREMENT

Subpart D 1910	NAVAIROSH
.22(a)(1)	2-1.2
.22(a)(2)	2-1.3.3
.22(a)(3)	2-1.3.2
.22(b)(1)	9-3.2
.22(b)(2)	2-1.4
.22(c)	2-2.2
.22(d)(1)	2-1.6
.22(d)(2)	2-1.6
.23(a)(1)	2-2.3.1 & 2-2.3.3
.23(a)(2)	2-2.3.2
.23(a)(3)	2-2.3.3c
.23(a)(3)(i)	2-2.3.3a
.23(a)(3)(ii)	2-2.3.3b
.23(a)(4)	2-2.3.6
.23(a)(5)	2-2.3.4
.23(a)(6)	2-2.3.5
.23(a)(7)	2-2.3.7
.23(a)(8)	2-2.4
.23(a)(9)	2-2.4
.23(a)(10)	2-3.7
.23(b)(1)	2-2.5
.23(b)(1)(i)	2-2.5.1
.23(b)(1)(ii)	2-2.2
.23(b)(2)	2-2.5.1
.23(b)(3)	2-2.5.2
.23(b)(4)	2-2.5
.23(b)(5)	2-2.6
.23(c)(1)	2-2.2
.23(c)(2)	2-2.2
.23(c)(3)	2-2.2
.23(d)(1)	2-3.6
.23(d)(2)	2-3.6
.23(e)(1)	2-2.1.1
.23(e)(2)	2-2.1.1
.23(e)(3)	2-2.1.1
.23(e)(4)	2-2.1.1
.23(e)(5)	2-2.1.1
.23(e)(6)	2-2.1.1
.23(e)(7)	2-2.1.1
.23(e)(8)	2-2.1.1
.23(e)(9)	2-2.1.1
.23(e)(10)	2-2.1.1

Subpart D (Continued)

1910	NAVAIROSH
.23(e)(11)	2-2.1.1
.24(a)	2-3.1
.24(b)	2-3.2
.24(c)	2-3.5
.24(d)	2-3.5
.24(e)	2-3.5
.24(f)	2-3.5
.24(g)	2-3.5
.24(h)	2-3.5
.24(i)	2-3.5
.24(j)	2-3.5
.25(a)	N/A - Intro
.25(b)(1)(i)	2-5.1.1
.25(b)(2) - (c)(1)(iii)(d)	Revoked
.25(c)(2)	2-5.3.1
.25(c)(2)(i)(a)	Revoked
.25(c)(2)(i)(b)	2-5.1.4.1 & 2-5.3.1.4
.25(c)(2)(i)(c)	2-5.1.8a
.25(c)(2)(i)(d) & (e)	Revoked
.25(c)(2)(i)(f)	2-5.1.8a
.25(c)(2)(i)(g) - (i)	Revoked
.25(c)(2)(ii) - (iv)(c)(2)	Revoked
.25(c)(3)(i) - (ii)(d)	Revoked
.25(c)(3)(iii)(a)	2-5.3.2.6
.25(c)(3)(iii)(b) - (g)(2)	Revoked
.25(c)(3)(iv)(a)	2-5.3.2.7
.25(c)(3)(iv)(b) - (c)(4)	Revoked
.25(c)(3)(v)(a)	2-5.3.3.2
.25(c)(3)(v)(b) - (g)	Revoked
.25(c)(4)(i)	Revoked
.25(c)(4)(ii)(a)	2-5.3.3.1
.25(c)(4)(ii)(b) - (b)(2)	Revoked
.25(c)(4)(iii)	N/A - Definition
.25(c)(4)(iii)(a)	2-5.3.2.5
.25(c)(4)(iii)(b) - (d)	Revoked
.25(c)(5)(i)	2-5.3.2.5
.25(c)(5)(ii) - (vii)(f)	Revoked
.25(d)(1)	N/A - Introduction
.25(d)(1)(i) - (iv)	2-5.1.1
.25(d)(1)(v) - (ix)	Revoked
.25(d)(1)(x)	2-5.1.2
.25(d)(1)(xi)	2-5.1.4.3
.25(d)(2)	N/A - Introduction
.25(d)(2)(i)	2-5.3.1.1 & 2-5.3.2.3
.25(d)(2)(ii)	2-5.1.7d
.25(d)(2)(iii)	2-5.3.1.4 & 2-5.3.2.2
.25(d)(2)(iv)	2-5.3.1.5
.25(d)(2)(v)	2-5.3.1.4
.25(d)(2)(vi)	2-5.3.2.2
.25(d)(2)(vii)	2-5.1.7a

Subpart D (Continued)

1910	NAVAIROSH
.25(d)(2)(viii)	2-5.1.7f
.25(d)(2)(ix)	2-5.3.1.6
.25(d)(2)(x)	2-5.1.5
.25(d)(2)(xi)	2-5.3.1
.25(d)(2)(xii)	2-5.3.3.1b
.25(d)(2)(xiii)	2-5.3.2.6
.25(d)(2)(xiv)	2-5.1.8a & 2-5.3.1.11
.25(d)(2)(xv)	2-5.3.1.8
.25(d)(2)(xvi)	2-5.3.2.6b
.25(d)(2)(xvii)	2-5.3.2.7
.25(d)(2)(xviii)	2-5.3.2.6
.25(d)(2)(xix)	2-5.3.2.4
.25(d)(2)(xx)	2-5.3.3.1a
.25(d)(2)(xxi)	Revoked
.26(a)(1)	2-5.1.8b
.26(a)(1)(i) - (ii)	Revoked
.26(a)(1)(iii)	2-5.1.4.1
.26(a)(1)(iv)	Revoked
.26(a)(1)(v)	2-5.1.4.2
.26(a)(1)(vi)	Revoked
.26(a)(2)(i)	2-5.1.8b
.26(a)(2)(ii)	2-5.3.2
.26(a)(2)(iii)	2-5.3.2.6 & 2-5.3.2.6a
.26(a)(2)(iv)	2-5.3.2.6a
.26(a)(2)(v)	Revoked
.26(a)(3)(i) - (ii)	Revoked
.26(a)(3)(iii)	2-5.1.8b & 2-5.3.3.1
.26(a)(3)(iv) - (vi)	Revoked
.26(a)(3)(vii)	2-5.3.3
.26(a)(3)(viii)	2-5.1.1 & 2-5.1.8b
.26(a)(4)(i)	2-5.3.3.2
.26(a)(4)(ii) - (v)	Revoked
.26(a)(5)(i)	2-5.1.8b
.26(a)(5)(ii) - (vi)	Revoked
.26(b)	Revoked
.26(c)(1)	N/A - Introduction
.26(c)(2)(i) - (iii)	Revoked
.26(c)(2)(iv)	2-5.1.1
.26(c)(2)(v)	2-5.1.1
.26(c)(2)(vi)	2-5.1.2
.26(c)(2)(vi)(a)	2-5.1.2
.26(c)(2)(vi)(b)	2-5.1.2
.26(c)(2)(vi)(c)	2-5.1.3
.26(c)(2)(vi)(d)	2-5.1.4.3
.26(c)(2)(vii)	2-5.1.2
.26(c)(3)(i)	2-5.3.2.3
.26(c)(3)(ii)	2-5.1.6
.26(c)(3)(iii)	2-5.3.2.4
.26(c)(3)(iv)	2-5.3.2.2
.26(c)(3)(v)	2-5.1.7a

Subpart D (Continued)

1910	NAVAIROSH
.26(c)(3)(vi)	2-5.3.1.6
.26(c)(3)(vii)	2-5.3.1
.26(c)(3)(viii)	2-5.3.1.11
.27	2-5.2
.28(a)(1)	2-6.1
.28(a)(2)	2-6.2.2
.28(a)(3)	2-6.3
.28(a)(3)(i)	2-6.3a
.28(a)(3)(ii)	2-6.3b
.28(a)(4)	2-6.2
.28(a)(5)	2-6.2.4
.28(a)(6)	2-6.6
.28(a)(7)	2-6.7
.28(a)(8)	2-6.2
.28(a)(9)	2-6.2
.28(a)(10)	2-6.2
.28(a)(11)	2-6.2.3
.28(a)(12)	2-6.4
.28(a)(13)	2-6.2.3
.28(a)(14)	2-6.2
.28(a)(15)	2-6.7.1
.28(a)(16)	2-6.2.5
.28(a)(17)	2-6.3.2
.28(a)(18)	2-6.8
.28(a)(19)	2-6.8
.28(a)(20)	2-6.7.2
.28(a)(21)	2-6.2
.28(a)(22)	2-6.2
.28(a)(23)	2-6.2
.28(a)(24)	2-6.2
.28(a)(25)	2-6.2
.28(a)(26)	2-6.2
.28(a)(27)	12-2.4.2.2
.28(b) - (u)	2-6.9
.28(v)	N/A - Scope
.29	2-6.10.1
.30(a)(1)	2-1.4.4
.30(a)(2)	2-1.4.4
.30(a)(3)	2-1.4.4.2
.30(a)(4)	2-1.4.4
.30(a)(5)	2-1.4.4.1
.30(b)(1)	10-1.2.1.2m
.30(b)(2)	9-3.2
.30(b)(3)	2-1.3
.30(c)(1) - (4)	10-1.2.1.2o

Subpart E

1910	NAVAIROSH
.35 - .37	3-3b
.38	7-1.2.1a

Subpart F

1910	NAVAIROSH
.66	2-7
.67	2-8
.68	2-10

Subpart G

1910	NAVAIROSH
.94	4-4.2
.95	4-7.1
.96	4-8.1
.97	4-8.2.1 & 13-4.5

Subpart H

1910	NAVAIROSH
.101(a)	8-3.3.2
.101(b)	8-3.1
.101(c)	8-3.4.2
.102(a) - (b)	5-3.1
.103	5-3.2
.104	5-3.3
.105	5-3.4
.106(a)	N/A - Definitions
.106(b) - (c)	5-3.5.2
.106(d)(1)(i)	5-3.5.3
.106(d)(1)(ii)	5-3.5.3a - d
.106(d)(2)(i)	5-3.5.3.1
.106(d)(2)(ii)	5-3.5.3.1
.106(d)(2)(iii)	5-3.5.3.1a & b
.106(d)(3)(i)	5-3.5.3.2
.106(d)(3)(ii) - (ii)(b)	5-3.5.3.2
.106(d)(4)	5-3.5.3.3
.106(d)(5)(i)	5-3.5.3.4
.106(d)(5)(ii)	N/A - Introductory
.106(d)(5)(iii)	5-3.5.3.4a
.106(d)(5)(iv)(a) - (d)	Revoked
.106(d)(5)(iv)(e)	5-3.5.3.4
.106(d)(5)(v)	5-3.5.3.4c
.106(d)(5)(vi)(a)	5-3.5.3.4d(5)
.106(d)(5)(vi)(b)	5-3.5.3.4d
.106(d)(5)(vi)(c)	5-3.5.3.4d(1)

Subpart H (Continued)

1910	NAVAIROSH
.106(d)(5)(vi)(d)	5-3.5.3.4d(2)
.106(d)(5)(vi)(e)	5-3.5.3.4d(3)
.106(d)(5)(vi)(f)	5-3.5.3.4d(4)
.106(d)(6)(i)	5-3.5.3.5
.106(d)(6)(ii)	5-3.5.3.5a
.106(d)(6)(iii)	5-3.5.3.5b
.106(d)(6)(iv)	5-3.5.3.5c
.106(d)(7)(i)	5-3.5.5.1
.106(d)(7)(i)(a)	5-3.5.5.1
.106(d)(7)(i)(b)	5-3.5.5.1
.106(d)(7)(ii)	7-4.4
.106(d)(7)(iii)	5-3.5.5.2
.106(d)(7)(iv)	5-3.5.5.3
.106(e)(1)	5-3.5.4
.106(e)(2)(i)	5-3.5.4
.106(e)(2)(ii)	5-3.5.4
.106(e)(2)(ii)(a)	5-3.5.3.2 & 5-3.5.3.3
.106(e)(2)(ii)(b)	5-3.5.4.1
.106(e)(2)(ii)(c)	N/A - Redundant to (b)
.106(e)(2)(iii)	5-3.5.4.2
.106(e)(2)(iv)(a)	5-3.5.4.3
.106(e)(2)(iv)(b)	5-3.5.4.4
.106(e)(2)(iv)(c)	5-3.5.4.5
.106(e)(2)(iv)(d)	5-3.5.4.2
.106(e)(3)	5-3.5.4.12
.106(e)(4)	5-3.5.4.2
.106(e)(5)(i)	7-4.2
.106(e)(5)(ii) - (v)	7-4.4
.106(e)(6)(i)	5-3.5.4.5
.106(e)(6)(ii)	5-3.5.4.6
.106(e)(7)	5-3.5.4.7
.106(e)(8)	12-2.4.2
.106(e)(9)(i)	5-3.5.4.4
.106(e)(9)(ii)	5-3.5.4.8
.106(e)(9)(iii)	5-3.5.4.11
.106(e)(9)(iv)	5-3.5.4.10
.106(f)	5-6.5
.106(g)(1)(i)(a)	5-6.1.1
.106(g)(1)(i)(b) - (c)	5-6.1
.106(g)(1)(i)(d)	Revoked
.106(g)(1)(i)(e)	5-6.1
.106(g)(1)(i)(e)(1)	5-6.1.1
.106(g)(1)(i)(e)(2)	5-6.1
.106(g)(1)(i)(e)(3)	Revoked
.106(g)(1)(i)(e)(4) - (5)	5-6.1
.106(g)(1)(i)(f)	5-6.1
.106(g)(1)(i)(g)	5-6.1
.106(g)(1)(ii)(a)	5-6.1
.106(g)(1)(ii)(b)	5-6.1.1
.106(g)(1)(ii)(c)	Revoked

Subpart H (Continued)

1910	NAVAIROSH
.106(g)(1)(iii)(a)	5-6.1.2
.106(g)(1)(iii)(b)	5-6.1.2
.106(g)(1)(iii)(c)	5-6.1
.106(g)(1)(iv)	Revoked
.106(g)(1)(v)	5-6.1.3
.106(g)(2)	Revoked
.106(g)(3)(i) - (iii)	5-6.1
.106(g)(3)(iv)(a)	5-6.1.4
.106(g)(3)(iv)(b)(1)	5-6.1.4
.106(g)(3)(iv)(b)(2)	5-6.1
.106(g)(3)(iv)(c) - (d)	5-6.1
.106(g)(3)(v)(a) - (f)	5-6.1
.106(g)(3)(vi)(a) - (b)	5-6.1.5
.106(g)(3)(vii)(a)	Revoked
.106(g)(3)(vii)(b) - (c)	5-6.1
.106(g)(4)	5-6.3
.106(g)(5)	5-6.1.6
.106(g)(6)	5-6.1
.106(g)(7)	5-6.1.7
.106(g)(8)	5-6.1.8
.106(g)(9)	5-6.1.9
.106(h)	5-6.6
.106(i)	N/A to Navy
.106(j)	N/A - Scope
.107(a)	N/A - Definitions
.107(b)	5-4.2.1
.107(c)(1)	5-4.2.3
.107(c)(1)(i)	5-4.2.8
.107(c)(1)(ii)	5-4.2.9
.107(c)(1)(iii)	5-4.2.10
.107(c)(1)(iv)	5-4.2.8
.107(c)(2)	5-4.2.3a
.107(c)(3)	5-4.2.3b
.107(c)(4)	5-4.2.3c
.107(c)(5)	5-4.2.3c
.107(c)(6)	5-4.2.3d
.107(c)(7)	5-4.2.3e
.107(c)(8)	5-4.2.3e
.107(c)(9)	5-4.2.3f
.107(d)	5-4.2.4
.107(e)	5-4.2.5
.107(f)(1)	5-4.2.6
.107(f)(2)	5-4.2.6
.107(f)(3)	5-4.2.6
.107(f)(4)	5-4.2.6
.107(g)(1)	5-4.2.7a
.107(g)(2)	5-4.2.7b
.107(g)(3)	5-4.2.7c
.107(g)(4)	5-4.2.7d
.107(g)(5)	5-4.2.7e

Subpart H (Continued)

1910	NAVAIROSH
.107(g)(6)	5-4.2.7f
.107(g)(7)	5-4.2.7g
.107(h)	5-4.2.8
.107(i)	5-4.2.9
.107(j)	5-4.2.9
.107(k)	5-4.2.10
.107(l)	5-4.2.8
.107(m)(1)	5-4.2.1
.107(m)(2)	5-4.2.5 & 5-4.2.7g
.107(n)	N/A - Scope
.108	5-5
.109	5-3.10
.110	5-3.6
.111	5-3.11

Subpart I

1910	NAVAIROSH
.132(a)	6-1.1
.132(b)	6-1.7
.132(c)	6-1.1.1i
.133(a)(1)	6-1.1
.133(a)(2)(i)	6-1.1.1a
.133(a)(2)(ii)	6-1.1.1b
.133(a)(2)(iii)	6-1.1.1c
.133(a)(2)(iv)	6-1.1.1d
.133(a)(2)(v)	6-1.1.1f
.133(a)(2)(vi)	6-1.1.1g
.133(a)(2)(vii)	6-1.1.1h
.133(a)(3)	6-2.4.3
.133(a)(4)	6-2.4.1
.133(a)(5)	6-2.1
.133(a)(6)	6-2.1
.134(a)(1)	6-4.1
.134(a)(2)	6-4.1.2
.134(a)(3)	6-1.1 & 6-1.3
.134(b)(1)	6-4.1.2a
.134(b)(2)	6-4.1.2b
.134(b)(3)	6-4.1.3
.134(b)(4)	6-4.1.2c
.134(b)(5)	6-4.1.2d
.134(b)(6)	6-4.1.2e
.134(b)(7)	6-4.1.2f
.134(b)(8)	6-4.1.2g
.134(b)(9)	6-4.1.2h
.134(b)(10)	6-4.1.4
.134(b)(11)	6-4.3.4
.134(c)	6-4.3.2
.134(d)(1)	6-4.4

Subpart I (Continued)

1910	NAVAIROSH
.134(d)(2) - (4)	6-4.4
.134(e)(1)	6-4.1.2a
.134(e)(2)	6-4.1.2b
.134(e)(3)	6-4.1.2a & 6-4.1.3e
.134(e)(3)(i) - (iii)	6-4.1.2h
.134(e)(4)	6-4.1.2i
.134(e)(5)	6-4.1.3 & 6-4.1.3h
.134(e)(5)(i)	6-4.1.3h & 6-4.5.1
.134(e)(5)(ii)	6-4.5 & 6-4.5.2
.134(e)(5)(iii)	6-4.5.2
.134(f)	6-4.6
.134(g)	6-4.2.3
.135	6-5.1
.136	6-6.2
.137	13-2.2.2.1

Subpart J

1910	NAVAIROSH
.141(a)(1)	Scope
.141(a)(2)	Definitions
.141(a)(3)(i)	4-6.1
.141(a)(3)(ii)	2-1.3.3
.141(a)(3)(iii)	4-6.1
.141(a)(4)(i)	4-6.2.2
.141(a)(4)(ii)	4-6.2.1
.141(a)(5)	4-6.3
.141(b)(1)(i)	4-6.4.2
.141(b)(1)(ii)	Revoked
.141(b)(1)(iii)	4-6.4.1
.141(b)(1)(iv)	Revoked
.141(b)(1)(v)	4-6.4.1
.141(b)(1)(vi)	4-6.4.1
.141(b)(1)(vii)	Revoked
.141(b)(2)(i)	4-6.4.4
.141(b)(2)(ii)	4-6.4.4
.141(b)(2)(iii)	4-6.4.4
.141(c)	4-6.5
.141(d)	4-6.6
.141(e)	6-1.6
.141(f)	6-1.6
.141(g)(1)	N/A
.141(g)(2)	4-6.7.2
.141(g)(3)	4-6.7.3
.141(g)(4)	4-6.7.2
.141(h)	4-6.7.1
.142	N/A
.143	Revoked
.144(a)(1)(i)	3-4.2.11.1

Subpart J (Continued)

1910	NAVAIROSH
.144(a)(1)(ii)	3-4.2.11.3
.144(a)(1)(iii)	3-4.2.11.1
.144(a)(2)	Revoked
.144(a)(3)	3-4.2.11.2
.144(a)(4) - (7)	Revoked
.144(b)	Revoked
.145(a)(1)	Scope
.145(a)(2)	Effective Date
.145(b)	Definition
.145(c)(1)	3-4.2.2
.145(c)(2)	3-4.2.3
.145(c)(3)	3-4.2.5
.145(d)(1)	3-4.2
.145(d)(2)	3-4.1
.145(d)(3)	Revoked
.145(d)(4)	3-4.1 & 3-4.2.3
.145(d)(5)	Revoked
.145(d)(6)	3-4.1 & 3-4.2.5
.145(d)(7) - (9)	Revoke
.145(d)(10)	3-4.2.7
.145(d)(11)	Revoked
.145(e)(1)	Revoked
.145(e)(2)	3-4.2.1
.145(e)(3)	Revoked
.145(e)(4)	3-4.2.9
.145(e)(5) - (8)	Revoked
.145(f)(1)(i)	3-4.2.10
.145(f)(1)(ii)	N/A - Introductory
.145(f)(2)	N/A - Definitions
.145(f)(3)	3-4.2.10.1
.145(f)(4)	3-4.2.10.2
.145(f)(5)	3-4.2.10.3
.145(f)(6)	3-4.2.10.4
.145(f)(7)	Revoked
.145(f)(8)(i)	Revoked
.145(f)(8)(ii)	3-4.2.10.5
.145(f)(8)(iii)	3-4.2.10.5

Subpart K

1910	NAVAIROSH
.151(a)	4-5.1
.151(b)	4-5.2
.151(c)	4-5.2.2

Subpart L

1910	NAVAIROSH
.155(a)	Scope
.155(b)	Application
.155(c)	Definitions
.156	7-1.2.1a
.157	7-4.2.6
.158	7-4.3
.159	7-4.4
.160	7-4.4
.161	7-4.4
.162	7-4.4
.163	7-4.4
.164	7-3
.165	7-3

Subpart M

1910	NAVAIROSH
.166	8-3.3.2
.167(a)	Definitions
.167(b)	8-3.4.2
.168	8-3.4.1
.169	8-2.2.3

Subpart N

1910	NAVAIROSH
.176(a)	9-3.2
.176(b)	9-5
.176(c)	2-1.2
.176(d)	Revoked
.176(e)	9-3.2.2
.176(f)	9-6
.176(g)	2-2.2
.177	3-7.5
.178(a)(1)	9-3
.178(a)(2) - (7)	9-3.1a(4)
.178(b) - (d)	9-3.1a(1)
.178(e)(1)	9-3.5.1
.178(e)(2)	9-3.1a(2)
.178(f)(1)	5-3.5
.178(f)(2)	5-3.6
.178(g)	13-2.4
.178(h)(1)	3-1.5
.178(h)(2)	9-3.1a(1)
.178(i)(1)	4-3.2a
.178(i)(2)	9-3.4
.178(j)	2-1.4.4 & 2-1.4.4.2
.178(k) - (q)	9-3.1a(1)

Subpart N (Continued)

1910	NAVAIROSH
.179	9-4.1.3.1a
.180	9-4.1.3.1b
.181	9-4.1.3.1c
.182	Effective Dates
.183	9-4.1.4.1
.184	9-4.7.2

Subpart O

1910	NAVAIROSH
0	10-1.2.1.1a

Subpart P

1910	NAVAIROSH
.241	Definitions
.242(a)	11-1.1
.242(b)	11-3.3.2.6
.243(a)(1)	11-3.4
.243(a)(2)	11-3.1
.243(b)(1)	11-3.3.2.4
.243(b)(2)	11-3.3.2.3
.243(c)	11-3.4
.243(d)	11-4.1
.243(e)	11-4.2
.244(a)	11-4.3
.244(b)	11-3.1

Subpart Q

1910	NAVAIROSH
.251	Defintions
.252(a)(1)(i)	12-3.1.1
.252(a)(1)(ii)	12-3.7
.252(a)(1)(iii)	12-2.1
.252(a)(1)(iv)	12-3.1.2
.252(a)(2)	12-3.2
.252(a)(3)	12-3.3
.252(a)(4)	12-3.4
.252(a)(5)	12-3.4
.252(a)(6)	N/A to Navy
.252(a)(7)	N/A to Navy
.252(a)(8)	Revoked
.252(b)(1)	Introductory
.252(b)(2)(i)	12-4.1
.252(b)(2)(ii)	12-4.3
.252(b)(2)(iii)	12-4.2

Subpart Q (Continued)

1910	NAVAIROSH
.252(b)(2)(iv)	12-4.3
.252(b)(3)	12-4.4
.252(b)(4)	12-4.5
.252(c)	12-5
.252(d)(1)	12-6.1
.252(d)(1)(i)	12-6.2
.252(d)(1)(ii)	12-6.2
.252(d)(1)(iii)	12-6.2
.252(d)(2)(i)	12-6.3c
.252(d)(2)(ii)	12-6.5
.252(d)(2)(iii)	12-6.6.1
.252(d)(2)(iv)	12-2.4.2.2
.252(d)(2)(v)	12-6.3a
.252(d)(2)(vi)	12-2.4
.252(d)(2)(vii)	12-6.3
.252(d)(2)(viii)	12-6.4
.252(d)(2)(ix)	12-6.3
.252(d)(2)(x)	12-6.6.1
.252(d)(2)(xi)	12-2.4.2.1
.252(d)(2)(xii)	12-2.4.2.1
.252(d)(2)(xiii)	12-2.2
.252(d)(2)(xiii)(a)	12-2.4
.252(d)(2)(xiii)(b)	12-2.4.2.1
.252(d)(2)(xiii)(c)	12-2.3
.252(d)(2)(xiii)(d)	12-2.4
.252(d)(2)(xiv)(a)	1-8.2
.252(d)(2)(xiv)(b)	12-2.4
.252(d)(2)(xiv)(c)(1)	12-6.2
.252(c)(2)(xiv)(c)(2)	12-6.2
.252(d)(2)(xiv)(c)(3)	1-8.2
.252(d)(2)(xiv)(d)	12-2.4
.252(d)(2)(xiv)(e)	12-2.4
.252(d)(2)(xiv)(f)	12-6.4
.252(d)(2)(xiv)(g)	12-6.6
.252(d)(3)	12-8
.252(d)(4)(i)	12-8.5
.252(d)(4)(ii)	12-8.4
.252(e)(1)(i)	2-2
.252(e)(1)(ii)	12-4.5
.252(e)(2)(i)(a)	12-7.2.1
.252(e)(2)(i)(b)	12-7.2.1b
.252(e)(2)(i)(c)	12-7.2.1c
.252(e)(2)(i)(d)	12-7.2.1d
.252(e)(2)(ii)	12-7.2.2
.252(e)(2)(iii)	12-7.2.3
.252(e)(3)(i)	6-1.1.5
.252(e)(3)(ii)	Revoked
.252(e)(4)(i)	Definitions
.252(e)(4)(ii)	12-9.3
.252(e)(4)(iii)	12-8.2

Subpart Q (Continued)

1910	NAVAIROSH
.252(e)(4)(iv)	12-8
.252(e)(4)(v)	12-8.5
.252(e)(4)(vi)	12-8.4
.252(f)	12-9.3
.252(g)	12-10

Subpart R

1910	NAVAIROSH
.261 - .268	3-9

Subpart S

1910	NAVAIROSH
.301	13-1.2a
.302(a)	13-1.3a
.302(b)	13-1.1a
.303	13-3.1
.304	13-3.2
.305	13-3.3
.306	13-3.4
.307	13-3.5
.308	13-3.6
.309 - .398	Reserved
.399	13-1.2a

Subpart T

1910	NAVAIROSH
T	3-8.3

Subpart Z

1910	NAVAIROSH
.1000	4-3.2a
.1001 - .1047	4-3.6
.1200	4-2

OSHA 29 CFR	NAVAIROSH
1915	3-8.1
1917	3-8.2
1918	3-8.2
1926	3-6.1.2

SECTION 2: NAVAIROSH REQUIREMENT TO DOL, OSHA OR OTHER STANDARD

Chapter 2

NAVAIROSH	1910	Other OSHA	Other
2-1.2	.22(a)(1)		
2-1.2.1			
2-1.2.2			
2-1.3			
2-1.3.1			
2-1.3.2	.22(a)(3)		
2-1.3.3	.22(a)(2)		
2-1.4	.22(b)(2)		
2-1.4.1			
2-1.4.2			
2-1.4.3	.22(b)(1)		
2-1.4.4	.30		
2-1.5			
2-1.6	.22(d)(1) & (2)		
2-2.1			
2-2.1.1	.23(e)	OSHA INST STD 1-1.10	
2-2.1.2		OSHA Prog Dir 100-58	
2-2.2	.23(c)		
2-2.3	.21(a)(2)		
2-2.3.1	.23(a)(1)		
2-2.3.2	.23(a)(2)		
2-2.3.3	.23(a)(3)		
2-2.3.4	.23(a)(5)		
2-2.3.5	.23(a)(6)		
2-2.3.6	.23(a)(4)		
2-2.3.7	.23(a)(7)		
2-2.4	.23(a)(8) & (9) .21(a)(1)		
2-2.5	.21(a)(11) .23(b)(1)	1926.500(c)(1)	
2-2.5.1	.23(b)(1) & (2)		
2-2.5.2	.23(b)(3)		
2-2.6	.21(a)(10) .23(b)(5)		
2-3.1	.24(a)		
2-3.2	.24(b)		
2-3.3	.24(b)		
2-3.4	.24(b)		
2-3.5	.24(c) thru (j)		
2-3.6	.23(d) & (e)(2) & (5)		
2-3.7	.24(g) .23(a)(10)		
2-4.1		1918.11(a) 1915.74(a)(1)	
2-4.1.1		1915.74(a)(1)	

Chapter 2 (Continued)

NAVAIROSH	1910	Other OSHA	Other
2-4.1.2		1915.74(a)(2) 1918.11(b)	
2-4.1.3		1918.74(a)(4) 1918.21(a)	
2-4.1.4		1915.74(a)(6) 1918.21(c)	
2-4.1.5		1915.74(a)(7) 1918.21(d)	
2-4.1.6		1915.74(a)(10) & (8) 1918.21(g) & (e)	
2-4.1.7		1915.74(a)(5) 1918.21(b)	
2-4.2		1915.74(a)(1) 1918.11(a)	
2-4.3		1915.74(d) 1918.22	
2-4.4.1		1915.74(a)(9) 1918.21(f)	
2-4.4.2		1915.74(a)(11) 1918.21(h)	
2-4.4.3		1915.74(a)(12) 1918.21(i)	
2-5.1			
2-5.1.1	.25(a) .25(d)(1)(i) thru (iv) .26(a)(3)(viii) .26(c)(2)(iv) & (v) .27(f)		
2-5.1.2	.25(d)(1)(x) .26(c)(2)(vi)(a) & (b) .26(c)(2)(vii)		
2-5.1.3	.26(c)(2)(vi)(c)		
2-5.1.4.1	.25(c)(2)(i)(b) .26(a)(1)(iii)		
2-5.1.4.2	.26(a)(1)(v)		
2-5.1.4.3	.25(d)(1)(xi) .26(c)(2)(vi)(d)		
2-5.1.5	.25(d)(2)(xi)		
2-5.1.6	.26(c)(3)(ii)		
2-5.1.7a	.25(d)(2)(vii) .26(c)(3)(v)		
2-5.1.7b			
2-5.1.7c			
2-5.1.7d	.25(d)(2)(ii)		
2-5.1.7e			
2-5.1.7f	.25(d)(2)(viii)		
2-5.1.8a	.25		ANSI A14.1
2-5.1.8b	.26		ANSI A14.2

Chapter 2 (Continued)

NAVAIROSH	1910	Other OSHA	Other
2-5.1.8c			ANSI A14.5
2-5.1.8d	.27		ANSI A14.3
2-5.1.8e		1926.450(h)	ANSI A14.4
2-5.2	.27(a) thru (e)		
2-5.3.1	.25(d)(2)(xi) .26(c)(3)(vii)		
2-5.3.1.1	.25(d)(2)(i)		
2-5.3.1.2			
2-5.3.1.3			ANSI A14.1 & 2
2-5.3.1.4	.25(c)(2)(i)(b) .25(d)(2)(iii) & (v)		
2-5.3.1.5	.25(d)(2)(iv)		
2-5.3.1.6	.25(d)(2)(ix) .26(c)(3)(vi)		
2-5.3.1.7			
2-5.3.1.8	.25(d)(2)(xv)		
2-5.3.1.9			ANSI A14.1 & 2
2-5.3.1.10			
2-5.3.1.11	.25(d)(2)(xiv) .26(d)(3)(viii)		
2-5.3.2	.26(a)(2)(ii)		
2-5.3.2.1			ANSI A14.1
2-5.3.2.2	.25(d)(2)(iii) & (vi) .26(c)(3)(iv)		
2-5.3.2.3	.25(d)(2)(i) .26(c)(3)(i)		
2-5.3.2.4	.25(d)(2)(xix) .26(c)(3)(iii)		
2-5.3.2.5	.25(c)(4)(iii)(a) .25(c)(5)(i)		
2-5.3.2.6	.25(c)(3)(iii)(a) .25(d)(2)(xiii) & (xviii) .26(a)(2)(iii)		
2-5.3.2.6a	.26(a)(2)(iii) & (iv)		
2-5.3.2.6b	.25(d)(2)(xvi)		
2-5.3.2.7	.25(c)(3)(iv)(a) .25(d)(2)(xvii)		
2-5.3.3	.26(a)(3)(vii)		
2-5.3.3.1	.25(c)(2) .25(c)(4)(ii)(a) .26(a)(3)(iii)		
2-5.3.3.1a	.25(d)(2)(xx)		
2-5.3.3.1b	.25(d)(2)(xii)		
2-5.3.3.2	.25(c)(3)(v)(a) .26(a)(4)(i)		
2-5.4		1926.450(b)	ANSI A14.4

Chapter 2 (Continued)

NAVAIROSH	1910	Other OSHA	Other
2-5.5		1915.72 1918.25	
2-6.1	.28(a)(1)		
2-6.2	.28(a)(4) .28(a)(8) thru (10) .28(a)(14) .28(a)(21) thru (26)		
2-6.2.1		1926.451(a)(3)	
2-6.2.2	.28(a)(2)		
2-6.2.3	.28(a)(11) & (13)		
2-6.2.4	.28(a)(5)		
2-6.2.5	.28(a)(16)	1926	
2-6.3	.28(a)(3)		
2-6.3a	.28(a)(3)(i)		
2-6.3b	.28(a)(3)(ii)		
2-6.3c		1915.71(j)	
2-6.3d		1926.451(a)(14)	
2-6.3.1	.28(a)(3)		
2-6.3.2	.28(a)(17)		
2-6.4	.28(a)(12)		
2-6.5			
2-6.6	.28(a)(6)		
2-6.7	.28(a)(7)		
2-6.7.1	.28(a)(15)		
2-6.7.2	.28(a)(20)		
2-6.7.3			
2-6.7.4			
2-6.8	.28(a)(18) & (19)		
2-6.9	.28(b) thru (u)	1915.71(c) & (g) 1926.451(b) thru (d) 1926.451(g) thru (y)	
2-6.10.1	.29		
2-6.10.2		1926.451(e)(8)	
2-6.10.3		1926.451(e)(6)	
2-6.10.4			
2-6.11 (all)			
2-7	.66		ANSI A120.1
2-8	.67		ANSI A92.2
2-9		1926.552(c)	
			ANSI A10.4
2-10	.68		ANSI A90.1

Chapter 3

NAVAIROSH	1910	Other OSHA	Other
3-2.1			
3-2.2			
3-2.3.1			
3-2.3.2			
3-2.3.3			
3-2.3.4			
3-2.4		1926.552(d)	
3-2.4.1			
3-2.4.2			
3-2.4.3			
3-2.4.4			
3-2.5		1926.56(b)	
3-2.5.1			
3-2.5.2			
3-2.5.3			
3-2.5.4			
3-2.6			
3-2.7			
3-2.8			
3-2.8.1			
3-2.8.2			
3-2.8.2.1			
3-2.8.2.2			
3-2.8.3			
3-2.8.4			
3-2.8.5	.212(a)(5)		
3-2.8.6			
3-2.8.7			
3-3	Subpart E		NFPA 101
3-4.1			NAVFAC P-309
3-4.2	.145(d)(1)	1926.200(a)	
3-4.2.1	.145(e)(2)		
3-4.2.2	.145(c)(1) .145(d)(2)	1926.200(b)	
3-4.2.3	.145(c)(2) .145(d)(4)	1926.200(c)	
3-4.2.4	.37(g)(4) .37(g)(6) thru (8)	1926.200(d)	
3-4.2.5	.145(c)(3) .145(d)(6)	1926.200(e)	
3-4.2.6		1926.200(f)	
3-4.2.7	.145(d)(10)		
3-4.2.8		1926.200(g)(2)	
3-4.2.9	.145(e)(4)		
3-4.2.10	.145(f)(1)	1926.200(h)(1)	
3-4.2.10.1	.145(f)(3)		
3-4.2.10.2	.145(f)(4)		
3-4.2.10.3	.145(f)(5)		

Chapter 3 (Continued)

NAVAIROSH	1910	Other OSHA	Other
3-4.2.10.4	.145(f)(6)		
3-4.2.10.5	.145(f)(8)		
3-4.2.11			NAVFAC P-309 MIL-STD-101B
3-4.2.11.1	.144(a)(1)		
3-4.2.11.2	.144(a)(3)		
3-4.2.11.3			NAVFAC P-309
3-5.1			
3-5.2			
3-5.3.1			
3-5.3.2			
3-5.3.3		1926.21(b)(4)	
3-6.1			
3-6.1.1			EM 385-1-1
3-6.1.2		1926	
3-6.1.3		1926.154	
3-6.1.4.1		1926.401(j)(1)	
3-6.1.4.2		1926.401(j)(2)	
3-6.1.4.3		1926.401(j)(4)	
3-6.1.4.4		1926.56	
3-6.2			
3-6.2.1		1926.202	
3-6.2.1.1			
3-6.2.1.2			NAVFAC P-309
3-6.2.2		1926.201(a)	
3-6.2.3			
3-6.2.4			
3-6.3		1926.653(f) & (u)	
3-6.3.1		1926.651(a) & (b)	
3-6.3.2		1926.651(j)	
3-6.3.3		1926.651(f)	
3-6.3.3.1		1926.651(c)	
3-6.3.3.2		1926.651(n) & (o)	
3-6.3.3.3		1926.651(q)	
3-6.3.3.4		1926.650(i) & (5)(d)	
3-6.3.4		1926.651(p)	
3-6.3.5		1926.651(i)	
3-6.3.6		1926.651(s)	
3-6.3.7		1926.651(t)	
3-6.3.8		1926.651(v)	
3-6.3.9.1		1926.652(a) thru (c)	
3-6.3.9.2		1926.652(h)	
3-6.3.9.3		1926.652(l)	
3-7.1			
3-7.1.1			
3-7.1.1.1			
3-7.1.1.2			

Chapter 3 (Continued)

NAVAIROSH	1910	Other OSHA	Other
3-7.1.2.1			
3-7.1.2.2			
3-7.1.3.1			
3-7.1.3.2			
3-7.1.3.3			
3-7.1.3.4			
3-7.1.3.4a			
3-7.1.3.4b			
3-7.1.3.4c			
3-7.2.1		1926.601(b)(2)	
3-7.2.2		1926.601(b)(3)	
3-7.2.3		1926.601(b)(4)	
3-7.2.4		1926.601(b)(6)	
3-7.2.5		1926.601(b)(8)	
3-7.2.6			NAVFAC P-300 OPNAVINST 5100.12B
3-7.2.7		1926.601(b)(10)&(12)	
3-7.2.8		1926.601(b)(13)	
3-7.2.9		1926.601(b)(14)	
3-7.3.1		1926.600(a)(1)	
3-7.3.1.1		1926.600(a)(3)	
3-7.3.1.2		1926.600(a)(5)	
3-7.3.2		1926, Subpart W	
3-7.4		1926, Subpart O	
3-7.5	.177		
3-8.1		1915	
3-8.2		1917 & 1918	
3-8.3	Subpart T		NAVSEA 0994-LP-001-9010
3-9	Subpart R		

Chapter 4

NAVAIROSH	1910	Other OSHA	Other
4-2.2	.1200	1926.21(b)(3) 1915.97(a) & (d) 1918.86(a) 1917.22(a)	NAVSUPINST 5100.27
4-2.3.1			49 CFR 171-179
4-2.3.2	.1200		NAVSUPINST 5100.27
4-2.3.2.1			
4-2.3.2.2			
4-2.3.2.3			

Chapter 4 (Continued)

NAVAIROSH	1910	Other OSHA	Other
4-2.3.2.4			
4-2.3.2.5			
4-2.3.2.6	.96(e) .252(f)		
4-2.4	.1200	1915.97(d) 1918.86(a) 1917.22(a) 1926.21(b)(3)	NAVSUPINST 5100.27
4-2.5	.1200	1960.34(d)	FED-STD-313B
4-2.5.1			
4-2.5.2			
4-2.6			NAVAIRINST 5103.1 NAVSEA S6470-AA-SAF-010
4-3.1			
4-3.2	Subpart Z		
4-3.2.1			
4-3.2.2			NAVSEA S6470-AA-SAF-010
4-3.3			
4-3.4			
4-3.4a			
4-3.4b			DOD 4145.19-R-1
4-3.4c			
4-3.4d			
4-3.5			NESO 20.2-011
4-3.6	Subpart Z		
4-4.1			
4-4.1.1	.134(a)(1)		
4-4.1.2			
4-4.2	.94		ACGIH
4-4.2.1			
4-4.2.2			
4-4.2.3			
4-4.3			NAVSEA S6470-AA-SAF-010
4-5.1	.151(a)		
4-5.1.1		1926.50(e)	
4-5.1.2		1926.50(f)	
4-5.2			
4-5.2.1		1926.50(d)(1)	
4-5.2.2	.151(c)		
4-5.3		1915.98(d) 1918.96(d)	
4-6.1	.141(a)(3)(i) & (iii)		
4-6.2.1	.141(a)(4)(ii)		
4-6.2.2	.141(a)(4)(i)		
4-6.2.3		1915.97(h)	
4-6.2.4			NESO 20.2-011

Chapter 4 (Continued)

NAVAIROSH	1910	Other OSHA	Other
4-6.3	.141(a)(5)		
4-6.4.1	.141(b)(1)(iii)		
	.141(b)(1)(v)&(vi)	1926.51(a)	
4-6.4.2	.141(b)(1)(i)		
4-6.4.3			
4-6.4.4	.141(b)(2)		
4-6.5	.141(c)	1926.51(c)	
4-6.6	.141(d)(1) & (2)(v)		
4-6.7.1	.141(h)		
4-6.7.2	.141(g)(2)		
4-6.7.3	.141(g)(3)		
4-7			OP 45
4-7.1			OPNAVINST 6260.2
4-7.2			OPNAVINST 6260.1B
4-7.3			OPNAVINST 5100.14
4-7.4			OPNAVINST 5100.23B
4-8.1	.96		
4-8.2.1			
4-8.2.2			
4-9			NAVMED P-5010 BUMEDINST 6200.7A
4-10			MIL-STD 1427C
4-11.1			NAVMED
4-11.2			NAVMED
4-11.3			NAVMED

Chapter 5

NAVAIROSH	1910	Other OSHA	Other
5-1			
5-2.1			NAVMATINST 5100.3A
5-2.2			
5-3.1	.102		
5-3.2	.103		
5-3.3	.104		NAVAIR 06-30-501
5-3.4	.105		
5-3.5.1	.106(a)(18) & (19)		
5-3.5.2	.106(b)		
5-3.5.3	.106(d)(1)		
5-3.5.3.1	.106(d)(2)		
5-3.5.3.2	.106(d)(3)		
5-3.5.3.3	.106(d)(4)(i) & (ii)		
5-3.5.3.4	.106(d)(5)(i) & (ii)		

Chapter 5 (Continued)

NAVAIROSH	1910	Other OSHA	Other
5-3.5.3.4a	.106(d)(5)(iii)		
5-3.5.3.4b	.106(d)(5)(iv)		
5-3.5.3.4c	.106(d)(5)(v)		
5-3.5.3.4d	.106(d)(5)(vi)(b)		
5-3.5.3.4d(1)	.106(d)(5)(vi)(c)		
5-3.5.3.4d(2)	.106(d)(5)(vi)(d)		
5-3.5.3.4d(3)	.106(d)(5)(vi)(e)		
5-3.5.3.4d(4)	.106(d)(5)(vi)(f)		
5-3.5.3.4d(5)	.106(d)(5)(vi)(a)		
5-3.5.3.5	.106(d)(6)(i)		
5-3.5.3.5a	.106(d)(6)(ii)		
5-3.5.3.5b	.106(d)(6)(iii)		
5-3.5.3.5c	.106(d)(6)(iv)		
5-3.5.4	.106(e)(1)(i)(a)		
5-3.5.4.1	.106(e)(2)(ii)(b)		
5-3.5.4.2	.106(e)(2)(iii) & (iv)(d)		
5-3.5.4.3	.106(e)(2)(iv)(a)		
5-3.5.4.4.	.106(e)(2)(iv)(b)		
5-3.5.4.5	.106(e)(2)(iv)(c)		
5-3.5.4.6	.106(e)(6)(ii)		
5-3.5.4.7	.106(e)(7)		
5-3.5.4.8	.106(e)(9)(ii)		
5-3.5.4.9	.106(e)(3)(v)(a)		
5-3.5.4.10			
5-3.5.4.11	.106(e)(9)(iii)		NESO 20.2-011
5-3.5.4.12	.106(e)(3)		
5-3.5.5.1	.106(d)(7)(i) & (i)(a)		
5-3.5.5.2	.106(d)(7)(iii)		
5-3.5.5.3	.106(d)(7)(iv)		
5-3.5.6.1			
5-3.5.6.2			
5-3.5.6.3			
5-3.5.6.4			
5-3.5.6.5			
5-3.6	.110		
5-3.7.1.1			
5-3.7.1.2			
5-3.7.2.1			
5-3.7.2.2			
5-3.7.2.3			
5-3.8			
5-3.9			
5-3.10			OPNAVINST 8023.2B
5-3.11	.111		
5-4.1			
5-4.2.1	.107(b)		NFPA 33
5-4.2.2	.107(b)(8)		
5-4.2.3	.107(c)(1)		

Chapter 5 (Continued)

NAVAIROSH	1910	Other OSHA	Other
5-4.2.3a	.107(c)(2)		
5-4.2.3b	.107(c)(3)		
5-4.2.3c	.107(c)(5)		
5-4.2.3d	.107(c)(6)		
5-4.2.3e	.107(c)(7)		
5-4.2.4	.107(d)		
5-4.2.5	.107(e)(2) & (3)		
5-4.2.6	.107(f)		
5-4.2.7a	.107(g)(1)		
5-4.2.7b	.107(g)(2)		
5-4.2.7c	.107(g)(3)		
5-4.2.7d	.107(g)(4)		
5-4.2.7e	.107(g)(5)		
5-4.2.7f	.107(g)(6)		
5-4.2.7g	.107(g)(7)		
5-4.2.7h			
5-4.2.8	.107(h) & (i) & (l)		
5-4.2.9	.107(j)(1)		
5-4.2.9.1	.107(j)(2) & (3)		
5-4.2.9.2	.107(j)(4)		
5-4.2.10	.107(k)		
5-4.3	.94(a)		
5-4.4			NFPA 410
5-4.5		1915, Subpart C	
5-5	.108		
5-6.1	.106(g)		
5-6.1.1	.106(g)(1)(i) & (ii)		
5-6.1.2	.106(g)(1)(iii)		
5-6.1.3	.106(g)(1)(v)		
5-6.1.4	.106(g)(3)(iv)		
5-6.1.5	.106(g)(3)(vi)		
5-6.1.6	.106(g)(5)		
5-6.1.7	.106(g)(7)		
5-6.1.8	.106(g)(8)		
5-6.1.9	.106(g)(9)		
5-6.2			
5-6.3	.106(g)(4)		
5-6.4		1918.86(c)	
5-6.4.1			49 CFR 176
5-6.4.2			
5-6.4.3			
5-6.4.4			
5-6.4.5			
5-6.4.6			
5-6.4.7			
5-6.4.8			
5-6.4.9			
5-6.5	.106(f)		

Chapter 5 (Continued)

NAVAIROSH	1910	Other OSHA	Other
5-6.6	.106(h)		
5-7.1			
5-7.2			
5-7.3			
5-7.4			NFPA 45
5-8			NFPA 54
5-9		1915.36	NSTM

Chapter 6

NAVAIROSH	1910	Other OSHA	Other
6-1.1	.132(a)		
6-1.1.1a	.133(a)(2)(i)		
6-1.1.1b	.133(a)(2)(ii)		
6-1.1.1c	.133(a)(2)(iii)		
6-1.1.1d	.133(a)(2)(iv)		
6-1.1.1e			
6-1.1.1f	.133(a)(2)(v)		
6-1.1.1g	.133(a)(2)(vi)		
6-1.1.1h	.133(a)(2)(vii)		
6-1.1.1i			
6-1.1.2	.134(a)(1)		
6-1.1.3			OPNAVINST 5100.23A
6-1.1.4			
6-1.1.5			
6-1.2			OP 5
6-1.3			OPNAVINST 5100.23A
6-1.4			OPNAVINST 5100.23A
6-1.5			OPNAVINST 5100.23A
6-1.6			
6-1.7			OPNAVINST 5100.23A
6-1.7.1	.134(b)(5)		OPNAVINST 5100.23A
6-1.7.2	.134(b)(5)		
6-1.7.3	.134(b)(7)		
6-1.8	.134(b)(6)		
6-2.1	.133(a)(1) & (b)		
6-2.1.1			
6-2.2			ANSI Z87.1

Chapter 6 (Continued)

NAVAIROSH	1910	Other OSHA	Other
6-2.3			
6-2.4.1	.133(a)(6)		ANSI Z87.1
6-2.4.2			ANSI Z87.1
6-2.4.3	.133(a)(3)		
6-2.4.4			ANSI Z88.2
6-2.4.5			OPNAVINST 5100.14
6-2.5			
6-2.6			
6-3	.95		OPNAVINST 6260.2
6-4.1	.134		
6-4.1.1	.134(a)(1)		
6-4.1.2	.134(b)		
6-4.1.2a	.134(b)(1)		
6-4.1.2b	.134(b)(2)		
6-4.1.2c	.134(b)(4)		
6-4.1.2d	.134(b)(5)		
6-4.1.2e	.134(b)(6)		
6-4.1.2f	.134(b)(7)		
6-4.1.2g	.134(b)(8)		
6-4.1.2h	.134(e)(3)		
6-4.1.2i	.134(b)(9)		
6-4.1.2j			
6-4.1.3	.134(b)(3)		ANSI Z88.2
6-4.1.4	.134(b)(10)		
6-4.2			ANSI Z88.2
6-4.3.1			ANSI Z88.2
6-4.3.2	.134(c)		ANSI Z88.2
6-4.3.3	.134(g)		
6-4.3.4			ANSI Z88.2 30 CFR 11
6-4.3.4.1			
6-4.3.4.2			
6-4.3.5			ANSI Z88.2
6-4.4	.134(d)(1)		
6-4.5			ANSI Z88.2
6-4.5.1	.134(e)(5)(i)		
6-4.5.2	.134(e)(5)(iii) & (ii)		
6-4.6	.134(f)		ANSI Z88.2
6-5.1	.135		
6-5.1.1			ANSI Z89.1
6-5.1.2			ANSI Z89.1
6-5.1.3			ANSI Z89.1
6-5.2			
6-5.3			
6-6.1			
6-6.2	.136		
6-6.2.1			ANSI Z41

Chapter 6 (Continued)

NAVAIROSH	1910	Other OSHA	Other
6-6.2.2			ANSI Z41
6-6.3.1			ANSI Z41 & OP 5
6-6.3.2			ANSI Z41
6-6.3.3			ANSI Z41
6-6.3.4			ANSI Z41
6-6.3.5			ANSI Z41
6-6.3.6			ANSI Z41
6-7.1			
6-8.1		1926.104	
6-8.1.1			ANSI A10.14
6-8.1.2			ANSI A10.14
6-8.2		1926.105	
6-8.2.1		1926.105(d)	
6-8.2.2		1926.105(d)(1)	
6-8.2.3			ANSI A10.14
6-8.2.4			ANSI A10.14
6-8.3	.137		
6-8.4.1		1926.106(a) & (b)	
6-8.4.2		1915.154(c) 1918.96(e) 1926.106(c)	
6-8.4.3		1915.154(c)(4) 1918.96(e) 1926.106(d)	

Chapter 7

NAVAIROSH	1910	Other OSHA	Other
7-1			NAVMAT 11320.14
7-1.1			NAVMAT 11320.14
7-1.2.1	Subparts E, H, L, Q	1915, Subpart C 1915, Subpart D 1926, Subpart F 1926, Subpart D	
7-1.2.2			NAVMAT 11320.14
7-1.2.3			NAVMAT 11320.14
7-2.1			
7-2.2			
7-2.3	Subpart L		NAVFAC DM-8
7-2.4			
7-3	.164 .165		NAVFAC DM-8
7-4.1			
7-4.2.1	.155(c)(8) thru (11)		

Chapter 7 (Continued)

NAVAIROSH	1910	Other OSHA	Other
7-4.2.2			
7-4.2.3	.157(d)(1)		
7-4.2.3d(1)	.157(d)(2)		
7-4.2.3d(2)	.157(d)(4)		
7-4.2.3d(3)	.157(d)(5)		
7-2.2.3d(4)	.157(d)(6)		
7-4.2.4			
7-4.2.5			
7-4.2.6	.157		NFPA 10
7-4.3	.158		NAVFAC DM-8, NFPA 14
7-4.4	.159 thru .163		NAVFAC DM-8, NFPA
7-5.1			
7-5.2			
7-5.3			
7-5.4.1a			
7-5.4.1b			
7-5.4.1c			
7-5.4.2			
7-5.4.3			
7-5.4.4			
7-5.4.5			
7-5.5.1			
7-5.5.2			
7-5.5.3	.106(g)(1)(i)(e)(1)		NFPA 385
7-5.5.4	.106(g)(9)		
7-5.5.5			NFPA 512
7-5.6.1		1926.150(a)(1)	
7-5.6.2		1926.150(a)(1) - (4)	
7-5.6.3		1926.150(b)	
7-5.6.4		1926.150(d)	
7-5.6.5		1926.150(e)	
7-5.6.6		1926.150(f)	
7-5.6.7		1926.151(b)	
7-5.6.8	.36(c)(1)		
7-5.7a			
7-5.7b			
7-5.7c			
7-5.7d			
7-5.7e			
7-5.7f			
7-5.7.1			
7-5.7.2			
7-5.7.3			
7-5.8		1915	
7-5.9		1917	

Chapter 8

NAVAIROSH	1910	Other OSHA	Other
8-1	.169(a)(2)		ASME
8-2.1.1			
8-2.1.1.1			
8-2.1.1.2			
8-2.1.1.3			
8-2.1.1.4			
8-2.1.1.5			NSTM 551
8-2.1.2			
8-2.2			
8-2.2.1			
8-2.2.1.1			NAVFAC MO-322
8-2.2.2			
8-2.2.2.1			
8-2.2.3	.169		
8-2.3			
8-2.4		1926, Subpart S	
8-3.1			
8-3.2a	.252(a)(2)(v)(b)(2)		
8-3.2b	.252(a)(2)(v)(b)(1)		
8-3.2c	.252(a)(2)(v)(b)(1)		
8-3.2d	.252(a)(2)(v)(b)(13)		
8-3.2e	.252(a)(2)(v)(b)(11)		
8-3.2f	.252(a)(2)(v)(b)(14)		
8-3.2g	.252(a)(2)(v)(b)(17)		
8-3.2h			
8-3.2i			
8-3.2j			
8-3.2k			
8-3.2l			
8-3.2m			
8-3.2n			
8-3.2o	.252(a)(2)(v)(b)(6)		
8-3.2p	.252(a)(2)(v)(b)(3)		
8-3.2q	.252(a)(2)(v)(b)(4)		
8-3.2r	.252(a)(2)(v)(b)(5)		
8-3.2s			
8-3.3			
8-3.3.1			
8-3.3.1.1			
8-3.3.1.2			
8-3.3.1.3			
8-3.3.2			
8-3.4.1	.168		
8-3.4.2	.167(b)(1)		
8-3.5			
8-3.5.1			
8-3.5.2			
8-3.6			

Chapter 8 (Continued)

NAVAIROSH	1910	Other OSHA	Other
8-3.6.1			
8-3.6.1.1			
8-3.6.1.2			
8-4.1			
8-4.2			
8-4.3			
8-5.1			
8-5.2			
8-5.3			
8-5.3.1			
8-5.3.2			
8-5.3.2.1			
8-5.3.2.2			
8-5.3.2.3			
8-5.3.2.4			
8-5.3.3			
8-5.3.4			
8-6.1			

Chapter 9

NAVAIROSH	1910	Other OSHA	Other
9-1.1			
9-1.2			
9-1.2.1			
9-1.2.2			
9-1.3			
9-1.4			
9-1.5.1			
9-1.5.2			
9-1.5.3			
9-2.1a		1926.555(a)(1)	
9-2.1b		1926.555(a)(2)	
9-2.1c			
9-2.1d			
9-2.1e		1926.555(a)(3)	
9-2.2			
9-2.3			
9-2.4		1926.555(a)(4)	
9-2.5		1926.555(a)(5)	
9-2.6		1926.555(a)(6)	
9-2.7		1926.555(a)(7)	
9-2.8		1926.555(a)(8)	
9-3	.178(a)(1)		

Chapter 9 (Continued)

NAVAIROSH	1910	Other OSHA	Other
9-3.1a	.178(a)(2)		NFPA 505
9-3.1b			
9-3.2	.176(a)		
9-3.2.1			
9-3.2.2	.176(e)		
9-3.3	.178(f)		
9-3.4	.178(i)(1)		
9-3.5.1	.178(m)(9)		
9-3.5.2			
9-3.6			
9-4.1.1			NAVFAC P-307
9-4.1.2			NAVFAC P-307
9-4.1.3	.179 thru .181		
9-4.1.3.1h	.179(b)(2)		
9-4.1.3.1i	.180(b)(2)		
9-4.1.3.1j	.181(b)(2)		
9-4.1.4.1	.183		
9-4.1.4.2		29 CFR 1918, F	NSTM 573
9-4.1.4.3			
9-4.2			
9-4.3.1			
9-4.3.2			
9-4.4.1			
9-4.4.2			NAVFAC P-307
9-4.4.3	.179(b)(5) .180(d)(3)(v)		
9-4.4.4	.179(j)(2)(iii)		NAVFAC P-307
9-4.4.5			
9-4.4.6a-d			
9-4.4.6e			
9-4.4.7			
9-4.4.8			
9-4.4.9			
9-4.4.10			
9-4.4.11			
9-4.4.12			OSHA Program Directive 1-11-2B
9-4.4.13		1915.115(d) 1917.45(i)(2) 1918.55 1918.74(a)(10) 1926.550(a)(9)	
9-4.4.14			
9-4.4.15			
9-4.4.16	.180(c)(1)(i)		
9-4.4.17			
9-4.4.18			
9-4.4.19			

Chapter 9 (Continued)

NAVAIROSH	1910	Other OSHA	Other
9-4.5.1		1915.114(a) & (b)	
9-4.5.2		1915.114(c) & (d)	
9-4.6.1	.184(d)	1926.251(a)(1)	
9-4.6.2	.184(f)(1)		
9-4.6.3		1926.251(a)(4)	
9-4.6.4			
9-4.7.1a			NAVSEA OP-5
9-4.7.1b			
9-4.7.1c			
9-4.7.1d	.184(c)(2)		
9-4.7.1e			
9-4.7.1f	.184(c)(5)		
9-4.7.1g			
9-4.7.1h	.184(c)(10)		
9-4.7.1i	.184(c)(11)		
9-4.7.1j	.184(c)(12)		
9-4.7.1k	.184(c)(6)		
9-4.7.1l			NAVFAC P-307
9-4.7.1m			
9-4.7.2	.184		ANSI B30.9 NSTM 613
9-5		1926.250	DOD 4145.19-R-1
9-6		1918	NAVFAC P-300 NAVFAC P-301 DOD 4145.19-R-1 49 CFR 171 to 179

Chapter 10

NAVAIROSH	1910	Other OSHA	Other
10-1.1			
10-1.2.1			
10-1.2.1.1	Subpart O	1915, Subpart J	
10-1.2.1.2			
10-1.2.1.3			
10-1.2.2			
10-2.1	.212(a)(2)		
10-2.2			
10-2.3			
10-2.4	.212(b)		
10-2.5.1	.213(b)(1)		
10-2.5.2	.213(b)(4)		
10-2.5.3	.213(b)(3)		
10.2.5.4	.213(b)(6)		
10-2.5.5	.213(b)(2)		
10-2.6			
10-2.7			

Chapter 11

NAVAIROSH	1910	Other OSHA	Other
11-1			
11-1.1	.242(a)	1926.300(a)	
11-1.2		1926.300(b)(1)	
11-1.3			
11-1.4			
11-1.5		1926.300(c)	
11-1.6			
11-2.1		1926.301(d)	
11-2.2		1926.301(c)	
11-2.3			
11-2.4			
11-2.5			
11-2.6			
11-3.1	.243(a)(2)		
11-3.2			
11-3.3			
11-3.3.1			
11-3.3.1.1			
11-3.3.1.2		1926.302(a)(2)	
11-3.3.1.3	.304(f)(5)(v)		
11-3.3.1.4			
11-3.3.1.5			
11-3.3.2.1		1926.302(b)(5)	
11-3.3.2.2			
11-3.3.2.3	.243(b)(2)	1926.302(b)(6) & (7)	
11-3.3.2.4	.243(b)(1)		
11-3.3.2.5			
11-3.3.2.6	.242(b)		
11-3.3.2.7			
11-3.3.3.1		1926.302(c)(1)	
11-3.3.3.2		1926.302(c)(2)	
11-3.3.4			
11-3.4			

Chapter 12

NAVAIROSH	1910	Other OSHA	Other
12-1			
12-2.1	.252(a)(1)(iii)		
12-2.2	.252(a)(1)(iv)		
12-2.2.1			
12-2.2.2			
12-2.3	.252(a)(1)(iv)		

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Chapter 12 (Continued)

NAVAIROSH	1910	Other OSHA	Other
12-2.4.1			
12-2.4.2	.252(d)(1)		NAVMAT 11320.14, Encl 1g
12-2.4.2.1	.252(d)(1)		NAVMAT 11320.14, Encl 1g & h
12-2.4.2.2			
12-2.4.3			
12-3.1.1			
12-3.1.2	.252(a)(1)(iv)		
12-3.2	.252(a)(2)		
12-3.3	.252(a)(3)		
12-3.4	.252(a)(4) & (5)		
12-3.5.1	.252(a)(5)(v)(a)		
12-3.5.2			
12-3.5.3	.252(a)(5)(v)(c)		
12-3.5.4			
12-3.5.5	.252(a)(5)(v)(e)&(f)		
12-3.6.1		1926.250(g)(1)&(2)	
12-3.6.2			
12-4.1	.252(b)(2)(i)		
12-4.2	.252(b)(2)(iii)		
12-4.2.1	.252(b)(2)(iii)(a)&(d)		
12-4.2.2	.252(b)(2)(iii)(b)		
12-4.2.3	.252(b)(2)(iii)(c)		
12-4.3	.252(b)(2)(iv)		
12-4.4			
12-4.5			
12-5	.252(c)		
12-6.1			
12-6.2	.252(d)(1)(i) thru (iii)		
12-6.3a	.252(d)(2)(v)		
12-6.3b	.252(d)(2)(ix)		
12-6.3c			
12-6.4	.252(d)(2)(viii)		
12-6.5	.252(d)(2)(ii)		
12-6.6.1	.252(d)(2)(iii)(a) .252(d)(2)(x)		
12-6.6.2a	.252(d)(2)(iii)(b)		
12-6.6.2b	.252(d)(2)(iii)(b)		
12-6.6.2c			
12-6.6.2d	.252(d)(2)(iii)(b)		
12-6.6.2e	.252(d)(2)(iii)(b)		
12-7.1			
12-7.2.1a	.252(e)(2)(i)(a)		
12-7.2.1b	.252(e)(2)(i)(b)		
12-7.2.1c	.252(e)(2)(i)(c)		
12-7.2.1d	.252(e)(2)(i)(d)		

Chapter 12 (Continued)

NAVAIROSH	1910	Other OSHA	Other
12-7.2.2	.252(e)(2)(ii)(j)		
12-7.2.2a	.252(e)(2)(ii)(b)		
12-7.2.2b	.252(e)(2)(ii)(i)		
12-7.2.2c	.252(e)(2)(ii)(i)		
12-7.2.3	.252(e)(2)(iii)		
12-7.3			
12-7.3.1			
12-7.3.2			
12-7.3.3			
12-7.3.4			
12-7.3.5			
12-7.3.6			
12-8.1			
12-8.2			
12-8.3			
12-8.4a	.252(d)(4)(ii)		
12-8.4b	.252(d)(4)(ii)		
12-8.4c			
12-8.5	.252(d)(4)(i)		
12-9.1	.252(f)(1)(i) thru (iii)		
12-9.2			
12-10	.252(g)		

Chapter 13

NAVAIROSH	1910	Other OSHA	Other
13-2.1.1			
13-2.1.2			
13-2.2.1			
13-2.2.2.1.	.137		
13-2.2.2.2			
13-2.2.2.3			
13-2.2.2.4			
13-2.2.3.1		1926.951(b)	
13-2.2.3.2			
13-2.2.4			
13-2.2.5			
13-2.2.5.1			
13-2.2.5.2			
13-2.2.5.3			
13-2.2.6			
13-2.2.7			
13-2.2.8			
13.2.2.9	.180(j)		

Chapter 13

NAVAIROSH	1910	Other OSHA	Other
13-2.2.10.1			
13-2.2.10.2			
13-2.2.10.3			
13-2.3.1			
13-2.3.2			
13-2.3.2.1			
13-2.3.2.2			
13-2.3.2.3			
13-2.3.3			
13-2.4	.178(g)		
13-2.4.1			
13-2.4.2			
13-2.5			
13-2.6			
13-3.1	.303		
13-3.2	.304		
13-3.3	.305		
13.3.4	.306		
13-3.5	.307 Subpart H		
13-3.6	.308		
13-4.1			
13-4.2			
13-4.3			
13-4.4			
13-4.5	.96		OP 3565
13-4.6			ANSI Z136.1 NAVELEX 5100.12
13-4.7			
13-5		1926, Subparts C & V	
13-6			NSTM 300

INDEX

Subject	Paragraph
A	
Acetylene	5-3.1
see also Combustibles	
see also Flammables	
see also Oxidizing Materials	
Acid	5-3.7
transfer	5-3.7.2
Air Conditioning, see Cooling Systems	
Air Receivers, see Receivers, Air	
Aircraft	
fuselage	2-1.5
wings	2-1.5
Aisles	2-1.4; 9-3.2
Alkalies	5-3.7
Ammonia, Anhydrous	5-3.11
Arc Welding, see Welding	
Asbestos	4-7.2; 6-7.1
B	
Bakery Equipment	3-9
Barrier	
awareness	10-4.2.1
guard	10-4.1.1; 10-4.1.3
Batteries	13-2.4
Beverages, see Food	
Blocks, Safety	10-4.2.3
Boards, Duck	2-1.3.3
Bridgeplate, see Dockboard	
Buildings	
construction	3-6
minimum design load	3-2.1
occupancy	7-5.6.8
temporary	7-5.6.7
C	
Cables	2-1.2.1; 12-4.5; 13-2.2.10.2
Cardiopulmonary Resuscitation	4-5.2; 13-2.1.1; 13-2.3.1
Chain	9-4.7.2

INDEX (Continued)

Subject	Paragraph
falls	9-4.5
see also Rigging	
see also Weight Handling Equipment	
Chambers	3-2.6
hyperbaric	4-3.2.2
Civilian, see Personnel, civilian	
Color Code, Safety	3-4.2.11
Combustibles	4-2.1; 4-4.1.2; 5-1; 5-7.3; 7-1.3; 13-4.3
gas	3-6.3.8
liquid	5-3.5; 5-4.2.3; 5-4.2.5; 5-6.1.7; 8-2.2.1.2
solid	5-3.9
see also Flammables	
Compressors	8-2; 8-5.3.2
Construction Equipment, see Mechanical Equipment	
Conveyors	9-2; 12-6.4
Cooling Systems	8-1; 8-4
see also Refrigerant Systems	
Cords, Extension	2-1.2.1; 11-3.3.1.2
Corners, Blind	2-1.4.1
Cranes	9-4.1.1.1; 9-4.4.7; 9-4.4.10; 13-2.2.9; 13-3.4; 13-4.3
helicopter	9-4.1.4.1
see also Hoists, personnel	
see also Weight Handling Equipment	
D	
Debris, see Housekeeping	
Decks	2-1.3
Deluge Showers, see Showers, Deluge	

INDEX (Continued)

Subject	Paragraph
Derricks	9-4.1.1.2; 9-4.4.7; 9-4.4.10; 13-2.2.9
see also Weight Handling Equipment	
Diving	3-8.3; 4-3.2.2
Dockboards	2-1.4.4; 2-1.4.4.2
DOD Hazardous Materials Information System	4-2.2; 4-2.5.1
DOD Occupational Safety and Health Protection Program Poster	1-9
Doors	2-2.5.1; 2-3.7; 3-2.3
chamber and vault	3-2.6
fire	7-2.4; 7-5.6.6
Duck Boards, see Boards, Duck	
Dumbwaiter, see Elevator	
E	
Egress	2-1.4; 2-3.1; 3-3; 7-5.6.7
Electronics	13-4
Elevator	2-6.3
see also Floor, openings	
Environmental Protection Agency	8-3.6
Escalator, see Elevator	
Excavation, see Trenches	
Exposure Limits	4-1
see also Permissible Exposure Limit Values	
Extension Cords, see Cords, Extension	
Extinguishers, Fire	3-7.1.1.1; 5-3.5.5.1; 5-6.1.9; 7-2.2; 7-2.3; 7-4; 7-5.7.2; 12-6.5; 12-6.6.2; 13-2.2.10.3

INDEX (Continued)

Subject	Paragraph
Eye Protection	1-3.3.2; 4-5.2.2; 4-7.3; 6-2; 6-4.5.2; 12-7.2; 13-2.4.1
see also Personal Protective Equipment	
F	
Factory Mutual Engineering Corporation	12-2.1
Federal Specification Number	8-3.3.1.1
Feed, Automatic or Semi-automatic	10-4.1.6
Fire Extinguishers, see Extinguishers, Fire	
Fire Prevention	7
see also Welding, fire prevention	
First Aid, see Medical Services	
Flags	3-6.2.2; 3-7.1.1
Flammables	4-2.1; 4-4.1.2; 5-1; 7-1.3; 7-5.5.3; 8-2.1.1; 13-4.3
cargo	5-6.4.1
gases	3-6.3.8; 8-2.1.1; 12-3.1.1; 13-3.5
liquids	5-3.5; 5-4.2.3; 5-4.2.5; 5-4.2.7; 5-6.1.7; 5-7.3; 7-5.5.1; 8-2.2.1.2; 12-6.1; 13-2.2.10.1
solids	5-3.9
see also Combustibles	
Floor	2-3.1
capacity, see Limit, Maximum Load	
elevations	2-1.4.2; 2-2.2
holes	2-2.4

INDEX (Continued)

Subject	Paragraph
new or replaced	2-1.3
openings	2-1.3.1; 2-2.1; 2-2.3; 2-6.3
chutes	2-2.3.3; 2-2.5.1
hatchway	2-2.3.3
ladderway	2-2.3.2
manholes	2-2.3.5
pits	2-2.3.4; 2-3.1
skylights	2-2.3.6
stairway	2-2.3.1
temporary	2-2.3.7
trap doors	2-2.3.4
Flushes, Eye, see Eye Protection	
Food	4-6.7
consumption	4-6.7.2
disposal of	4-6.7.3
service facilities	4-6.7.1
Footwear, Safety	6-6
see also Personal Protective Equipment	
Forktrucks, see Trucks, powered industrial	
Freezer, see Chambers	
Fuel Gas Systems	5-8; 12-3.4; 12-3.5.1; 12-3.5.2; 12-3.7; 12-8.4
see also Welding, gas	
Fueling	
transfer	5-6; 7-5.5.2
vehicles	3-7.1.2.2; 9-3.3
Fume Hoods, see Hoods, Fume	
Furnaces, see Heating Systems	

G

Gas	
compressed	8-3
cylinders	8-3.2; 8-3.4.2; 8-5.3.4; 12-3.2

INDEX (Continued)

Subject	Paragraph
freeing	3-6.3.8; 4-2.6; 4-4.1; 4-4.2.2; 4-4.3; 8-4.2; 12-2.4.2.1
welding, see Welding, gas	
Groundskeeping	3-5
Guardrails, see Railing	
H	
Hand-Feeding Tools, see Tools, hand-feeding	
Handrails	2-1.4.2
Hazardous Materials	
handling and disposal of	4-1; 4-6.2.4; 7-5.5.5
Information System	4-2.2
permissible quantities	5-7.1
see also Combustibles	
see also Flammables	
see also Oxidizing Materials	
see also Toxics	
Head Protection	6-5
see also Personal Protective Equipment	
Hearing Conservation	4-7.1; 6-1.1.5; 6-3
see also Noise	
see also Personal Protective Equipment	
Heating Systems	8-1; 8-4; 13-3.4
Heavy Construction Equipment	3-7.4
Hoists	9-4.1.1.3; 13-3.4
personnel	2-9; 9-3.5.2; 9-4.4.12; 9-4.4.18
see also Weight Handling Equipment	
Hoods, Fume	5-7.2
Hooks	9-4.4.4; 9-4.4.5; 9-4.4.6
see also Rigging	

INDEX (Continued)

Subject	Paragraph
Horns	2-1.4.1; 3-7.2.2
Hoses	2-1.2.1; 7-4.3; 8-2.1.1; 8-2.3; 11-3.3.2.3
see also Welding, hose	
Hot Work	12
see also Welding	
Housekeeping	2-1.2; 4-6.1; 4-6.2
Hydrogen	5-3.2
see also Combustibles	
see also Flammables	
see also Oxidizing Materials	
I	
Illumination	3-2.5; 3-4.2.4; 3-6.2.1.1; 3-7.2.1
temporary	3-6.1.4
Industrial Hygiene Services	4-11
Interlock	10-4.1.3
J	
Jacks, see Tools, portable	
L	
Labeling	4-2.2; 4-2.3; 5-2.2; 12-9.2
DOT	4-2.3.1; 4-2.3.2; Table 4-1; Figures 4-1 thru 4-24
see also NFPA	
Ladders	2-5; 2-6.1; 9-4.4.14; 13-2.2.9

INDEX (Continued)

Subject	Paragraph
construction	2-5.1.8; 2-5.4; 2-5.5
double-cleated	2-5.1.7; 2-5.3.1.7
extension, see Ladders, nonself-supporting	
fixed	2-2.2; 2-3.2; 2-5.1.2; 2-5.1.8; 2-5.2; 2-6.4
inspection	2-5.1.2
Jacob's	2-4
job-made	2-5.1.8; 2-5.4
maintenance	2-5.1.1
maximum load	2-5.1.6
nonself-supporting	2-5.3.2
portable	2-5.1.2; 2-5.1.7; 2-5.1.8; 2-5.3
protective coatings	2-5.1.3
rungs	2-5.1.1; 2-5.1.4; 2-5.1.7; 2.5.3.1.9; 2-5.3.1.11
sectional, see Ladders, nonself-supporting	
self-supporting	2-5.3.3
single, see Ladders, nonself-supporting	2-5.1.5
step, see Ladders, self-supporting	
straight	2-4
trestle, see Ladders, self-supporting	
usage	2-5.1.7; 2-5.3.1
see also Scaffolds	
Landings, see Stairs, landings	
Laser, see Radiation, nonionizing	
Laundry	3-9
Lawnmowers, see Tools, portable	
Lifesaving Equipment	6-8.4
see also Personal Protective Equipment	
Lighting, see Illumination	
Limit, Maximum Load	2-1.6
see also Ladder, maximum load	

INDEX (Continued)

Subject	Paragraph
Lines, Tag, see Tag Lines	
Liquid Oxygen (LOX)	5-3.3, Table 6-1
Lock Out	10-2.6; 10-4.1.8; 13-4.2
Longshoring	3-8.2; 5-6.4; 7-5.9
M	
Machine Guarding	2-2.2; 10
Manlifts	2-10
Marine Service Stations	5-6.3
Mat, Textured	2-1.3.3
Material Safety Data Sheets	4-2.5; 4-4.1; 5-2.2
Materials Handling and Storage	9
Maximum Load Limit, see Limit, Maximum Load	
Mechanical Equipment	3-7.3
Medical Services	4-1; 4-4.1; 4-5
Microwave, see Radiation, nonionizing	
see also Radio Frequency	
Military - unique	1-3.3.1
Mirrors	2-1.4.1
Motor Vehicles	3-7; 7-5.5.5
see also Refuel Operations	
N	
NFPA	1-6.1
labels	4-2.3.2; Table 4-1; Fig. 4-1 thru Fig. 4-4
hazard identification system	Table 4-2
codes	7-1.2.2
Nets, Safety	6-8.2
see also Personal Protective Equipment	
Nitrous Oxide	5-3.4
see also Combustibles	
see also Flammables	
see also Oxidizing Materials	
Noise	4-1; 4-7.1

INDEX (Continued)

Subject	Paragraph
O	
Occupational Safety and Health Act of 1970 ...	1-1
Office	
equipment	3-2.7
lighting, see Illumination	
Openings	
floor, see Floor, openings	
roof	2-2.1
wall, see Wall, openings	
Outriggers	9-4.4.12.3; 9-4.4.16
Ovens, see Chambers	
Oxiding Materials	5-1; 5-3.7.1.1; 5-3.9
solids	5-3.9
see also Combustibles	
see also Flammables	
Oxygen	4-3.2.2; 5-3.3; 6-4.1.1; 12-3.1.1; 12-3.4; 12-3.5.1; 12-3.5.2; 12-3.7; 12-8.4
see also Combustibles	
see also Flammables	
see also Fuel Gas Systems	
see also Welding, gas	
P	
Paint	
aircraft	5-4.4; 7-5.7.1
removal	5-4.3
scaffolds, see Scaffolds, painting	
ship	5-4.5
Paneling	2-2.2
Paper	3-9
Paperboard Mills, see Paper	
Passageways	3-2.2
see also Aisles	

INDEX (Continued)

Subject	Paragraph
Permissible Exposure Limit Values	4-3.2; 4-3.3; 4-4.2; 6-4.1
see also Toxics	
Personal Protective Equipment	4-3.3; 4-7.4; 5-4.2.7; 6; Table 6-1; 9-1.2; 10-1.1; 10-4.2.5; 11-1.5; 12-7; 13-2.2
Personnel	
civilian	1-3.2
military	1-3.2
Pest Control	4-6.3
Petroleum Gas, Liquified	5-3.6
see also Combustibles, liquids	
see also Flammables, liquids	
Plants	
bulk	5-6.5
processing	5-6.6
Platform	2-1.3; 2-2.3.2; 2-2.5.2; 2-3.1; 2-3.7; 2-5.3.1.1; 13-2.2.4
powered	2-7
work	2-1.5; 2-2.2; 2-5.1
see also Scaffolds	
Pull Lifts	9-4.5
see also Weight Handling Equipment	
Pulp, see Paper	

R

Radiation	4-1; 4-8; 6-2.6
ionizing	4-8.1
nonionizing	4-8.2; 13-4.5; 13-4.6

INDEX (Continued)

Subject	Paragraph
Radio Frequency	13-4.5
see also Radiation, nonionizing	
Rail	
car	2-1.4.4.1
transportation, see Transportation	
Railing	2-1.5; 2-2.1.1; 2-2.2; 2-2.3; 2-2.5.1; 2-2.5.2; 2-3.6; 2-6.3; 2-6.8; 2-6.11.4; 6-8.1;
Ramp	2-2.2; 2-5.3.1
see also Dockboard	
Receivers, Air	8-2.2
Refrigerant Systems	8-5
cylinders	8-5.2
Refrigerators	5-7.3
see also Chambers	
Refuel Operations	5-6
of portable powered tools	11-3.3.3.1
see also Fueling, transfer	
Resistance Welding, see Welding, resistance	
Respirators	4-4.1.1; 6-4; 12-9
Revisions	1-5
Rigging	9-4.6; 9-4.7.1; 13-4.3
see also Weight Handling Equipment	
Roof	2-2.2; 2-2.3.6; 12-6.1
Runway	2-2.2; 2-5.3.1

S

Safeguarding	10-4; 13-4.2
primary	10-4.1
secondary	10-4.2
see also Machine Guarding	

INDEX (Continued)

Subject	Paragraph
Safety Color Code, see Color Code, Safety	
Safety Nets, see Nets, Safety	
Sanitation	4-1; 4-6
see also Housekeeping	
see also Toilet Facilities	
Sawmills	3-9
Scaffolds	2-5.1; 2-5.3.1; 2-5.3.3.2; 2-6; 9-4.5.2; 13-2.2.9
barge	2-6.11
construction	2-6.2
inspection	2-6.6
loading	2-6.2; 2-6.7; 2-6.7.3
manually propelled mobile	2-6.10
painting	2-6.5
planks	2-5.1.7
pontoon, see Scaffolds, barge	
specific types	2-6.9; Table 2-1
weather restrictions	2-6.8
Screening	2-2.2; 2-2.5.2; 2-2.6; 2-6.3.2
Service Stations, Marine, see Marine Service Stations	
Shackles, see Rigging	
Shields	10-4.1.2; 10-4.1.3
Shipbuilding and Repair	1-2.2; 1-3.3; 2-6.3; 3-8.1; 4-2.5; 5-9; 7-5.8; 13-4.3
Showers, Deluge	4-5.2.2; 13-2.4.1
Sight Conservation, see Eye Protection	

INDEX (Continued)

Subject	Paragraph
Signs, Warning	2-1.3.1; 2-1.4.1; 2-2.3.7; 2-5.3.1.5; 3-4; 9-2.6
Slings	3-7.3.1.1; 9-4.4.6; 9-4.4.9; 9-4.4.10; 9-4.7
see also Rigging	
Solvents	5-3.8; 5-4.2.7; 5-7.3; 7-5.3; 7-5.7.1; 8-2.2.1.2; 13-4.7
Spray Finishing	5-4
Stairs	2-1.3; 2-2.2; 2-2.3.1; 2-5.3.1; 2-6.4
construction	2-3.1; 2-3.5
fixed industrial	2-3
landings	2-2.5.2; 2-3.7
spiral	2-3.3
winding	2-3.4
see also Ladders	
Standpipes	7-4.3; 7-5.6.4
Storage	9-5
in bins	2-1.2.1
in cribs	2-1.2.1
in lockers	2-1.2.1
in sacks	2-1.2.1
maintenance	7-5.2
on scaffolds	2-6.7.2
Storms, storage of aircraft during	7-5.7.3
T	
Tag, Accident Prevention	3-4.1; 3-4.2.10

INDEX (Continued)

Subject	Paragraph
Tag Lines	9-4.4.6
Tag Out	10-2.6; 10-4.2.4; 13-4.2
Tank	
dip	5-5
portable	5-3.5.3; Table 5-1; 8-3.1
Telecommunications	3-9; 13-2.1.1
Textiles	3-9
Thermal Stress	4-9
Thoroughfares, see Passageways	
Toeboards	2-2.1.1; 2-2.2; 2-2.3.1; 2-2.3.2; 2-2.3.3; 2-2.5.1; 2-2.5.2; 2-2.6; 2-6.3; 2-6.3.2
Toilet Facilities	4-6.5
Tools	
hand-feeding	10-4.2.2
portable	1-3.3.1.1; 11
cuts and strokes	11-2.4
electric-powered	11-3.3.1
explosive actuated fastening	11-4.1
fuel-powered	11-3.3.3
handles	11-2.1; 13-2.2.5
hydraulic-powered	11-3.3.4
impact	11-2.2; 11-2.6.3
jacks	3-7.3.1.1; 11-4.3
lawn mowers	3-5.3.1; 11-4.2
pneumatic-powered	8-2.3; 11-3.3.2
sharp edged	11-2.3
storage	11-1.4
striking	11-2.6.2

INDEX (Continued)

Subject	Paragraph
wrenches	11-1.2; 11-2.6.1
Torches, see Welding, torches	
Towing	
vehicles	3-7.1.2.1
Toxics	4-2.1; 4-3; 8-5.3.1; 13-4.7
disposal of	4-3.5
gases	8-2.1.1
storage and handling	4-3.4
ventilation	4-1; 4-4
see also Permissible Exposure Limit Values	
Transportation	9-6
Trenches	3-6.1; 3-6.3
Trucks	
aerial lift	2-8
powered industrial	9-1.3; 9-3
Two Hand Device	
hand-feeding	10-4.2.2
U-V	
Underwriters Laboratories, Incorporated	12-2.1; 13-3.4
Unknown Materials	4-2.2
Vaults	3-2.6
Ventilation	
systems	4-4.2
see also Respirators	
Vermin Control, see Pest Control	
W	
Walkway	2-2.2; 9-4.4.14
Wall	
holes	2-2.6
openings	2-2.1; 2-2.5
Warning Signs, see Signs, Warning	
Washing Facilities	4-6.6
see also Shower, Deluge	
Water Supply	4-6.4
containers, drinking water	4-6.4.3
drinking	4-6.4.1
nonpotable	4-6.4.4

INDEX (Continued)

Subject	Paragraph
potable	4-6.4.2
Wax, Floor	2-1.3.3
Weight Handling Equipment	9-1.3; 9-4
operators	9-4.2
see also Cranes	
see also Derricks	
see also Hoists	
see also Hooks	
see also Outriggers	
see also Winches	
Welding	12
arc	12-4; 12-7.2.1; 12-7.2.3; 12-7.3.1; 12-8.5
electrode removal	12-8.5
filter shade selection	Table 12-1
fire prevention	7-1.2.1 7-1.3; 7-5.1; 12-6
gas	12-7.2.1; 12-7.2.2; 12-8.4
hose	12-2.1; 12-3.5; 12-8.4
pipelines	12-10
resistance	12-5; 12-7.2.1
torches	12-2.1; 12-3.6; 12-7.2.1; 12-8.4
see also Personal Protective Equipment	
Winches	9-4.1.1.4
see also Weight Handling Equipment	
Windows, see Wall, openings	
Wiring	13-3.2; 13-3.3
Wrenches, see Tools, portable	