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MILITARY HANDBOOK

HAZARDOUS WASTE STORAGE FACILITIES



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## ABSTRACT

Basic guidance for the design of hazardous waste storage facilities is presented for use by experienced architects and engineers. This handbook includes design guidelines for site selection, safety, security, communications, housing requirements, and operational guidelines for routine operation and safety and emergency procedures.

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## FOREWORD

This military handbook has been developed from an evaluation of facilities in the shore establishment, from surveys of the availability of new materials and construction methods, and from selection of the best design practices of the Naval Facilities Engineering Command (NAVFACENGCOM), other Government agencies, and the private sector. It uses to the maximum extent feasible, national professional society, association, and institute standards. Deviations from this criteria, in the planning, engineering, design, and construction of Naval shore facilities, cannot be made without prior approval of NAVFACENGCOMHQ Code 04.

Design cannot remain static any more than can the functions it serves or the technologies it uses. Accordingly, recommendations for improvement are encouraged and should be furnished to Naval Facilities Engineering Command Headquarters (Code 04).

This handbook shall not be used as a reference document for procurement. Do not reference it in military or Federal specifications or other procurement documents.

**CRITERIA ENGINEERING CRITERIA MANUALS**

<b><u>DM NO.</u></b>	<b><u>TITLE</u></b>
*5.01	Surveying
*5.02	Hydrology
*5.03	Drainage Systems
*5.04	Pavements
*5.05	General Provisions and Geometric Design for Roads Streets, Walks, and Open Storage Areas
*5.06	Trackage
*5.07	Water Supply Systems
*5.08	Domestic Wastewater Control
*5.09	Industrial and Oily Wastewater Control
*5.10	Solid Waste Disposal
*5.12	Fencing, Gates, and Guard Towers
MIL-HDBK-1005/13	Hazardous Waste Storage Facilities
*5.14	Groundwater Pollution Control
* When NAVFAC Design Manuals (DM) are revised, they will be converted to Military Handbooks (MIL-HDBK).	

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## Section 1. INTRODUCTION

1.1 Scope. The criteria in this handbook shall govern the design of hazardous waste storage facilities. The handbook provides guidelines to ensure that storage of hazardous wastes will meet the Federal criteria mandated by Title 40 of the Code of Federal Regulations (CFR), Parts 260 through 266.

1.2 Cancellation. This handbook cancels and supersedes NAVFAC Design Manual DM-5.13, Hazardous Waste Storage and Transfer Facilities dated August 1982 and interim criteria titled Hazardous Waste Storage Facilities distributed by NAVFAC letter of 18 February 1986.

1.3 Applicability. The criteria in this handbook apply to the construction of all Department of Defense (DOD) facilities that are used for long-term storage of hazardous waste or are otherwise subject to the requirements of 40 CFR, Parts 264, 265, and 270 and that are located in the 50 states, the District of Columbia, Puerto Rico, and U.S. territories and possessions. They shall be used to the extent practicable at DOD installations in foreign countries, based on host nation requirements and agreements. (See DOD Directive 5100.50, Protection and Enhancement of Environmental Quality, and DOD Directive 6050.7, Environmental Effects Abroad of Major DOD Actions.)

1.4 General Discussion. There are two types of hazardous waste storage facilities: a short-term storage facility, where materials are stored for periods of less than 90 days, and a long-term storage facility. A long-term storage facility usually does not require a permit to operate, but operations in a short-term storage facility are required to meet packaging and labeling requirements and to date the receipt of hazardous wastes. The requirements for short-term facilities are given in 40 CFR 262.20 and 40 CFR 262.34. The long-term facility is a permanent facility subject to the requirements of 40 CFR, Parts 264 and 265, and the permit requirements of 40 CFR, Part 270.

1.5 Policy. Minimum quantities of hazardous waste to be stored will be established in order to justify the cost of construction of a permanent new facility. Consideration will be given to utilizing available, existing conforming storage facilities within the local geographical area prior to considering the construction of a new facility.

The facility shall be designed to meet Federal, State, and local environmental criteria. The design requirements set forth in this manual are mandatory for the long-term facility. Storage facilities will be either enclosed or open, as required by regulation and by the nature of the material to be stored. The modification of existing facilities is the preferred alternative to the construction of new facilities. An estimate of the quantity and type of hazardous waste to be stored may be found in hazardous materials environmental management surveys or hazardous waste management plans, which can be obtained for the using agency. All facilities that store wastes more than 90 days shall comply with the requirements of the Federal hazardous waste permit program, 40 CFR 122, and authorized State agencies. Floor packing densities shall be as specified in the Office of Safety and Health Administration (OSHA) Safety and Health Standards (29 CFR 1910).

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1.5 Referenced Documents. The criteria applicable to the design of hazardous waste storage facilities are as follows:

- a) Construction Criteria Manual, DOD Directive 4270.1-M
- b) Floodplain Management Guidelines, Federal Register Vol. 43 N 29 (Protection of Environment) (43 FR 6030), February 10, 1978
- c) Title 40, Code of Federal Regulations, Parts 122, 124, 260 through 266, 270, 300 (National Oil and Hazardous Substances Pollution Contingency Plan and 761 (Toxic Substance Control Act Regulations)
- d) Title 49 (Transportation), Code of Federal Regulations, Parts 171 through 179
- e) Title 29 (Labor-OSHA Safety and Health Standards), Code of Federal Regulations, Part 1910
- f) Protection and Enhancement of Environmental Quality, DOD Directive 5100.50
- g) Environmental Effects Abroad of Major DOD Actions, DOD Directive 6050.7
- h) National Environmental Policy Act, DOD Directive 6050.1
- i) Specifications for Highway Bridges, AASHTO H-20, American Association of State Highway and Transportation Officials
- j) Resource Conservation and Recovery Act, PC 94-580, Subtitle C, as regulated by 40 CFR, Part 124, 260 through 266, and 270
- k) Flammable and Combustible Liquids Code, National Fire Protection Association, NFPA-30
- l) Hazardous Chemicals Data, National Fire Protection Association, NFPA-49
- m) Explosion Venting, National Fire Protection Association, NFPA-68
- n) National Electric Code, National Fire Protection Association, NFPA-70
- o) Emergency Eyewash and Shower Equipment, American National Standards Institute, ANSI Z 358.1-1981
- p) A Method for Determining the Compatibility of Hazardous Wastes, Environmental Protection Agency, EPA-600/z-80-076
- q) Industrial Ventilation - A Manual of Recommended Practices, American Conference of Government Industrial Hygienists (ACGIH)

Plans and specifications shall be available for review by the Environmental Protection Agency or by the appropriate State agencies. The concept design shall be reviewed and approved by the host installation.

The environmental impact of the facility shall be assessed in accordance with the provisions of the National Environmental Policy Act as required by DOD 6050.1 and component implementing directives.

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## Section 2. DESIGN GUIDELINES

2.1 Site Selection. The selection of a site for the storage facility is an important part of the design effort. Guidelines for long-term facilities are given in 40 CFR 264.18. Site selection shall agree with the appropriate land use designation on the installation master plan.

2.1.1 Proximity to Critical Areas. A buffer zone of 15 meters (50 feet) shall be provided between the facility and the nearest inhabited area, stream, or body of water. For critical mission areas such as petroleum, oils, and lubricants (POL), ordnance, or flammable stores, buffer zones appropriate to those facilities will be maintained.

2.1.2 Groundwater Hydrological and Chemical Data. The designer shall determine variations in groundwater elevation and the direction of groundwater flow. These data shall be used by the designer to evaluate the damage potential of a spill or release and to assure that the design is adequate to prevent spills from contaminating surface water and groundwater. Groundwater monitoring, sufficient to establish background levels, may be performed by the host installation.

2.1.3 Surface Water Hydrological Data. The site shall be above, or protected from, flooding. The floodplains are the lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, those areas subject to a 1-percent or greater chance of flooding in any given year. The base floodplain shall be used to designate the 100-year floodplain, the 1-percent flooding probability. The critical action floodplain is the flood level for which even a slight chance for flooding is too great a hazard (43 CFR 6030, February 10, 1978). This level is defined as the 500-year floodplain, the 0.2-percent flooding probability. The surface water elevations for the floodplains can be obtained from the U.S. Army Corps of Engineers. The requirement for determining the floodplains is given in DOD 4270.1-M.

2.1.4 Soil Information. The engineering characteristics of the soil shall be determined at the locations of the facility and the access roads. The location exchange characteristics of the soil shall be determined at a minimum of two points on this site. This information will be used to determine the capacity of the soil to retain pollutants in the event of a spill.

2.1.5 Geological Information. If the facility is located in a political jurisdiction listed in Appendix VI of Paragraph 40, CFR 264.18, the facility shall not be within 61 meters (200 feet) of a fault that has had displacement in Holocene time (Holocene time refers to the most recent geological time period, including approximately the last 11,000 years). The 61 meters shall be measured along a direct line perpendicular to the plan of the fault intersecting the nearest extremity (i.e., fence line) of the facility to the fault line.

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2.1.6 Meteorological Information. The information provided for the design of a facility incorporates meteorological data to establish structural and mechanical criteria. Prevailing wind direction shall be used to site the facility so that, in the event that toxic gases or smoke are released, the effect on the populated or mission areas will be minimized.

2.1.7 Accessibility. The facility shall be located where there are access roads of adequate load-bearing capacity and where routing through residential areas will not be required.

2.2 General Requirements. Facilities will be designed to store non-leaking containers labeled in accordance with Department of Transportation (DOT)/Environmental Protection Agency (EPA) criteria. The use of direct buried containers (i.e., tanks) will not be acceptable.

2.2.1 Enclosed or Open Facilities. General criteria for electrical design, fire protections, ventilation, and materials of construction are summarized in Table 1.

2.2.2 Safety.

2.2.2.1 Access and Exit. Access to and exit from the storage facility will be restricted to periods when the facility is manned. During periods when the facility is not manned, entrance shall be completely restricted either through locked gates, door, or both. In accordance with 40 CFR 264.14 (c), a sign visible from 8 meters (25 feet) shall be placed on all access roads and entrances to the storage facility. The sign shall have the legend: "Danger - Unauthorized Personnel Keep Out."

2.2.2.2 Showers and Eyewash Station. Eyewash/deluge showers will be provided within 10 seconds and within 100 feet of travel distance for both long- and short-term storage facilities (in conformance with Emergency Eyewash and Shower Equipment, ANSI Standard Z 358.1-1981).

2.2.2.3 Ventilation. All generally occupied areas (administrative, latrines, etc.) shall follow the recommendations of the American Conference of Government Industrial Hygienists (ACGIH), Industrial Ventilation, A Manual of Recommended Practices, and shall have positive-pressure ventilation in enclosed spaces, as shown in Table 1. Negative pressure shall be maintained in all enclosed waste storage areas. Ventilation shall conform to OSHA Standard 1910.106 for flammable liquid vapors. Dehumidification of the air and exhausting the air to outside are recommended for storage areas containing materials that react with water or that have corrosive vapors, specifically the acid waste, and reactive waste storage areas. Storage and/or transfer areas containing materials hazardous to health shall be ventilated.

2.2.2.4 Fire Protection. Fire protection shall be provided as required by Construction Criteria Manual, DOD 4270.1-M. Since reactive wastes may react violently with water, the storage area for these wastes shall be protected by a gaseous-type system (i.e., CO<sub>2</sub> or Halon 1301).

**Table 1**  
General Design Requirements,  
Enclosed or Open Hazardous Waste Storage Facilities

<u>Area</u>	<u>Ventilation</u>	<u>Electrical</u>		<u>Materials of Construction</u>			<u>Fire Protection</u>	
		Explosion Proof	Corrosion-Resistant	NEMA Fire-Resistant Type	Non-Absorbent	Corrosion-Resistant	Drains	Sprinkler Density
Office	Positive Pressure	No	No	1	Yes	No	N/A	0.16 gpm/ft <sup>2</sup>
Clean Room	Positive Pressure	No	No	1	Yes	No	Sanitary Sewer	0.16 gpm/ft <sup>2</sup>
Dirty Room	Positive Pressure	No	No	4	Yes	No	Sanitary Sewer	0.16 gpm/ft <sup>2</sup>
Lavatory	Positive Pressure	No	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
Acid Wastes	Negative Pressure	Yes	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
Organic Wastes	Negative Pressure	No	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
Caustic Wastes	Negative Pressure	Yes	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
Reactive Wastes	Negative Pressure	Yes	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
Oxidizer Wastes	Negative Pressure	Yes	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
General Wastes	Negative Pressure	Yes	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>
Mechanical Room	Positive Pressure	No	No	1	Yes	No	Sanitary Sewer	0.16 gpm/ft <sup>2</sup>
*Flammable	Negative Pressure	Yes	Yes	7	Yes	Yes	Captured	0.35 gpm/ft <sup>2</sup>

\* Requirement must meet NFPA-30, FLAMMABLE AND COMBUSTIBLE LIQUID CODE

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The sprinkler densities required for the various storage areas shall be as indicated in Table 1. Sprinkler heads shall be suitable for installation in a corrosive environment. Containment shall be in accordance with Resource Conservation and Recovery Act, PL-580, Subtitle C, and OSHA Safety and Health Standards (29 CFR 1910) and, as appropriate, with Toxic Substances Control Act Regulations (40 CFR 761).

Cut-off Room and Attached Building are defined in National Fire Protection Association NFPA 30 Flammable and Combustible Liquids and are categorized as a Separate Inside Storage Area; i.e., "A room or building used for the storage of liquids in containers or portable tanks, separated from other types of occupancies."

In storage areas that are classified as liquid warehouses, explosion venting is not required.

Liquid warehouses are defined in NFPA 30 as separate detached buildings or attached buildings separated from other types of occupancies by standard 4-hour fire rated walls, used for warehousing-type operations for liquids. Subdivision of a liquid warehouse does not constitute a basis for changing its classification.

2.2.2.5 Explosion Venting. In storage areas that are classified as a cut-off room or an attached building and where Class I-A liquids (NFPA 30) are stored in containers larger than 1 gallon, the exterior wall or roof construction shall be designed to include explosion venting features such as lightweight wall assemblies, lightweight roof assemblies, and roof hatches or windows of the explosion venting type. Explosion Venting, NFPA 68, provides information on this subject and should be used in conjunction with good engineering judgment.

2.2.2.6 Safety Equipment Lockers. Lockers for equipment (such as two sets of protective clothing and self-contained breathing apparatus) shall be readily available for personnel operating the facility. The requirements set forth in 29 CFR 1910, Subpart I, Personnel Protective Equipment, shall apply.

2.2.2.7 Stack Height. Hazardous waste shall be stored in racks not exceeding 25 feet in height where a materials handling system that elevates the operator (operator-up) with the wastes is used. When systems that do not elevate the operator (operator-down) are used, rack height shall be limited to 18 feet.

2.2.2.8 Containment. Container storage areas shall have provisions for containing leaks, spills, and accumulated precipitation as required by 40 CFR, Part 264.175. Containment systems for flammable or combustible liquid storage shall also comply with NFPA 30.

## 2.2.3 Communications.

a) Telephone or wireless communications shall be provided.

b) Internal communications should consist of a master and station receive and talk, if the size of facility warrants (40 CFR 265.32).

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2.3.2 Sorbent Material for Spills. All facilities shall maintain an adequate supply of compatible sorbent material for application to liquid spills and leaks. Sufficient storage area shall be provided for sorbent material.

2.3.3 Personnel Facilities. Locker rooms, showers, and toilet facilities shall be provided only when not available in adjacent facilities.

2.4 Enclosed or Open Storage Facilities. General design criteria are shown in Table 1. The storage area shall be designed to prevent surface or groundwater contamination and to capture completely each class of waste individually. The access and exit roadway and the portion of the facility floor expected to receive vehicular traffic shall be designed for wheel loading in accordance with American Association of State Highway and Transportation Officials (AASHTO) H-20, Specifications for Highway Bridges. The water lines to the sprinkler systems shall be equipped with a positive backflow preventer. Other design considerations include the requirement to isolate acid storage from the other categories of waste, the requirement to isolate flammable liquids from acids and oxidizers, and the desirability of isolating the acids containing organics from the oxidizers. The handling method will depend on the quantity and packing of the waste to be handled.



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### Section 3. OPERATIONAL GUIDELINES

3.1 General. The facility design must be closely coordinated with the using agency's operational plan and requirements, as well as the comprehensive and contingency plans (fire protection, spill containment, disaster preparedness, etc.) of the host installation. This section is provided to give the designer a basic understanding of the operational requirements for the facility.

3.1.2 Container Storage. Only non-leaking containers that are safe to handle and correctly labeled shall be stored in this facility. The containers shall be stored according to type and in such a manner as to facilitate inspection and removal with a minimum of handling. The quantities and type of storage will dictate the space available, must be specified during the design, and must be adhered to by the operating agency.

3.2 Compatibility of Wastes. The storage areas have been divided into six categories according to the chemical characteristics of the hazardous wastes. The groups were selected from the EPA publication, A Method for Determining the Compatibility of Hazardous Wastes (EPA 600/2-80-076, April 1980). These categories are as follows:

3.2.1 Acid Wastes. Wastes containing inorganic acids with a pH of 4.0 and below.

3.2.2 Caustic Wastes. Wastes containing inorganic bases with a pH of 9.0 and above.

3.2.3 Organic Wastes. Wastes containing nonreactive organic materials.

3.2.4 Oxidizer Wastes. Wastes containing oxidizing inorganic compounds.

3.2.5 Reactive Wastes. Wastes that react violently with water.

3.2.6 General Wastes. Wastes that are not chemically active and not primarily organic in nature.

The general chemical characteristics of each category should be considered in planning the location of each storage area. Table 2 should be used to locate the storage areas on the basis of the compatibility of various categories. Compatible wastes may be separated by a single partition. Incompatible wastes shall be separated by barriers designed in accordance with the National Fire Codes, as published by the National Fire Protection Association.



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Table 2

Compatibility of Hazardous Waste Categories

	Acid	Caustic	Organics	Oxidizers	Reactive	General
Acid	--	NC	NC	NC	NC	NC
Caustic	NC	--	NC	C	NC	NC
Organics	NC	NC	--	NC	NC	NC
Oxidizers	NC	C	NC	--	NC	C
Reactive	NC	NC	NC	NC	--	NC
General	NC	NC	NC	C	NC	--

C - Compatible, NC - Not Compatible

Note: Even though wastes may be compatible by generic type, as stated above, specific wastes may not be compatible within that type. Wastes should always be reviewed individually for compatibility and, if incompatible, should not be stored together. See DOD INST 4145.19 R-1 Storage and Material Handling.

3.3 Operational Criteria. Operational aspects and contingency plans that may affect the design of the facility shall be obtained from the using agency and host installation.

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## REFERENCES

A Method for Determining the Compatibility of Hazardous Waste, Environmental Protection Agency (EPA-600/2-80-076), 401 M Street, SW., Washington, DC 20460.

Department of Defense (DOD) documents - Copies can be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

Construction Criteria Manual - DOD 4270.1-M

Environmental Effects Abroad of Major DOD Actions - DOD Directive 6050.7

National Environmental Policy Act - DOD Directive 6050.1

Protection and Enhancement of Environmental Quality - DOD Directive 5100.50

Storage and Material Handling - DODINST 4145.19 R-1

Physical Security and Loss Prevention - OPNAVINST 5530.14A.

Emergency Eyewash and Shower Equipment, ANSI Z 358.1, 1981 American National Standards Institute, 1430 Broadway, New York, NY 10013.

Industrial Ventilation - A Manual of Recommended Practices, American Conference of Government Industrial Hygienists (ACGIH), 6500 Glen Way Avenue, Cincinnati, Ohio 45211.

National Fire Protection Association, Inc. (NFPA), Batterymarch Park, Quincy, MA 02269.

Explosion Venting, NFPA-68

Flammable and Combustible Liquids Code, NFPA-30

Hazardous Chemicals Data, NFPA-49

National Electric Code, NFPA-70

Specifications for Highway Bridges, AASHTO H-20, American Association of State Highway and Transportation Officials, 444 North Capitol Street, NW., Suite 225, Washington, DC 20001.

U.S. Code of Federal Regulations (CFR).

Title 29, Labor (OSHA Safety and Health Standards), CFR Part 1910

Title 40, Protection of Environment, CFR Parts 122, 124, 260 through 266, 270, 300 (National Oil and Hazardous Substances Pollution Contingency Plan), and 761 (Toxic Substances Control Act Regulations)

Title 49, Transportation, CFR Parts 171 through 179

U.S. Federal Register (FR), Floodplain Management Guidelines, 43 FR 6030, dated February 10, 1978.

U.S. Public Law (PL), Resource Conservation and Recovery Act, PL 94-580. Copies of CFR, FR, and PL can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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