

UNIFIED FACILITIES CRITERIA (UFC)

DESIGN: HAZARDOUS WASTE STORAGE



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DESIGN: HAZARDOUS WASTE STORAGE

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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEERING SUPPORT AGENCY

Record of Changes (changes indicated by \1\ ... /1/)

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UFC 4-451-10N
16 January 2004

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with [USD\(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: [Criteria Change Request \(CCR\)](#). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site <http://dod.wbdg.org/>.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

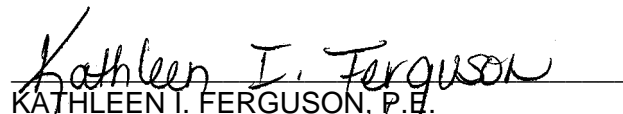
AUTHORIZED BY:




DONALD L. BASHAM, P.E.
 Chief, Engineering and Construction
 U.S. Army Corps of Engineers



DR. JAMES W. WRIGHT, P.E.
 Chief Engineer
 Naval Facilities Engineering Command



KATHLEEN I. FERGUSON, P.E.
 The Deputy Civil Engineer
 DCS/Installations & Logistics
 Department of the Air Force



Dr. GET W. MOY, P.E.
 Director, Installations Requirements and
 Management
 Office of the Deputy Under Secretary of Defense
 (Installations and Environment)

CONTENTS

| | Page |
|---|------|
| CHAPTER 1 INTRODUCTION | |
| Paragraph 1-1 PURPOSE AND SCOPE | 1-1 |
| 1-2 APPLICABILITY | 1-1 |
| 1-2.1 General Building Requirements | 1-1 |
| 1-2.2 Safety | 1-1 |
| 1-2.3 Fire Protection | 1-1 |
| 1-2.4 Antiterrorism/Force Protection | 1-1 |
| 1-3 REFERENCES | 1-2 |
| | |
| APPENDIX A MIL-HDBK 1005/13..... | A-1 |
| | |
| APPENDIX B MIL-HDBK 1005/13, NOTICE 2, 15 MAY 1999..... | B-1 |

CHAPTER 1

INTRODUCTION

1-1 **PURPOSE AND SCOPE.** This UFC is comprised of two sections. Chapter 1 introduces this UFC and provides a listing of references to other Tri-Service documents closely related to the subject. Appendix A contains the full text copy of the previously released Military Handbook (MIL-HDBK) on this subject. This UFC serves as criteria until such time as the full text UFC is developed from the MIL-HDBK and other sources.

This UFC provides general criteria for the design of hazardous waste storage facilities.

Note that this document does not constitute a detailed technical design, maintenance or operations manual, and is issued as a general guide to the considerations associated with design of economical, efficient and environmentally acceptable hazardous waste storage facilities.

1-2 **APPLICABILITY.** This UFC applies to all Navy service elements and Navy contractors; Army service elements should use the references cited in paragraph 1-3 below; all other DoD agencies may use either document unless explicitly directed otherwise.

1-2.1 **GENERAL BUILDING REQUIREMENTS.** All DoD facilities must comply with UFC 1-200-01, *Design: General Building Requirements*. If any conflict occurs between this UFC and UFC 1-200-01, the requirements of UFC 1-200-01 take precedence.

1-2.2 **SAFETY.** All DoD facilities must comply with DODINST 6055.1 and applicable Occupational Safety and Health Administration (OSHA) safety and health standards.

NOTE: All **NAVY** projects, must comply with OPNAVINST 5100.23 (series), *Navy Occupational Safety and Health Program Manual*. The most recent publication in this series can be accessed at the NAVFAC Safety web site: www.navfac.navy.mil/safety/pub.htm. If any conflict occurs between this UFC and OPNAVINST 5100.23, the requirements of OPNAVINST 5100.23 take precedence.

1-2.3 **FIRE PROTECTION.** All DoD facilities must comply with UFC 3-600-01, *Design: Fire Protection Engineering for Facilities*. If any conflict occurs between this UFC and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence.

1-2.4 **ANTITERRORISM/FORCE PROTECTION.** All DoD facilities must comply with UFC 4-010-01, *Design: DoD Minimum Antiterrorism Standards for Buildings*. If any conflict occurs between this UFC and UFC 4-010-01, the requirements of UFC 4-010-01 take precedence.

1-3 **REFERENCES.** The following Tri-Service publications have valuable information on the subject of this UFC. When the full text UFC is developed for this subject, applicable portions of these documents will be incorporated into the text. The designer is encouraged to access and review these documents as well as the references cited in Appendix A.

1. US Army Corps of Engineers **USACE TL 1110-3-459**, Hazardous Waste
 Commander Storage Criteria, 03 November 1993
 USACE Publication Depot
 ATTN: CEIM-IM-PD
 2803 52nd Avenue
 Hyattsville, MD 20781-1102
 (301) 394-0081 fax: 0084
 karl.abt@hq02.usace.army.mil
 <http://www.usace.army.mil/inet/usace-docs/>

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16 January 2004

APPENDIX A

**MIL-HDBK 1005/13
HAZARDOUS WASTE STORAGE**

MIL-HDBK-1005/13
30 APRIL 1987
SUPERSEDING
NAVFAC DM-5.13
AUGUST 1982

MILITARY HANDBOOK

HAZARDOUS WASTE STORAGE

NO DELIVERABLE DATA REQUIRED BY THIS DOCUMENT

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MIL-HDBK-1005/13
 NOTICE 1
 31 May 1996

MILITARY HANDBOOK
 HAZARDOUS WASTE STORAGE FACILITIES

TO ALL HOLDERS OF MIL-HDBK-1005/13:

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| NEW PAGE | DATE | SUPERSEDED PAGE | DATE |
|----------|---------------|-----------------|---------------|
| vii | 31 May 1996 | vii | 30 April 1987 |
| viii | 30 April 1987 | No Change | |
| 3 | 31 May 1996 | 3 | 30 April 1987 |
| 3a | 31 May 1996 | New Page | |
| 4 | 30 April 1987 | No Change | |

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

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ABSTRACT

Basic guidance for the design of hazardous waste storage and transfer facilities is presented for use by experienced architects and engineers. The manual includes design guidelines for site selection, safety, security, communications, utilities, and building construction, and operational guidelines for routine operation, safety and emergency procedures.

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 NAVFACENGCOM HQ 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

| DM NO. | TITLE |
|------------------|--|
| 5. 01 | Surveying |
| 5. 02 | Hydrology and Hydraulics |
| 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 |
| MIL-HDBK-1005/7 | Water Supply Systems |
| MIL-HDBK-1005/8 | Domestic Wastewater Control |
| MIL-HDBK-1005/9 | 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 |

MIL-HDBK-1005/13
Change 1, 31 May 1996

HAZARDOUS WASTE STORAGE FACILITIES

CONTENTS

| | | Page |
|------------------|---|------|
| | | ÄÄÄÄ |
| Section 1 | INTRODUCTION | |
| 1.1 | Scope | 1 |
| 1.2 | Cancellation | 1 |
| 1.3 | Applicability | 1 |
| 1.4 | General Discussion | 1 |
| 1.5 | Policy | 1 |
| 1.6 | Referenced Documents | 2 |
| Section 2 | DESIGN GUIDELINES | |
| 2.1 | Site Selection | 3 |
| 2.1.1 | Proximity to Critical Areas | 3 |
| 2.1.2 | Ground Water Hydrological and Chemical Data | 3 |
| 2.1.3 | Surface Water Hydrological Data | 3a |
| 2.1.4 | Soil Information | 3a |
| 2.1.5 | Geological Information | 3a |
| 2.1.6 | Meteorological Information | 4 |
| 2.1.7 | Accessibility | 4 |
| 2.2 | General Requirements | 4 |
| 2.2.1 | Enclosed or Open Facilities | 4 |
| 2.2.2 | Safety | 4 |
| 2.2.2.1 | Access and Exit | 4 |
| 2.2.2.2 | Showers and Eyewash Station | 4 |
| 2.2.2.3 | Ventilation | 4 |
| 2.2.2.4 | Fire Protection | 4 |
| 2.2.2.5 | Explosion Venting | 6 |
| 2.2.2.6 | Safety Equipment Lockers | 6 |
| 2.2.2.7 | Stack Height | 6 |
| 2.2.2.8 | Containment | 6 |
| 2.2.3 | Communications | 6 |
| 2.2.4 | Security | 7 |
| 2.2.5 | Electrical | 8 |
| 2.3 | Housing Requirements | 8 |
| 2.3.1 | Office | 8 |
| 2.3.2 | Sorbent Material for Spills | 9 |
| 2.3.3 | Personnel Facilities | 9 |
| 2.4 | Enclosed or Open Storage Facilities | 9 |

MIL-HDBK-1025/1
Change 1, 31 May 1996

| | Page |
|------------------|-------------------------------------|
| | ÄÄÄÄ |
| Section 3 | |
| | OPERATIONAL GUIDELINES |
| 3.1 | General 10 |
| 3.1.2 | Container Storage. 10 |
| 3.2 | Compatibility of Wastes. 10 |
| 3.2.1 | Acid Wastes. 10 |
| 3.2.2 | Caustic Wastes 10 |
| 3.2.3 | Organic Wastes 10 |
| 3.2.4 | Oxidizer Wastes. 10 |
| 3.2.5 | Reactive Wastes. 10 |
| 3.2.6 | General Wastes 10 |
| 3.3 | Operational Criteria 11 |

TABLES

| | | |
|---------|--|----|
| TABLE 1 | General Design Requirements, Enclosed or Open Hazardous Waste Storage Facilities | 5 |
| 2 | Compatibility of Hazardous Waste Categories. | 11 |

| | | |
|-------------------|-----------|----|
| REFERENCES | | 12 |
|-------------------|-----------|----|

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 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 for materials stored greater than 90 days. A long-term storage facility usually does not require a permit to operate, but operations in a short-term 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 closed 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).

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

- a) Construction Criteria Manual, MIL-HDBK-1190
- b) Floodplain Management Guidelines, Federal Register Vol. 43 N 29
- 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) Resources Conservation and Recovery Act, PC 94-580, Subtitle C, as regulated by 40 CFR, Parts 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.

MIL-HDBK-1005/13
Change 1, 31 May 1996

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 storage 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. Provide a minimum buffer zone of 15 meters (50 feet) between the hazardous waste (HW) storage building and adjacent inhabited areas, facilities, and waterways. The buffer zone begins at the outer limit of the storage containers when outdoor storage is planned. Larger buffer zones are required for mission areas storing products such as petroleum, flammable or combustible liquids, and toxic materials. Refer to MIL-HDBK-1008B, Fire Protection for Facilities Engineering, Design, and Construction, the Uniform Building Code and the National Fire Protection Association (NFPA) standards for information on critical buffer zones. Evaluate the following factors when selecting a site for a HW storage facility: the quantity and type of hazardous material stored, storage retrieval system (e.g., racking, shelving, and stacking), automatic fire suppression systems, size of doors and windows and other openings on adjacent buildings, building construction materials (including fire walls and doors), the relative height of adjacent buildings, and other environmental conditions such as prevailing winds and topography. The type of materials stored over the life of the facility may change as the Navy mission changes. Most building and fire codes protect people and property from fire and explosion hazards but do not address health and environmental effects of an accidental release or long-term, low-level exposures. Conduct a risk assessment and appropriate hazard analysis for accidental releases and day-to-day operations at HW storage buildings. A more detailed analysis may be required for HW facilities located near waterways, inhabited areas, and non-industrial areas such as housing and child care centers. Use sound scientific and engineering principles up front during planning and design to identify and minimize hazards associated with the facility throughout its life cycle.

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

MIL-HDBK-1005/13
Change 1, 31 May 1996

2.1.3 Surface Water Hydrological Data. The site shall be above, or protected from, flooding. The flood plains 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 flood plain shall be used to designate the 100-year flood plain, the 1-percent flooding probability. The critical action flood plain is the flood level for which even a slight chance for flooding is too great a hazard (43 CFR 6030). This level is defined as the 500-year flood plain, the 0.2-percent flooding probability. The surface water elevations for the flood plains can be obtained from the U.S. Army Corps of Engineers. The requirement for determining the flood plains 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 soils shall be determined at a minimum of two points on this site. This information will also 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 (e.g., fence line) of the facility to the fault line.

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 routine through residential areas will not be required.

2.2 General Requirements. Facilities to 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 protection, 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 MIL-HDBK-1190. Since reactive wastes may react violently with water, the storage area for these wastes shall be protected by a gaseous-type system (i.e., CO₂ or Halon 1301).

MIL-HDBK-1005/13

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

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

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 judgement.

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).

c) Emergency alarms shall provide the capability of activating an emergency alarm from each storage area and office. The sprinkler alarm system shall be equipped to transmit alarms to the fire station or to a suitable location that is continuously manned when a local fire station is not available.

2.2.4 Security. The fence for the storage area shall be 15 feet from the outside perimeter road of the facility. Except for Naval facilities, the fence shall have a minimum height of 2 meters (6 feet) and shall be of the chain-link type.

The standard perimeter or boundary fence that must be used by the Navy to enclose restricted areas is defined in OPNAVINST 5530.14A, Physical Security and Loss Prevention dated 16 Sep 1985. Specifically:

(1) Fabric. The standard fence fabric will be 9-gauge (3.8 mm) zinc or aluminum-coated steel wire chain link with mesh openings not larger than two inches (50 mm) per side and a twisted and barbed selvage at top and bottom.

(2) Fabric Ties. Only 9-gauge (3.8 mm) steel ties will be used. If the ties are coated or plated, the coating or plating will be electrolytically compatible with the fence fabric to inhibit corrosion.

(3) Height. The standard height of a security fence is eight (8) feet (2.4 meters). This includes a fabric height of seven (7) feet (2.1 meters), plus a topguard. Building connections may need to be higher. Fencing 12 feet (3.6 meters) high from the connection point with a building to a point 12 feet (3.6 meters) away from the building is suggested.

(4) Fencing Posts, Supports and Hardware. All posts, supports, and hardware for security fencing will meet the requirements of Federal Specification RR-F-191J/GEN of 22 July 1981. All fastening and hinge hardware will be secured in place by peening or welding to allow proper operation of components, but prevent disassembly of fencing or removal of gates. All posts and structural supports will be located on the inner side of the fencing. Posts will be positively secured into the soil to prevent shifting, sagging or collapse.

(5) Reinforcement. Taut reinforcing wires will be installed and interwoven or affixed with fabric ties along the top and bottom of the fence for stabilization of the fence fabric.

(6) Ground Clearance. The bottom of the fence fabric must be within two inches (50 mm) of firm soil or buried sufficiently (concrete footings or gravel may be used) in soft soil to compensate for shifting soil.

(7) Culverts and Openings. Culverts under or through a fence shall be of ten inch (254 mm) pipe, or of clusters of such pipe or equivalent. Openings under or through a fence will be secured with material equal or greater in strength than the overall barrier.

(8) Fence Placement. No fence will be located so that the features of the land (its topography) or structures (buildings, utility tunnels, light and telephone poles, fire escapes, ladders, etc.) defeat its purpose by allowing passage over, around or under the fence.

(9) Top Guards. A top guard must be constructed on all perimeter fences and may be added on interior enclosures for additional protection. A top guard is an overhang of barbed wire or barbed tape along the top of a fence, facing outward (away from protected site) and upward at approximately a 45-degree angle. Top guard supporting arms will be permanently affixed to the top of fence posts to increase the overall height of the fence at least one (1) foot (0.3 meter). Three strands of 12-gauge (2.7 mm) barbed wire, equally spaced, must be installed on the supporting arms. The top guard of fencing adjoining gates may range from a vertical height of 18 inches (0.45 meter) to the normal 45-degree outward protection, but only for sufficient distance along the fence to open the gates adequately.

(10) Barriers. Buildings, structures, waterfronts and other barriers used instead of (or as a part of) a fence line must provide equivalent protection to the fencing required for that area. Therefore, all windows, doors and other openings or means of access must be guarded or properly secured.

b) Alternative Fencing. Where a boundary passes through an isolated area (forest, jungle, swamp) that is unpatrolled and where vehicular passage is impossible, the boundaries may be defined with a three or four strand 12-gauge (2.7 mm) barbed wire fence approximately four (4) feet (1.2 meters) high. It will be posted as required.

Alternative fencing may be used only to define a perimeter boundary; it shall not be used to enclose restricted areas.

2.2.5 Electrical.

a) The fenced-in yard area shall be illuminated to a level of 0.1 foot-candle.

b) Interior lighting will generally be provided in accordance with DOD MIL-HDBK-1190. Lighting in storage areas will be sufficient to ensure immediate location of leaks upon inspection.

c) All raceways shall be designed and installed in accordance with the National Electric Code, National Fire Protection Association, NFPA-70, for hazardous locations.

2.3 Housing Requirements. This manual covers the design of long-term storage facilities. The general design criteria are summarized in Table 1. Additional considerations are listed below:

2.3.1 Office. Facilities may require office space although not necessarily collocated with the storage site. Access to a computer terminal is recommended for large-scale record and inventory control.

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.

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.

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.

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 - MIL-HDBK-1190

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.

UFC 4-451-10N
16 January 2004

APPENDIX B

**MIL-HDBK 1005/13, NOTICE 2
HAZARDOUS WASTE STORAGE**

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|---------------------|
| NOTICE OF CHANGE |
|---------------------|

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|------------|
| INCH-POUND |
|------------|

MIL-HDBK-1005/13
NOTICE 2
15 May 1999

DEPARTMENT OF DEFENSE
HANDBOOK

HAZARDOUS WASTE STORAGE FACILITIES

TO ALL HOLDERS OF MIL-HDBK-1005/13:

1. THE FOLLOWING PAGES OF MIL-HDBK-1005/13 HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

| NEW PAGE | DATE | SUPERSEDED PAGE | DATE |
|----------|---------------|-----------------|-------------|
| 4 | 30 April 1987 | 4 | 15 May 1999 |

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-HDBK-1005/13 will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the handbook is completely revised or canceled.

Custodian:
Navy - YD2

Preparing Activity:
Navy - YD2
(Project FACR-5009)

AMSC N/A

AREA FACR

MIL-HDBK-1005/13

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 should 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 should be located where there are access roads of adequate load-bearing capacity and where routine through residential areas will not be required.

2.2 General Requirements. Facilities be will 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 (e.g., 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 should 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) should be placed on all access roads and entrances to the storage facility. The sign should 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 Z358.1-1981).

2.2.2.3 Ventilation. All generally occupied areas (administrative, latrines, etc.) should follow the recommendations of the American Conference of Government Industrial Hygienists (ACGIH), Industrial Ventilation, A Manual of Recommended Practices, and should have positive-pressure ventilation in enclosed spaces, as shown in Table 1. Negative pressure should be maintained in all enclosed waste storage areas. Ventilation should 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 should be ventilated.

2.2.2.4 Fire Protection. Fire protection should be provided as required by Construction Criteria Manual, DOD MIL-HDBK-1190. Since reactive wastes may react violently with water, the storage area for these wastes should be protected by a gaseous-type system approved by the NFPA or DOD.

SUPERSEDES PAGE 4 OF NOTICE 1 TO MIL-HDBK-1005/13.