DEPARTMENT OF DEFENSE

# JAPAN ENVIRONMENTAL GOVERNING STANDARDS

April 2024

**ISSUED BY**
**HEADQUARTERS, U.S. FORCES, JAPAN**

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

HEADQUARTERS
UNITED STATES FORCES, JAPAN
APO AREA PACIFIC 96328-5068

MEMORANDUM FOR DISTRIBUTION

FROM: COMUSFJ

SUBJECT: 2024 Japan Environmental Governing Standards

1. Attached is the revised 2024 Japan Environmental Governing Standards (JEGS). All substantive changes from the previous edition are summarized in the attached USFJ information paper. Components are directed to implement the 2024 JEGS upon receipt.

2. As environmental law continues to evolve, the JEGS may be amended in the future. The HQ USFJ point of contact concerning the JEGS is COL Abigail Cathelineaud, USFJ Command Engineer, at DSN 225-3618, or e-mail at abigail.a.cathelineaud.mil@mail.mil.

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Commander

2 Attachments:
1. The 2024 JEGS
2. USFJ 2024 JEGS Information Paper

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# CHAPTER 1: OVERVIEW

## 1.1 PURPOSE

1.1.1 The purpose of the Japan Environmental Governing Standards (JEGS) is to provide environmental compliance criteria for United States (U.S.) Department of Defense (DoD) installations in Japan. The JEGS are the primary source of environmental standards for U.S. Armed Forces in Japan.

1.1.2 The JEGS implements DoD Instruction (DoDI) 4715.05, Environmental Compliance at Installations Outside the United States (Incorporating Change 2, dated August 31, 2018), and is based upon the format and standards of DoD Manual (DoDM) 4715.05, Overseas Environmental Baseline Guidance Document (OEBGD, Volumes 1–5, Incorporating Change 2, June 29, 2020). DoDI 4715.05 requires development of a Final Governing Standard (FGS) for Japan, and designates Commander, U.S. Forces, Japan (COMUSFJ) as the Lead Environmental Component (LEC) for Japan. The JEGS are the FGS for Japan. COMUSFJ as LEC for Japan is authorized by DoDI 4715.05 to issue the JEGS.

1.1.3 U.S. Forces, Japan (USFJ) unilaterally updates the JEGS every two years.[1] The 2024 JEGS are an update of the 2022 JEGS that USFJ published in April 2022. JEGS updates are the result of the cooperative teamwork between USFJ, DoD Service Components in Japan, and other pertinent organizations within USFJ's Area of Responsibility.

1.1.4 The JEGS were developed by adopting the more protective of applicable U.S. standards, Japanese standards, or international agreement standards.[2] Applicable Japanese standards are those promulgated by the national Government of Japan (GOJ). The JEGS are consistent with the applicable provisions of Article IV of the "Agreement under Article VI of the Treaty of Mutual Cooperation and Security between the United States of America and Japan, Regarding Facilities and Areas and the Status of United States Armed Forces in Japan," also known as the "Status of Forces Agreement (SOFA) between the United States and Japan."

## 1.2 APPLICABILITY

1.2.1 The JEGS apply to the actions of the DoD Service Components at all facilities and areas granted to the United States under Article II.1.(a) of the SOFA (referred to as "U.S. exclusive use facilities and areas"). In the JEGS, "installation" means U.S. exclusive use facilities and areas when referring to a geographical area. Facilities and areas remain under Article II.1.(a) even if an Article II.4.(a) joint-use agreement is granted to a public or private Japanese entity. DoD Service Components must use the JEGS as criteria for environmental

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[1] USG/GOJ Joint Statement of Environmental Principles, 11 September 2000.

[2] Agreement Between the United States of America and Japan on Cooperation in the Field of Environmental Stewardship Relating to the U.S. Armed Forces in Japan, Supplementary to the Agreement Under Article VI of the Treaty of Mutual Cooperation and Security Between the United States of America and Japan, Regarding Facilities and Areas and the Status of United States Armed Forces in Japan, 28 September 2015, Article 3-2.

compliance rather than the individual source documents that have been reconciled by the DoD Lead Environmental Component in the creation of the JEGS.

1.2.2 Contractors performing work on behalf of the DoD within an exclusive use facility or area must comply with the JEGS. Contracts must reflect the JEGS to the extent that such requirements are relevant and practicable.

1.2.3 Host nation contractors whose activities are funded by the GOJ within U.S. exclusive use facilities and areas are not generally familiar with the JEGS. Installations should propose incorporation of specific requirements of the JEGS during the design phase of construction, through the applicable project authorization document, to ensure the environmental standards more protective of human health and the environment are included in the project criteria package and final design.

1.2.4 DoD Service Components may issue supplementary criteria more protective of the environment than required by the JEGS, provided they first obtain written concurrence from the DoD Lead Environmental Component. Requests for more protective criteria must be evaluated based on their potential impact upon other activities and installations, and upon their relationship with GOJ authorities. DoD activities and installations must clearly identify variances from the JEGS in all requests for resources.

1.2.5 Environmental laws and regulations promulgated by local prefectures and municipalities do not apply within U.S. exclusive use facilities and areas. DoD Service Components must not enter into agreements with GOJ authorities at any level that establishes a criterion for compliance different than that provided in the JEGS without the prior written approval of the DoD Lead Environmental Component.

1.2.6 If DoD activities are expected to be located within SOFA Article II.4.(b) facilities and areas (referred to as “limited use facilities and areas”), the LEC must be contacted to determine the applicability of the JEGS. DoD Service Components should ensure appropriate environmental requirements are incorporated into Article II.4.(b) governing bilateral agreements to the extent to which the standards of the JEGS need apply.

## 1.3 EXEMPTIONS

The JEGS do not apply to the following:

1.3.1 U.S. military vessels, ships, aircraft, or space vehicles. The JEGS, however, apply to support functions for U.S. military vessels, ships, aircraft, or space vehicles provided by the DoD Service Components, including the management and disposal of off-loaded waste or hazardous materials.

1.3.2 Off-installation training.

1.3.3 Contingency locations and associated operations and deployments, including cases of hostilities, contingency operations in hazardous areas, peacekeeping missions, or relief operations. These operations include U.S. Forces operating as part of a multinational force not under full U.S. control.

1.3.4 Facilities and activities associated with the Naval Nuclear Propulsion Program, in accordance with Executive Order (E.O.) 12344, and conducted pursuant to Title 42 United States Code (USC) Section 7158.[3]

1.3.5 Actions to remediate environmental contamination, which are addressed in DoDI 4715.08, Remediation of Environmental Contamination Outside the United States (Incorporating Change 2, August 31, 2018).

1.3.6 Environmental analyses conducted in accordance with Executive Order (E.O.) 12114, Environmental Effects Abroad of Major Federal Actions.[4]

1.3.7 U.S. exclusive use facilities and areas that do not have the potential to affect the natural environment (e.g., activities that are primarily administrative) or where, in consultation with the Assistant Secretary of Defense for Energy, Installations, and Environment (ASD(EI&E)), the geographic Combatant Commander concerned has determined that no significant force health protection or environmental threats exist.

1.3.8 Activities, systems, operations and areas on DoD installations for which DoD has no authority or responsibility including Cooperative Security Locations.

1.3.9 Disposal of radioactive waste, which is addressed in DoD Instruction 4715.27, DoD Low-Level Radioactive Waste (LLRW) Disposal Program (Change 2, Effective April 12, 2019) and DoD Service Component directives.

## 1.4 ADDITIONAL INFORMATION

1.4.1 The DoD Service Components are responsible for ensuring DoD installations in Japan under their control comply with the JEGS. The DoD Service Components must establish and implement an environmental audit program to ensure all major DoD installations in Japan assess compliance with the JEGS at least once every three years.

1.4.2 Laboratory analyses necessary to implement the JEGS must normally be conducted in a laboratory that has been certified by a U.S. or Japanese regulatory authority, or accredited through the DoD Environmental Laboratory Accreditation Program (ELAP),[5] for the applicable test method and follows required quality assurance and quality control protocol.[6] In the absence of a certified laboratory, analyses may also be conducted at a laboratory that has an established reliable record of quality assurance compliance with standards for the applicable test method that are generally recognized by appropriate industry or scientific organizations.

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[3] 42 USC Chapter 84 Subchapter III §7158: Naval Reactor and Military Application Programs.

[4] E.O. 12114: Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

[5] USFJ has determined there is no laboratory certification program in Japan through a Japanese regulatory authority comparable to DoD ELAP. Laboratory analysis to determine compliance with the JEGS must therefore normally be conducted in a laboratory accredited by DoD ELAP.

[6] USFJ has determined that the quality assurance and control protocols of Japanese Industrial Standards (JIS) do not meet DoD ELAP criteria. There may be situations, however, in which analysis by a JIS method is necessary in order to meet the requirements of the JEGS, such as if a hazardous waste disposal facility in Japan specifically requires JIS analysis in order to accept the hazardous waste for disposal.

1.4.3 The JEGS do not create any rights or obligations enforceable against the U.S., the DoD, or any of its Service Components, nor does it create any standard of care or practice for individuals. Although the JEGS refer to other DoD Directives (DoDDs), DoDIs, and DoDMs, it is intended only to coordinate the requirements of those issuances needed to implement the policies found in DoDI 4715.05, Environmental Compliance at Installations Outside the United States. The JEGS do not change other DoDDs, DoDIs, and DoDMs or alter DoD policies. Conflicts, issues, or concerns related to the JEGS should be presented to the DoD Lead Environmental Component.

## 1.5 PERMITS AND LICENSES

1.5.1 In accordance with the SOFA, permits, licenses, or other forms of official approvals are not required by DoD activities and installations. Permits, licenses, or other forms of official approvals may, however, be required under GOJ law for certain contracted activities specified herein. When required, all such permits, licenses and other forms of official approval must be obtained by the contractor from the appropriate governmental authority. DoD Service Components will assist contractors when they are applying for a required permit, license or other form of official approval by providing necessary information only.

1.5.2 If the conditions of any permit, license or other form of official approval provides for a less protective standard than prescribed in the JEGS, the JEGS must remain the compliance standard unless an exception is obtained in writing from the DoD Lead Environmental Component.

## 1.6 USFJ COMMAND ENGINEER

On behalf of COMUSFJ, the USFJ Command Engineer (CMD ENG) provides environmental oversight and direction to DoD Service Component Commanders on installation implementation of and compliance with the JEGS. Service Components must consult with the CMD ENG on matters regarding interpretation of and exceptions to the JEGS. Exceptions to the JEGS must be submitted to the CMD ENG by the Service Component Commanders and require the written approval of COMUSFJ.

Send any questions or comments pertaining to the JEGS to:

Commander, U.S. Forces, Japan
Unit 5068, Attn: USFJ/J4, Command Engineer
APO, AP 96328-5068

# VOLUME I: CONSERVATION

## VOLUME I.A: DEFINITIONS

These terms and their definitions are for the purposes of this volume.

Adverse effect. Changes that diminish the integrity or significance of natural, historic and cultural resources.

Archeological resource. As a subset of historic and cultural resources, these may include any material remains of prehistoric or historic human life or activities. Such resources may include pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal remains, or any portion of these items.

Biosecurity. Managing relevant risks to human, animal, and plant life and health, and associated risks to the environment from the introduction of disease, invasive or alien species, and pests.

Conservation. Planned management, use, and protection; continued benefit for present and future generations; and prevention of exploitation, destruction, and neglect.

Criteria package (CP). A document that outlines user and design requirements, and becomes the basis for developing the construction drawings.

Cultural property.[7] Cultural property in Japan consists of the following:

(1) Tangible cultural property. Structures, buildings, pictures, sculptures, applied crafts, calligraphic works, classical books, ancient documents, and other tangible cultural products that are of significant historical or artistic value to Japan (including lands and other objects which are combined with these objects to create such value); archaeological and other historical resources of significant scientific value.

(2) Intangible cultural property. Drama, music, applied art, and other intangible cultural products that are of a significant historical or artistic value to Japan.

(3) Folk cultural property. Manners and customs related to food, clothing and housing, to occupations, to religious faiths, and to annual festivals, etc.; folk performing arts; folk skills; clothes, utensils, houses and other objects, which are indispensable to the understanding of changes in the mode of life of Japan.

(4) Monuments. Shell mounds, tumuli, sites of fortified capitals, sites of forts, sites of castles, monument houses and other sites, which are of significant historical or scientific value to Japan; gardens, bridges, gorges, sea-shores, mountains, and other places of scenic beauty, which are of significant artistic or aesthetic value to Japan; animals (including their habitats, breeding areas and trails), plants (including their self-seeded areas), and geological features and minerals (including the areas where peculiar natural phenomena are recognizable), which are of significant scientific value to Japan.

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[7] GOJ Law for the Protection of Cultural Properties, Article 2.

(5) Cultural landscapes. Landscapes that have been created by people's lives or occupations in their community as well as by the climate prevailing in such community, and which are indispensable to the understanding of the mode of life or occupation of Japan.

(6) Groups of traditional buildings. Groups of traditional buildings of a high value, which form a certain historic configuration in combination with their environments.

Cultural property registry.[8] Cultural properties the GOJ views as especially in need of preservation and utilization measures. Can include tangible cultural property, folk cultural property, and monuments.

Ecosystem-based management. A goal-driven approach to managing natural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of nature's timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements; and is realized through effective partnerships. It is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.

Endangered species.[9] Any species of wild flora or fauna listed or designated by the GOJ because continued existence of the species is, or is likely to be, endangered, and is therefore subject to special protection from destruction or adverse modification of associated habitat. With regard to any species of wild fauna and flora, the number of individuals of the species is notably small, the number of individuals of the species is decreasing notably, the major habitat of the individuals of the species is disappearing, the environment where the individuals of the species live or grow is deteriorating notably, to a level that would be detrimental to the survival of the species, or there are any other circumstances that would be detrimental to the survival of the species.

(1) National endangered species. Endangered species of wild fauna and flora of which individuals live or grow in Japan.

(2) International endangered species. Endangered species of wild fauna and flora for which arrangements have been made to ensure the conservation of the species through international cooperation (excluding national endangered species of wild fauna and flora).

(3) Temporarily designated endangered species. Any species of wild fauna and flora, other than national endangered species and international endangered species, that the GOJ has designated as requiring special urgency.

Enduring location.[10] A location is enduring when DoD intends to maintain access and use of that location for the foreseeable future. The following types of sites are considered enduring for U.S. Government purposes: main operating base, forward operating site, and cooperative

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[8] GOJ Law for the Protection of Cultural Properties, Articles 57, 90, 132.

[9] GOJ Act on Conservation of Endangered Species of Wild Fauna and Flora, Articles 4, 5.

[10] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

security location. All three types of locations may be composed of more than one distinct site. Enduring locations are published in the OSD-approved Enduring Location Master List.

Final design (FD). The last phase of project development prior to construction. The final design includes the final engineering drawings and technical specifications.

Historic and cultural resources. A prehistoric or historic district, site, building, structure, or object significant in world, national, or local history, architecture, archeology, engineering, or culture. This includes artifacts, archeological resources, records, and material remains that are related to such a district, site, building, structure, or object, and also includes natural resources (plants, animals, landscape features, etc.) that may be considered important as a part of a country's traditional culture and history. A property listed on the World Heritage List or lists of cultural property in Japan is considered a historic and cultural resource.

Historic and cultural resources program. A program for identification, evaluation, documentation, curation, acquisition, protection, rehabilitation, restoration, management, stabilization, maintenance, recording, and reconstruction of historic and cultural resources. Includes safeguarding cultural property against the foreseeable effects of an armed conflict in compliance with the 1954 Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict.[11]

Historic structure.[12] A man-made structure that in principle is over 50 years old, is of significant historical value to Japan, and falls under one of the following items:

(1) Contributes to the historical landscape of Japan.

(2) Has become a model of architecture.

(3) Is not easy to reproduce.

Host nation-protected species. Any species of flora or fauna listed or designated by the host nation because continued existence of the species is, or is likely to be, threatened, and is therefore subject to special protection from destruction or adverse modification of associated habitat.

Installation.[13] An enduring location consisting of a base, camp, post, station, yard, center, or other DoD activity under the operational control of the Secretary of a Military Department or the Secretary of Defense.

International agreement.[13] A multilateral or bilateral agreement, such as a base rights or access agreement, a status-of-forces agreement, or any other instrument defined as a binding

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[11] Convention for the Protection of Cultural Property in the Event of Armed Conflict with Regulations for the Execution of the Convention, 14 May 1954, The Hague, Netherlands.

[12] GOJ Law for the Protection of Cultural Property, Article 182; Ministry of Education, Culture, Sports, Science and Technology Notification No. 44 of 2005.

[13] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

international agreement in accordance with DoDD 5530.3, International Agreements.

Invasive species.[14] A non-native organism whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human, animal, or plant health.

(1) Designated invasive alien species.[15] Living individuals (including eggs, seeds, and their organs) designated by the GOJ as existing outside their original habitats as a result of introduction from overseas into Japan and must be eradicated, and that are recognized to cause or likely to cause adverse effects on ecosystems, human safety, agriculture, forestry, and/or fisheries because of their differences with native Japanese organisms. Includes subspecies or variant species.

(2) Designated invasive alien species requiring immediate action.[16] Invasive alien species (including eggs, seeds, and their organs) designated by the GOJ as requiring immediate action such as inspection, control, and other measures to prevent the spread of said species upon discovery, because their spread is likely to cause significant ecological damage and significantly impair the stability of national life.

Inventory. The act of determining the location of historic and cultural resources that may have world, national, or local significance, or the record of such determinations.

Material remains. Physical evidence—whether above ground, below ground, or underwater—of human habitation, occupation, use, or activity, including the site, loci, or context in which such evidence is situated. Such evidence may include structures; artifact concentrations or scatters; whole or fragmentary tools, implements, containers, weapons, clothing, and ornaments; by-products, waste products, or debris resulting from manufacture or use; organic waste; human remains; rock carvings, rock paintings, and intaglios; rock shelters and caves; and all their portions or wreckage.

Mitigation. Specific steps designed to lessen or offset the adverse effects of a DoD action on a historic or cultural resource.

Natural resources. Living and inanimate materials, but not artifacts, existing in nature that are of aesthetic, ecological, educational, historical, recreational, scientific, or other value.

Natural resources management. Actions taken that combine science, economics, and policy to study, preserve, manage, and restore natural resources to strike a balance with the needs of people and the ability of the ecosystem to sustain and support the natural environment.

Natural resources management plan. An integrated plan focused, to the maximum extent practicable, on ecosystem-based management. It shows the interrelationships of individual components of natural resources management (e.g., fish and wildlife, forestry, land management,

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[14] DoDI 4150.07, DoD Pest Management Program, Section G.2.

[15] GOJ Act on the Prevention of Adverse Ecological Impacts Caused by Designated Invasive Alien Species, Article 2-1.

[16] GOJ Act on the Prevention of Adverse Ecological Impacts Caused by Designated Invasive Alien Species, Article 2-3.

outdoor recreation) to mission requirements and other land use activities affecting an installation's natural resources.

Preservation. The act or process of applying measures to sustain the existing form, integrity, and material of a building, structure, or other historic or cultural resource, and the existing form and vegetative cover of a site. It may include initial stabilization work where necessary, as well as ongoing maintenance of the historic building materials.

Protection. In the context of historic and cultural resources protection in JEGS Chapter 2, the act or process of applying measures designed to affect the physical condition of a property by safeguarding it from deterioration, loss, attack, or alteration, or to cover or shield the property from danger or injury. In the case of buildings and structures, such treatment is generally temporary and anticipates future historic preservation treatment; in the case of archaeological sites, the protective measure may be temporary or permanent.

Service component. A command consisting of the Service Component Commander and all those Service forces, such as individuals, units, detachments, organizations, and installations under that command, including the support forces that have been assigned to a combatant command or further assigned to a subordinate unified command or joint task force.

Significant natural resources. Natural resources identified as having special importance to an installation or its ecosystem. Natural resources may be significant on a local, regional, national, or international scale. Threatened or endangered species and SAR and their habitats are significant natural resources.

Species at risk (SAR). Includes species on the United States Fish and Wildlife Service/National Oceanic and Atmospheric Administration Fisheries Service Foreign Species List or GOJ list designated as threatened, endangered, country-specific protected species, or a species that is a candidate for listing. SAR may also include species whose potential designation as threatened, endangered, or country-specific protected species could require conservation efforts that may substantially affect a military mission.

Standards. Substantive elements of U.S. laws and Federal regulations applicable to DoD installations, facilities, and actions in the United States or that have extraterritorial application or are determined necessary to protect human health and the environment on installations outside the United States.

United States.[17] The several States, the District of Columbia, the Commonwealths of Puerto Rico and the Northern Mariana Islands, American Samoa, Guam, Midway and Wake Islands, any other territory or possession of the United States, and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States.

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[17] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

## VOLUME I.B: ACRONYMS

| | |
|---|---|
| CP | criteria package |
| DODI | Department of Defense instruction |
| FD | final design |
| GOJ | Government of Japan |
| LEC | Lead Environmental Component |
| SAR | species at risk |
| USC | United States Code |
| USG | United States Government |

# CHAPTER 2: HISTORIC AND CULTURAL RESOURCES

## 2.1 INTRODUCTION

This chapter contains standards on the preservation and management of historic and cultural resources.

## 2.2 GENERAL

In consideration of the World Heritage List and cultural property entered in the Cultural Property Registry in accordance with the GOJ Law for the Protection of Cultural Properties, under U.S. Federal law installations must take into account the effect of any action on a cultural property for the purpose of avoiding or mitigating any adverse effects.[18]

## 2.3. PERSONNEL QUALIFICATIONS

Installations must ensure that:

2.3.1 Personnel performing historic or cultural resource functions have the necessary expertise in world, national, and local history and culture.

2.3.2 Personnel directing historic and cultural resource functions are trained and qualified to the level of their responsibilities in the management of historic or cultural resources.

## 2.4 CULTURAL RESOURCES MANAGEMENT PLAN

Installations must:

2.4.1 After consultation with the appropriate local governmental authorities:

2.4.1.1 Develop and maintain an inventory of historic and cultural resources in areas under DoD control using records searches and visual surveys. Installations should use geospatial referencing to document locations of historic and cultural resources, when possible.

2.4.1.2 Establish appropriate measures to protect and preserve known historic or cultural resources, including measures to prevent DoD personnel from disturbing or removing historic or cultural resources without permission of the appropriate local governmental authorities.

2.4.2 If cultural resources are identified in areas under DoD control, prepare, maintain, and implement a historic and cultural resources management plan that includes the information needed to:

2.4.2.1 Make appropriate decisions about historic and cultural resources identified on the installation inventory.

2.4.2.2 Mitigate any adverse effects, as necessary.

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[18] 54 USC Subtitle III §307101(e): National Park Service and Related Programs, National Preservation Programs, World Heritage Convention, Consideration of Undertaking on Property.

## 2.5 AVOIDANCE AND MITIGATION OF ADVERSE EFFECTS

Installations must ensure that the possible adverse effects of DoD actions on historic and cultural resources are avoided or mitigated, to the extent practicable.

2.5.1 Before proceeding with any major construction, major repair work, or ground-disturbing activity, evaluate the proposed project site, in consultation with the appropriate local governmental authorities, and consider all practicable means to appropriately avoid, minimize, and mitigate any adverse effects on historic and cultural resources. Unless a prior analysis has cleared the site, the analysis must include at a minimum:

2.5.1.1 Preparing a site plan illustrating the limit of construction and work. Modifications to the project boundaries after approval require re-evaluation of the project.

2.5.1.2 Determining the presence or absence of historic and cultural resources that may be affected by the project.

2.5.1.3 Assessing the effect or potential effect of the proposed project on historic or cultural resources.

2.5.1.4 Identifying any appropriate mitigation for potential adverse effects and specifying limitations, restrictions, or provisions. Mitigation may include, but is not limited to:

2.5.1.4.1 Limiting the magnitude of the action.

2.5.1.4.2 Relocating the action in whole or in part.

2.5.1.4.3 Repairing, rehabilitating, or restoring the affected resources or property.

2.5.1.4.4 Recovering and recording data from cultural properties that may be destroyed or substantially altered.

2.5.2 Maintain records of processed actions.

2.5.3 If potential historic or cultural resources not previously inventoried are discovered in the course of a DoD action:

2.5.3.1 Preserve and protect the newly discovered items pending consultation with appropriate local governmental authorities.

2.5.3.2 Consult with appropriate local governmental authorities prior to determining the appropriate treatment of the historic or cultural resource. The installation commander will make the decision on final disposition after coordination with the appropriate local governmental authorities.

## 2.6 HISTORIC STRUCTURES

Installations must:

2.6.1 Properly manage historic structures to avoid or mitigate adverse effects. During expansion, renovation, or repair of a historic structure, maintain the structure's original characteristics, such as location, scale, figure, design, and color.[19]

2.6.2 Review criteria packages and final designs for construction projects that impact historic structures for compliance with the requirements of Paragraph 2.6.1.

2.6.2 Request an exception to the JEGS per JEGS Paragraph 1.6 for construction projects not in compliance with Paragraph 2.6.1.

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[19] GOJ Enforcement Order of the Act on Protection of Cultural Properties, Article 4.

# CHAPTER 3: NATURAL RESOURCES AND ENDANGERED SPECIES

## 3.1 INTRODUCTION

This chapter establishes standards on the conservation of natural resources. Conservation measures may include protection of significant natural resources, including any species of flora or fauna or considered species at risk (SAR), by either U.S. or Japanese governments. Such measures may include protection of the habitats of those species.

## 3.2 GENERAL

Installations must evaluate natural resources for significance.

3.2.1 Installations must determine the presence of SAR, all of which are considered significant natural resources, through surveys or other methods.

3.2.2 Installations that actively manage fish and wildlife, forestry, vegetation and erosion control, agricultural activities, grazing activities, or wetlands protection normally have significant resources, but must consider the following items when determining significance:

3.2.2.1 The degree of active management needed.

3.2.2.2 Special natural features.

3.2.2.3 Aesthetics.

3.2.2.4 Outdoor recreational opportunities.

3.2.2.5 The ecological context of the installation.

## 3.3 PERSONNEL QUALIFICATIONS

Installations must ensure that personnel who:

3.3.1 Perform natural resources functions have the requisite expertise or training in their discipline (e.g., SAR, wetlands, soil stabilization, habitats, ecosystems, and other ecological systems of concerns).

3.3.2 Direct natural resources functions are trained in natural resources management.

## 3.4 NATURAL RESOURCES MANAGEMENT PLAN

Installations with significant natural resources must prepare a natural resources management plan.

3.4.1 Natural Resources Management Plans must:

3.4.1.1 Incorporate the principles of ecosystem-based management.

3.4.1.2 Contain information needed to make appropriate decisions about natural resources management.

3.4.1.3 Maintain a relevant and updated baseline list of plant and animal species located at each installation for all pertinent taxonomic and regionally important groups.

3.4.1.4 Ensure that biologically or geographically significant or sensitive natural resources, such as Japanese endangered species, are monitored and managed for their protection and long-term sustainability.[20]

3.4.1.5 Address natural resource management in support of biosecurity.

3.4.1.6 Ensure no net loss of installation capabilities and capacity to train, test, or perform other mission-essential functions. Enhance installation capabilities and capacity to the maximum extent practicable.

3.4.2 Natural Resources Management Plans should be coordinated, after consulting the LEC, with the appropriate local governmental authorities.

## 3.5 NATURAL RESOURCES MANAGEMENT PLAN IMPLEMENTATION

Installations with significant natural resources must take steps to protect and enhance those resources.

3.5.1 Maintain, or have access to, the current list of species established by Title 16 United States Code Chapter 35, also known as the "Endangered Species Act," to ensure installations follow the same obligations the GOJ has in respecting and protecting U.S. endangered species that are migratory and appear in Japan.[21]

3.5.2 Through surveys or other methods, determine the presence of any SAR and their habitats.

3.5.3 Notify, after the LEC has been consulted, the appropriate local governmental authorities of the discovery of any SAR not previously known to be present on the installation.

3.5.4 Emphasize the maintenance and protection of habitats favorable to the reproduction and survival of indigenous flora and fauna, as appropriate.

3.5.5 Maintain grounds to support designated mission uses, and use native vegetation to maintain the natural landscape, wherever practical.

3.5.6 Ensure land and vegetative management activities are consistent with current conservation and land use principles (e.g., ecosystem protection, biodiversity conservation, mission-integrated land use, wildfire prevention, and invasive species control), as appropriate.

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[20] GOJ Act on Conservation of Endangered Species of Wild Fauna and Flora, Article 4; GOJ Order for Enforcement of the Act on Conservation of Endangered Species of Wild Fauna and Flora, Article 1 and Appended Table 1. Designated as "national endangered species of wild fauna and flora." The most current list of Japanese national endangered species is available at the GOJ Ministry of the Environment website.

[21] 16 USC Chapter 35: Conservation, Endangered Species.

3.5.7 Use protective vegetative cover or other standard soil erosion and sediment control practices to control dust, stabilize sites, and avoid silting of streams, as appropriate.

## 3.6 INVASIVE SPECIES

Installations must take the following actions in the event a designated invasive alien species or designated invasive alien species requiring immediate action is discovered:[22]

3.6.1 Notify the LEC, Service Component Commander, and the appropriate local governmental authorities. Provide subsequent notifications when the installation finds a new discovery of the same species on the installation, and determines the new discovery is not associated with the initial discovery.

3.6.2 Implement actions to control and eradicate the species.

3.6.3 Coordinate and cooperate with the appropriate local governmental authorities in efforts to control and eradicate the species.

## 3.7 RECORDKEEPING

Installations must maintain records of natural resources management plan development and implementation, and other records associated with management of natural resources and SAR.

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[22] GOJ Act on the Prevention of Adverse Ecological Impacts Caused by Designated Invasive Alien Species, Article 2; GOJ Order for Enforcement of the Act on the Prevention of Adverse Ecological Impacts Caused by Designated Invasive Alien Species, Article 1 and Appended Table 1. The most current list of designated invasive alien species and designated invasive alien species requiring immediate action is available at the GOJ Ministry of the Environment website.

# VOLUME II: AIR AND TOXICS

## VOLUME II.A: DEFINITIONS

Unless otherwise noted, these terms and their definitions are for the purpose of this volume.

Abatement. In the context of LBP in JEGS Chapter 6, any set of measures designed to permanently eliminate LBP or LBP hazards. Abatement includes the removal of LBP and lead-contaminated dust, the permanent enclosure or encapsulation of LBP, the replacement of components or fixtures painted with LBP, and the removal or covering of lead-contaminated soil. Abatement also includes all preparation, cleanup, disposal, and post-abatement clearance activities associated with such measures.

Adequately wet. Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions coming from ACM are observed, then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wet.

Air curtain incinerator. Refer to the definition of “Municipal waste combustion (MWC) units.”

Air pollutant. Any air pollution agent or combination of such agents, including any physical, chemical, biological, or radioactive substance or matter that is emitted into the ambient air, including precursors to the formation of an air pollutant.

Asbestos. Generic term used to describe six distinctive varieties of fibrous mineral silicates, including chrysotile, amosite, crocidolite, tremolite asbestos, anthrophylite asbestos, actinolite asbestos, and any other of these materials that have been chemically treated or altered.

Asbestos containing material (ACM). Any material containing more than 0.1 percent asbestos based on weight.[23]

(1) Friable asbestos containing material (ACM).[24] Any ACM that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Also referred to as “dispersal ACM” in Japan.

(2) Nonfriable asbestos containing material (ACM).[25] Any ACM in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. Asbestos fibers may be released under other conditions such as demolition, removal, or mishap. Also referred to as “non-dispersal ACM” in Japan.

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[23] GOJ Order for Enforcement of the Industrial Safety and Health Act, Article 6-23.

[24] UFGS-02 82 00 Unified Facilities Guide Specifications, Asbestos Remediation, Part 1.2.16.

[25] UFGS-02 82 00 Unified Facilities Guide Specifications, Asbestos Remediation, Part 1.2.23.

Asbestos waste. Municipal solid waste or industrial waste containing more than 0.1 percent of asbestos based on weight.

(1) Type I asbestos waste. Asbestos waste that is friable (dispersal). Includes but is not limited to sprayed asbestos, asbestos lagging and insulation, fire resistant asbestos, items contaminated with asbestos as a result of asbestos removal operations (e.g., personal protective equipment, work clothes, plastic sheeting), and discarded tools or instruments (e.g., dust masks, dust collection filters).[26] Type I asbestos waste is categorized as a Specified Hazardous Industrial Waste (SHIW), which is subcategory of Specially Controlled Industrial Waste (SCIW).[27]

(2) Type II asbestos waste. Asbestos waste that is nonfriable (non-dispersal). Type II asbestos waste is categorized as an industrial waste.[28]

Bare soil. Soil, including sand, not covered by grass, sod, or other live ground covers, or by wood chips, gravel, artificial turf, or similar covering.

Boiler. A device that combusts any fuel to produce either steam or hot water (or any other heat transfer medium). Also referred to as steam/hot water generating units. This definition does not include nuclear steam generators or process heaters.

Capacitor. A device for accumulating and holding a charge of electricity and consisting of conducting surfaces separated by a dielectric. Commonly referred to as “condensers” in Japan.

(1) Small capacitor. A capacitor that contains less than 1.36 kg [3.0 lbs] of dielectric fluid.

(2) Large high-voltage capacitor. A capacitor that contains 1.36 kg [3.0 lbs] or more of dielectric fluid and that operates at 2,000 volts (alternating current or direct current) or above.

(3) Large low-voltage capacitor. A capacitor that contains 1.36 kg [3.0 lbs] or more of dielectric fluid and that operates below 2,000 volts (alternating current or direct current).

Chemical waste landfill. A landfill where a high level of protection against risk of injury to human health or the environment from migration of deposited PCBs to land, water, or the atmosphere is provided by incorporating special methods for locating, engineering, and operating the landfill.

Child-occupied facility. A facility, or portion of a facility, visited regularly by the same child, under six years of age, on at least two different days within any week, provided that: each days’ visit lasts at least three hours; the combined weekly visits last at least six hours; and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day-care centers, preschools, playgrounds, and kindergarten classrooms.

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[26] GOJ Ordinance for Enforcement of the Act on Waste Management and Public Cleansing, Article 1-2.

[27] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4.

[28] GOJ Ordinance for Enforcement of the Act on Waste Management and Public Cleansing, Article 7-2.

Clearance. Visual evaluation and testing (collection and analysis of environmental samples) conducted after LBP hazard reduction activities, interim controls, and standard treatments to determine that the work is complete and no lead-contaminated bare soil or lead-contaminated settled dust exist in a facility frequented by children under six years of age.

Cold cleaning machine. Any device or piece of equipment that contains or uses liquid solvent, into which parts are placed to remove soil and other contaminants from the surfaces of the parts or to dry the parts. Cleaning machines that contain and use heated, non-boiling solvent to clean the parts are classified as cold cleaning machines.

Certified reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Comfort cooling. An air-conditioning appliance used to provide cooling in order to control heat or humidity in occupied facilities including but not limited to residential, office, and commercial buildings. Comfort cooling appliances include, but are not limited to, chillers, commercial split systems, and packaged roof-top units.

Commercial refrigeration. A refrigeration appliance used in the retail food and cold storage warehouse sectors. Retail food appliances include the refrigeration equipment found in supermarkets, convenience stores, restaurants and other food service establishments. Cold storage includes the refrigeration equipment used to store meat, produce, dairy products, and other perishable goods.

Commercial reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Commercial/retail waste. Refer to the definition of "Municipal solid waste (MSW)."

Compression ignition reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Construction.[29] Fabrication, erection, or installation of an affected facility.

Deteriorated paint. Any interior or exterior paint or other coating that is peeling, chipping, chalking, cracking, or is otherwise damaged or separated from the substrate.

Dioxins. Chemical byproducts of incineration processes, including improper municipal solid waste incineration, to include polychlorinated dibenzofurans (PCDF), polychlorinated dibenezo-para-dioxins (PCDD), and coplanar polychlorinated biphenyls (coplanar PCB).

DoD school. A primary or secondary school that serves dependents of the U.S. military and civilian personnel and is operated by the DoD Education Activity.

Dust-lead hazard. Refer to the definition of "Lead-based paint (LBP) hazard."

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[29] 40 CFR §60.2: Standards of Performance for New Stationary Sources, General Provisions, Definitions.

Emergency combustion turbine.[30] Any stationary combustion turbine which operates as a mechanical or electrical power source only when the primary power source for a facility has been rendered inoperable by an emergency situation.

Emergency compression ignition or emergency spark ignition reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Encapsulation. The application of any covering or coating that acts as a barrier between the LBP and the environment. Encapsulation may be used as a method of abatement if it is designed to be permanent.

Enclosure. The use of rigid, durable construction materials that are mechanically fastened to the substrate to act as a barrier between LBP and the environment. Enclosure may be used as a method of abatement if it is designed to be permanent.

Enduring location.[31] A location is enduring when DoD intends to maintain access and use of that location for the foreseeable future. The following types of sites are considered enduring for U.S. Government purposes: main operating base, forward operating site, and cooperative security location. All three types of locations may be composed of more than one distinct site. Enduring locations are published in the OSD-approved Enduring Location Master List.

Energy use systems. Systems located on-site that use energy (steam, hot water, process heat, or electricity) from a boiler. Includes, but is not limited to, process heating; compressed air systems; machine drive (motors, pumps, fans); process cooling; facility heating, ventilation, and air-conditioning systems; hot water systems; building envelope; and lighting.

Evaluation. In the context of LBP in JEGS Chapter 6, a visual evaluation, risk assessment, risk assessment screen, paint inspection, paint testing, or a combination of risk assessment and paint inspection to determine the presence of deteriorated paint, LBP, or an LBP hazard.

Fire pump compression reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Freeboard ratio. The ratio of the solvent cleaning machine freeboard height to the smaller interior dimension (length, width, or diameter) of the solvent cleaning machine.

Friable asbestos containing material (ACM). Refer to the definition of "Asbestos containing material (ACM)."

Friction surface. An interior or exterior surface that is subject to abrasion or friction, including, but not limited to, window, floor, and stair surfaces.

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[30] 40 CFR §60.331, Standards for Performance for New Stationary Sources, Standards of Performance for Stationary Gas Turbines: Definitions.

[31] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

Halogenated solvent. Solvents that contain a halogen such as chlorine, bromine, or iodine.

Hazard reduction. Measures designed to reduce or eliminate human exposure to LBP hazards through various methods, including interim controls or abatement or a combination of the two.

Hazardous air pollutant.[32] A substance that is likely to harm human health if inhaled continuously and is a cause of air pollution.

High-level polychlorinated biphenyl (PCB) waste.[33] Flammable material that contains greater than 100,000 ppm PCBs, or non-flammable material that contains greater than 5,000 ppm PCBs. Includes the following:

(1) PCB undiluted solution that has become waste;

(2) Oil containing PCB that has become waste, in which a proportion of PCB exceeds the above standard; or

(3) A substance to which PCB is applied that has become waste, into which PCB is soaked, adhered or contained, in which a proportion of PCB exceeds the above standard.

Hospital and infectious medical waste incinerator (HIMWI). Any device that combusts any amount of hospital waste or infectious medical waste.

(1) Large HIMWI units. An HIMWI whose maximum design waste burning capacity is more than 227 kg [500 lbs] per hour; a continuous or intermittent HIMWI whose maximum charge rate is more than 227 kg [500 lbs] per hour; or batch HIMWI whose maximum charge rate is more than 1,814 kg [4,000 lbs] per day.

(2) Medium HIMWI units. An HIMWI whose maximum design waste burning capacity is more than 91 kg [200 lbs] per hour but less than or equal to 227 kg [500 lbs] per hour; a continuous or intermittent HIMWI whose maximum charge rate is more than 91 kg [200 lbs] per hour but less than or equal to 227 kg [500 lbs] per hour; or a batch HIMWI whose maximum charge rate is more than 726 kg [1,600 lbs] per day but less than or equal to 1,814 kg [4,000 lbs] per day.

(3) Small HIMWI units. An HIMWI whose maximum design waste burning capacity is less than or equal to 91 kg [200 lbs] per hour; a continuous or intermittent HIMWI whose maximum charge rate is less than or equal to 91 kg [200 lbs] per hour; or a batch HIMWI whose maximum charge rate is less than or equal to 726 kg [1,600 lbs] per day.

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[32] GOJ Air Pollution Control Act, Article 2.

[33] GOJ Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 2; GOJ Order for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 2; GOJ Ordinance for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 4.

Hospital waste. Discards generated at a hospital, except unused items returned to the manufacturer. Hospital waste does not include human corpses, remains, and anatomical parts that are intended for interment or cremation.

Impact surface. An interior or exterior surface that is subject to damage by repeated sudden force, such as certain parts of doorframes.

In or near commercial buildings. Within the interior of, on the roof of, attached to the exterior wall of, in the parking area serving, or within 30 meters [98.4 ft] of a non-industrial, non-substation building.

Incinerator. In the context of:

(1) PCB disposal in JEGS Chapter 7, an engineered device using controlled-flame combustion to thermally degrade PCBs and PCB items. Examples include rotary kilns, liquid injection incinerators, cement kilns, and high-temperature boilers.

(2) Air emissions in JEGS Chapter 4, any furnace used in the process of burning solid or liquid waste for the purpose of reducing the volume of the waste by removing combustible matter, including equipment with heat recovery systems for either hot water or steam generation.

Industrial process refrigeration (IPR). Complex customized appliances that include industrial ice machines, appliances used directly in the generation of electricity, and ice rinks. Where one appliance is used for both industrial process refrigeration and other applications, it is considered industrial process refrigeration equipment if 50 percent or more of its operating capacity is used for industrial process refrigeration.

Industrial waste. Solid waste generated by industrial processes and manufacturing that is not characterized as hazardous waste in accordance with JEGS Chapter 16.

Industry standards and practices. Applicable or recognized standards and practices relevant to the design, construction, installation, operation and maintenance, inspection, and repair of facilities and equipment.

Infectious medical waste. Solid waste produced by medical facilities that is specially managed because it has the potential to cause disease in humans or animals, or may pose a risk to both individuals or community health if not managed properly, and that includes the following classes:

(1) Microbiology waste, including cultures and stocks of etiologic agents that, due to their species, type, virulence, or concentration, are known to cause disease in humans.

(2) Pathology waste, including tissues and organs, amputated limbs or other body parts, fetuses, placentas, and similar tissues from surgery, delivery, or autopsy procedures. Waste contaminated with an infectious agent, including carcasses, body parts, blood, and bedding are also included. Non-contaminated carcasses of animals that died from natural causes or vehicular impact are typically not considered pathology waste and are disposed of as solid waste in accordance with JEGS Chapter 15 where local regulations permit.

(3) Blood and blood products (including serum, plasma, and other blood components), items contaminated with liquid or semi-liquid blood or blood products and items saturated or dripping with blood or blood products, and items caked with blood or blood products that are capable of releasing these materials during handling.

(4) Potentially infectious materials, including fluids such as semen, vaginal secretions, cerebrospinal fluid, pericardial fluid, pleural fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any bodily fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.

(5) Sharps, including hypodermic needles, syringes, biopsy needles, and other types of needles used to obtain tissue or fluid specimens, needles used to deliver intravenous solutions, scalpel blades, Pasteur pipettes, specimen slides, cover slips, glass petri plates, and broken glass potentially contaminated with infectious pathogens.

(6) Infectious waste from isolation rooms, but only including those items that were contaminated or likely to have been contaminated with infectious agents or pathogens, including bodily excretions and discarded materials contaminated with blood.

Installation.[34] An enduring location consisting of a base, camp, post, station, yard, center, or other DoD activity under the operational control of the Secretary of a Military Department or the Secretary of Defense.

Institutional reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Institutional solid waste. Refer to the definition of "Municipal solid waste (MSW)."

Institutional solid waste incinerator. Refer to the definition of "Municipal waste combustion (MWC) units."

Interim controls. A set of measures designed to temporarily reduce human exposure or likely exposure to LBP hazards. Interim controls include, but are not limited to, repairs, occasional and ongoing maintenance, painting, temporary containment, specialized cleaning, clearance, ongoing activities, and the establishment and operation of management and resident education programs.

International agreement.[34] A multilateral or bilateral agreement, such as a base rights or access agreement, a status-of-forces agreement, or any other instrument defined as a binding international agreement in accordance with DoDD 5530.3, International Agreements.

Large high-voltage capacitor. Refer to the definition of "Capacitor."

Large hospital and infectious medical waste incinerator (HIMWI). Refer to the definition of "Hospital and infectious medical waste incinerator (HIMWI)."

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[34] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

Large low-voltage capacitor. Refer to the definition of "Capacitor."

Lead-based paint (LBP). Paint or other surface coatings that contain lead equal to or exceeding 1.0 milligram per $cm^2$, or 0.5 percent by weight or 5,000 ppm by weight.

Lead-based paint (LBP) hazard. Includes paint-lead hazard, dust-lead hazard, or soil-lead hazard.

(1) Paint-lead hazard. A paint-lead hazard is any of the following:

(a) Any LBP on a friction surface that is subject to abrasion and where the lead dust levels on the nearest horizontal surface underneath the friction surface (e.g., the window sill or floor) are equal to or greater than the dust-lead hazard levels identified in the definition of dust-lead hazard.

(b) Any damaged or otherwise deteriorated LBP on an impact surface that is caused by impact from a related building component (such as a doorknob that knocks into a wall or a door that knocks against its doorframe).

(c) Any chewable lead-based painted surface on which there is evidence of teeth marks.

(d) Any other deteriorated LBP in any residential building or child-occupied facility or on the exterior of any residential building or child-occupied facility.

(2) Dust-lead hazard. Surface dust in a residential dwelling or child-occupied facility that contains a mass-per-area concentration of lead equal to or exceeding 10 $\mu g/ft^2$ on floors or 100 $\mu g/ft^2$ on interior window sills based on wipe samples.

(3) Soil-lead hazard. Bare soil on residential real property or on the property of a child-occupied facility that contains total lead equal to or exceeding 400 ppm (microgram per gram) in a play area, or an average of 1,200 ppm of bare soil in the rest of the yard based on soil samples.

Lead-containing paint. Paint or other similar surface coating materials containing lead or lead compounds in which the lead content (calculated as lead material) is in excess of 0.009 percent by weight of the total nonvolatile content of the paint or the weight of the dried paint film.

Leak. In the context of PCBs in JEGS Chapter 7, any instance in which a PCB article, container, or equipment has any PCBs on any portion of its external surface.

Leak inspection. The examination of an appliance to determine the location of refrigerant leaks.

Leak rate. The rate at which an appliance is losing refrigerant, measured between refrigerant charges. The leak rate is expressed in terms of the percentage of the appliance's full charge that would be lost over a 12-month period if the current rate of loss were to continue over that period.

Limit of quantitation (LOQ). The smallest concentration that produces a quantitative result with known and recorded precision and bias.

Low-level polychlorinated biphenyl (PCB) waste.[35] Flammable material that contains greater than 0.5 ppm PCBs and less than 100,000 ppm PCBs, or non-flammable material that contains greater than 0.5 ppm and less than 5,000 ppm PCBs. Refer to JEGS Table 7.2.

Malfunction.[36] Any sudden, infrequent, and not reasonably preventable failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner which causes, or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

Medium hospital and infectious medical waste incinerator. Refer to the definition of "Hospital and infectious medical waste incinerator (HIMWI)."

Modification.[37] Any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted. In addition:

(1) Routine maintenance, repair, and replacement is not considered a physical change, and the following are not considered a change in the method of operation.

(2) An increase in the production rate, if such increase does not exceed the operating design capacity of the source.

(3) An increase in the hours of operation.

(4) Use of an alternative fuel or raw material if, prior to the effective date of a paragraph in in this part of the CFR that imposes conditions on or limits modifications, the source is designed to accommodate such alternative use.

Motor vehicle. Any commercially available vehicle that is not adapted to military use which is self-propelled and designed for transporting persons or property on a street or highway, including, but not limited to, passenger cars, light-duty vehicles, and heavy-duty vehicles.

Municipal solid waste (MSW). Any residential, commercial or retail, or institutional solid waste.

(1) Residential solid waste includes material discarded from residential dwellings, hotels, motels, and other similar permanent or temporary housing.

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[35] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 1-2; GOJ Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 2; GOJ Order for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 2; GOJ Ordinance for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 4.

[36] 40 CFR §63.1101: National Emission Standards for Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology, Definitions.

[37] 40 CFR §60.2: Standards of Performance for New Stationary Sources, General Provisions, Definitions.

(2) Commercial or retail solid waste includes material discarded by stores, offices, restaurants, warehouses, nonmanufacturing activities at industrial facilities, and other similar establishments or facilities.

(3) Institutional solid waste includes solid waste generated by schools, hospitals (nonmedical waste), nonmanufacturing activities at prisons and government facilities, and other similar institutional establishments or facilities.

(4) Residential, commercial or retail, and institutional solid waste does not include yard waste and refuse-derived fuel (RDF); used oil; sewage sludge; wood pallets; construction, renovation, and demolition waste (which include railroad ties and telephone poles); clean wood; industrial process or manufacturing waste; medical waste; or motor vehicles (including motor vehicle parts or vehicle fluff).

<u>Municipal waste combustion (MWC) units</u>. Any equipment that combusts solid, liquid, or gasified MSW including, but not limited to, field-erected MWC units (with or without heat recovery), modular MWC units (starved-air or excess-air), boilers (for example, steam generating units), furnaces (whether suspension-fired, grate-fired, mass-fired, air curtain incinerators, or fluidized bed-fired), and pyrolysis/combustion units.

(1) Large MWC units have a rated capacity greater than 227 Mtons [250 tons] per day.

(2) Small MWC units have a rated capacity of 32-227 Mtons [35-250 tons] per day.

(3) Very small MWC units have the capacity to combust less than 32 Mtons [35 tons] per day of MSW or RDF.

(4) <u>Air curtain incinerator</u>. An incineration unit operating by forcefully projecting a curtain of air across an open, integrated combustion chamber (fire box) or open pit or trench (trench burner) in which combustion occurs.

(5) <u>Institutional solid waste incinerator</u>. Any combustion unit that combusts institutional solid waste and is a distinct operating unit of the institutional facility that generated the waste. Institutional solid waste incineration units include field-erected, modular, cyclonic burn barrel, and custom built incineration units operating with starved or excess air, and any air curtain incinerator that is a distinct operating unit of the institutional facility that generated the institutional solid waste.

(6) <u>Other solid waste incinerator</u>. Either a very small MWC unit or an institutional waste incineration unit.

<u>Nonfriable asbestos containing material (ACM)</u>. Refer to the definition of "Asbestos containing material (ACM)."

<u>Other solid waste incinerator (OSWI)</u>. Refer to the definition of "Municipal waste combustion (MWC) units."

<u>Ozone-depleting substance (ODS)</u>. Either a Class I or Class II substance as listed in Tables 4.21, 4.22, and 4.23.

Paint-lead hazard. Refer to the definition of "Lead-based paint (LBP) hazard."

Pathology waste. Refer to the definition of "Infectious medical waste."

Permanent. In the context of LBP in JEGS Chapter 6, an expected design life of at least 20 years.

Polychlorinated biphenyl (PCB). Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contain such substance.

Polychlorinated biphenyl (PCB) adhering material.[38] Any material, including metals, ceramics, and concretes, whose surface(s) have been in direct contact with PCBs, that contains greater than 0.5 ppm PCBs.

Polychlorinated biphenyl (PCB) article. Any manufactured article, other than a PCB container, that contains PCBs and whose surface(s) has been in direct contact with PCBs. Includes capacitors, transformers, electric motors, pumps, and pipes.

Polychlorinated biphenyl (PCB) article container. Any package, can, bottle, bag, barrel, drum, tank, or other device used to contain PCB articles or PCB equipment, and whose surface(s) has not been in direct contact with PCBs.

Polychlorinated biphenyl (PCB) capacitor. Any capacitor that contains greater than 0.5 ppm PCBs.

Polychlorinated biphenyl (PCB) container. Any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB articles, and whose surface(s) has been in direct contact with PCBs.

Polychlorinated biphenyl (PCB) contaminated electrical equipment. Any electrical equipment including, but not limited to, transformers, capacitors, ballasts, circuit breakers, reclosers, voltage regulators, switches, electromagnets, and cable, that contain greater than 0.5 ppm PCBs.

Polychlorinated biphenyl (PCB) equipment. Any manufactured item, other than a PCB container or a PCB article container, that contains a PCB article or other PCB equipment, and includes microwave ovens, electronic equipment, and fluorescent light ballasts and fixtures.

Polychlorinated biphenyl (PCB) flammable material.[39] Any flammable material, including sludge, paper, wood, textiles, and plastics, that contains greater than 0.5 ppm PCBs.

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[38] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4; GOJ Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 2.

[39] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4; GOJ Ordinance for Enforcement of Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 4.

Polychlorinated biphenyl (PCB) item. Any PCB article, PCB article container, PCB container, or PCB equipment that deliberately or unintentionally contains or has as a part of it any PCB, or PCBs at a concentration of greater than 0.5 ppm PCBs.

Polychlorinated biphenyl (PCB) transformer. Any transformer, whether in use or in storage, that contains greater than 0.5 ppm PCBs.

Polychlorinated biphenyl (PCB) treated material.[40] Any material that has been previously treated for the removal of PCBs that contains greater than 0.5 ppm PCBs.

Pyrolysis. Thermochemical decomposition of organic material at elevated temperatures in the absence of $O_2$ (or any halogen).

Qualified energy assessor. Someone with the demonstrated background, experience, and abilities to evaluate energy savings opportunities for steam generation and major energy using systems.

Reconstruction or reconstructed. Unless otherwise specified, the replacement of components of a source to such an extent that the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable new source.

Re-evaluation. A visual evaluation of painted surfaces and limited dust and soil sampling conducted periodically following LBP hazard reduction where LBP is still present.

Refrigerant. Any substance that is used for heat transfer purposes and provides a cooling effect.

Refuse-derived fuel (RDF). Fuel derived from Municipal solid waste (MSW).

Replacement. In the context of LBP in JEGS Chapter 6, a strategy of abatement that entails removing building components that have surfaces coated with LBP (such as windows, doors, and trim) and installing new components free of LBP.

Residential reciprocating internal combustion engine (RICE). Refer to the definition of “Stationary reciprocating internal combustion engine (RICE).”

Residential waste. Refer to the definition of “Municipal solid waste (MSW).”

Restricted access area. Areas where access by unauthorized personnel is controlled by fences, other man-made structures, or naturally occurring barriers such as mountains, cliffs, or rough terrain.

Risk assessment. An on-site investigation to determine the existence, nature, severity, and location of LBP hazards and the provision of a report explaining the results of the investigation and options for reducing LBP hazards.

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[40] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4.

Risk assessment screen. A sampling protocol that is used in dwellings in relatively good condition and where the probability of finding LBP hazards is low. The protocol involves inspecting such dwellings and collecting samples from representative locations on the floor, interior window sills, and window troughs to determine whether conducting a risk assessment is warranted.

Secondary containment. A system that provides an essential line of defense in the event of a failure of the primary containment, such as a bulk storage container, a mobile or portable container, piping, or oil-filled equipment.

Shutdown. The cessation of operation of an affected source or equipment. Includes, but is not limited to, periodic maintenance, replacement of equipment, or repair.

Small capacitor. Refer to the definition of "Capacitor."

Small hospital and infectious medical waste incinerator (HIMWI). Refer to the definition of "Hospital and infectious medical waste incinerator (HIMWI)."

Soil-lead hazard. Refer to the definition of "Lead-based paint (LBP) hazard."

Spark ignition reciprocating internal combustion engine (RICE). Refer to the definition of "Stationary reciprocating internal combustion engine (RICE)."

Specially controlled industrial waste (SCIW).[41] Industrial waste having a nature likely to harm human health or the living environment, such as explosive, toxic, or infectious. SCIW is a term relevant to the transportation, treatment, or disposal of waste by Japanese contractors, not to the management of hazardous waste within DoD installations.

Specified hazardous industrial waste (SHIW).[42] A subcategory of Specially Controlled Industrial Waste (SCIW), which includes PCB waste; PCB-contaminated substances; materials treated for PCBs; slag; waste asbestos; dust and cinder dust; waste oil, waste sludge, acid, and alkali; and waste consisting of mercury or mercury compounds.

Stack. Any point in a source designed to emit solids, liquids, or gases into the air, including a pipe or duct but not including flares.

Standards. Substantive elements of U.S. laws and Federal regulations applicable to DoD installations, facilities, and actions in the United States or that have extraterritorial application or are determined necessary to protect human health and environment on installations outside the United States.

Startup. The first time the source begins production or the first time additional or changed equipment is put into operation.

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[41] GOJ Act on Waste Management and Public Cleansing, Article 2.
[42] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4.

Stationary combustion turbine (stationary gas turbine). All equipment, including, but not limited to, the turbine, the fuel, air, lubrication and exhaust gas systems, control systems (except emissions control equipment), heat recovery system, and any ancillary components and subcomponents comprising any simple cycle stationary combustion turbine, any regenerative or recuperative cycle stationary combustion turbine, any combined cycle combustion turbine, and any combined heat and power combustion turbine based system. Stationary means that the combustion turbine is not self-propelled or intended to be propelled while performing its function. It may, however, be mounted on a vehicle for portability.

Stationary reciprocating internal combustion engine (RICE). Any internal combustion engine that uses reciprocating motion to convert heat energy into mechanical work. Stationary means that it remains in a single location (i.e., does not move at all) for 12 months or longer or is expected to remain in a single location for 12 months or longer.

(1) Certified RICE. A RICE that is EPA-certified and approved for use in the United States.

(2) Commercial RICE. A RICE used in commercial establishments such as office buildings, hotels, stores, telecommunications facilities, restaurants, financial institutions such as banks, doctor's offices, and sports and performing arts facilities.

(3) Compression ignition RICE. A RICE in which ignition of the fuel is caused by the elevated temperature of the air in the cylinder due to mechanical compression. Compression ignition RICE work by compressing either air, or air plus residual combustion gases from the exhaust, inducted into the chamber during the intake stroke. This compression increases the air temperature inside the cylinder to such a high degree that atomized diesel fuel injected into the combustion chamber ignites.

(4) Emergency compression ignition or emergency spark ignition RICE. Any stationary RICE that is operated to provide either electrical power or mechanical work during an emergency situation. Examples include engines used to produce power for critical networks or equipment (including power supplied to portions of a facility) when electric power from the local utility (or the normal power source, if the facility runs on its own power production) is interrupted, or engines used to pump water in the case of fire or flood, etc. To be considered "emergency," an engine must not operate more than 100 hours per calendar year for non-emergency purposes, including maintenance and testing.

(5) Fire pump compression ignition RICE. A compression ignition RICE that provides either electrical power or mechanical work to operate a water pump for a fire suppression system.

(6) Institutional RICE. A RICE used in institutional establishments such as medical centers, nursing homes, research centers, institutions of higher education, correctional facilities, elementary and secondary schools, libraries, religious establishments, police stations, and fire stations.

(7) Residential RICE. A RICE used in residential establishments such as homes or apartment buildings.

(8) Spark ignition RICE. A RICE with a spark plug (or other sparking device) relating to either a gasoline-fueled engine or any other type of engine with operating characteristics significantly similar to the theoretical Otto combustion cycle. Spark ignition RICE usually use a throttle to regulate intake air flow to control power during normal operation. Dual-fuel engines in which a liquid fuel (typically diesel fuel) is used for compression ignition, and gaseous fuel (typically natural gas) is used as the primary fuel at an annual average ratio of less than two parts diesel fuel to 100 parts total fuel on an energy equivalent basis, are spark ignition RICE.

Substantial contact area. An area that is subject to public access on a routine basis or that could result in skin contact.

Toxic equivalence (TEQ). A weighted quantity measure based on the toxicity of each member of the dioxin and dioxin-like compounds category relative to the most toxic member of the category.

United States.[43] The several States, the District of Columbia, the Commonwealths of Puerto Rico and the Northern Mariana Islands, American Samoa, Guam, Midway and Wake Islands, any other territory or possession of the United States, and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States.

Vapor cleaning machine. A batch or in-line solvent cleaning machine that boils liquid solvent which generates solvent vapor that is used as a part of the cleaning or drying cycle.

Volatile organic compound (VOC).[44] Any organic compound that is emitted into the atmosphere and is in gaseous form at the time when released, excluding substances that are not a source for the generation of suspended particulate matter or oxidants.

## VOLUME II.B: ACRONYMS

| | |
|---|---|
| ACM | asbestos containing material |
| °C | degrees Celsius |
| CAS | Chemical Abstracts Service |
| CEMS | continuous emission monitoring system |
| CFR | Code of Federal Regulations |
| cm | centimeter |
| $cm^2$ | square centimeter |

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[43] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.
[44] GOJ Air Pollution Control Act, Article 2.

| | |
|---|---|
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| DLA | Defense Logistics Agency |
| DoD | Department of Defense |
| DoDD | Department of Defense directive |
| DoDI | Department of Defense instruction |
| dscm | dry standard cubic meter |
| ESP | electrostatic precipitator |
| °F | degrees Fahrenheit |
| ft | foot or feet |
| $ft^2$ | square foot or feet |
| g/HP-hr | grams per horsepower hour |
| g/kW-hr | grams per kilowatt hour |
| GOJ | Government of Japan |
| GJ/hr | gigajoules per hour |
| GJ/yr | gigajoules per year |
| HAP | hazardous air pollutant |
| HC | hydrocarbon |
| HCFC | hydrochlorofluorocarbon |
| HCl | hydrogen chloride |
| HFC | hydrofluorocarbon |
| Hg | mercury |
| HHV | higher heating value |
| HIMWI | hospital and infectious medical waste incinerator |
| HP | horsepower |
| hr | hour |
| IPR | industrial process refrigeration |
| J | joule |

| | |
|---|---|
| JEGS | Japan Environmental Governing Standards |
| kg | kilogram |
| kg/GJ | kilogram per gigajoules |
| kW | kilowatt |
| lb | pound |
| lb/MMBtu | pound per million British thermal units |
| lb/MWh | pound per megawatt-hour |
| LBP | lead-based paint |
| LHV | lower heating value |
| LPG | liquefied petroleum gas |
| µg | microgram |
| $\mu g/ft^2$ | microgram per square foot |
| $\mu g/m^2$ | microgram per square meter |
| $m^2$ | square meter |
| mg | milligram |
| mg/dscm | milligram per dry standard cubic meter |
| MMBtu/hr | million British thermal units per hour |
| MSW | municipal solid waste |
| Mton | metric ton |
| MW | megawatt |
| MWC | municipal waste combustion |
| MWh | megawatt-hour |
| ng | nanogram |
| ng/dscm | nanogram per dry standard cubic meter |
| ng/J | nanograms per joule |
| NMHC | nonmethane hydrocarbons |
| $NO_x$ | nitrogen oxide |
| $O_2$ | oxygen |

| | |
|---|---|
| ODS | ozone depleting substance |
| OSWI | other solid waste incinerator |
| PCB | polychlorinated biphenyl |
| PCDD | polychlorinated dibenezo-para-dioxin |
| PCDF | polychlorinated dibenzofuran |
| PCE | perchloroethylene |
| PM | particulate matter |
| ppm | parts per million |
| ppmv | parts per million by volume |
| ppmvd | parts per million by volume, dry basis |
| RDF | refuse derived fuel |
| RICE | reciprocating internal combustion engine |
| SCIW | specially controlled industrial waste |
| SHIW | specified hazardous industrial waste |
| SLB | stroke lean burn |
| $SO_X$ | sulfur oxide |
| $SO_2$ | sulfur dioxide |
| SRB | stroke rich burn |
| TBtu/yr | trillion British thermal units per year |
| TCE | trichloroethylene |
| TEQ | toxic equivalence |
| USC | United States Code |
| USFJ | United States Forces, Japan |
| VOC | volatile organic compound |

# CHAPTER 4: AIR EMISSIONS

## 4.1 INTRODUCTION

This chapter contains standards on the control of air emissions sources. It includes, but is not limited to, control of emissions from boilers, incinerators, dry cleaning machines, solvent cleaning machines, stationary combustion sources, and use of ozone-depleting substances (ODSs). Refer to Table 4.1 for the location of additional standards in this manual related to air emission sources.

**Table 4.1: Additional Standards Related to Air Emission Sources**

| For: | Refer to JEGS: |
|---|---|
| Asbestos | Chapter 5 |
| Hazardous materials | Chapter 10 |
| Petroleum, oil, and lubricants | Chapter 11 |
| Underground storage tanks | Chapter 12 |
| Hazardous waste | Chapter 16 |

## 4.2 GENERAL

Installations must ensure compliance with the following standards for air emission sources, as applicable. For sources covered in Tables 4.2, 4.6, 4.10, and 4.11 through 4.20, units in use as of 29 June 2020 must be operated and maintained according to manufacturer specifications, but are not required to be retrofitted or replaced in order to meet emission concentration limits.

4.2.1 Maintenance and Repair of Equipment. All equipment that generates air pollutants must be operated and maintained in accordance with the manufacturer's specifications, including preventive maintenance inspections. Any equipment failing to meet emission limits prescribed in this chapter must be evaluated along with any affiliated pollution control devices for needed repairs or changes in operating parameters to bring emissions into compliance. Equipment must be repaired or replaced as soon as technically feasible.

4.2.2 Stack Height and Diameter. Stack height and diameter must be based on industry standards and practices for the specific source and dispersion modeling, as applicable, to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash.

4.2.3 Source Testing. All emission sources requiring testing or continuous emissions monitoring systems (CEMS) must have sampling and testing facilities that ensure safe and easy access (including platforms and sampling ports, as well as power sources for test equipment) to determine the nature and quality of emissions that are or may be discharged as a result of source operations. All equipment and support facilities used for source testing, CEMS operation, and quality assurance should be compliant with industry standards.

4.2.4 Recordkeeping. The following recordkeeping requirements apply to all units.

4.2.4.1 Retain records related to compliance with emission limits for three years (e.g., continuous monitoring system results, test results, tune-up records, fuel certifications, performance test results).

4.2.4.2 Retain manufacturer specifications, manufacturer-supplied certificates of conformity, manufacturer-supplied emissions test data, maintenance inspection logs, one-time performance test results, and repair records for the life of the unit.

4.2.5 Personnel Qualifications. Personnel involved in activities associated with the control of air emission sources should be trained consistent with their responsibilities. Personnel must meet the training and qualification standards of Paragraphs 4.4.4 and 4.9.5.1, as applicable.

4.2.6 Air Emission Standards. In a case where two standards for the same parameter are given in this chapter, the more protective standard will prevail.

## 4.3 BOILERS

Installations must ensure that boilers meet the standards of this paragraph, as applicable. Standards for boilers specified below are based on several parameters, including heat input capacity, date when construction began, and type of fuel combusted.

4.3.1 Air Emission Limits

4.3.1.1 The following standards apply to units with a maximum design heat input capacity greater than or equal to 10.56 gigajoules per hour (GJ/hr) [10 million British thermal units per hour (MMBtu/hr)]:

4.3.1.1.1 Boiler units must meet the emission limits for specific sized units shown in Table 4.2.

4.3.1.1.2 For units combusting liquid fossil fuel, compliance with particulate matter (PM) and sulfur dioxide ($SO_2$) emission limits must be demonstrated by combusting oil containing no more than 0.50 weight percent sulfur demonstrated by fuel certification.

4.3.1.2 Initial demonstration of compliance with the Table 4.2 emission limits can be accomplished using one or more of the following:

4.3.1.2.1 Test data from the boiler manufacturer.

4.3.1.2.2 Test data from the owner/operator.

4.3.1.2.3 Data from a CEMS and/or a continuous opacity monitoring system.

4.3.1.2.4 Data from fuel analysis/certification (where applicable).

4.3.1.3 Subsequent demonstration of compliance:

4.3.1.3.1 Is required if significant changes occur to the boiler (e.g., modification, reconstruction) that may affect emissions or if there is a change in fuel type/quality.

4.3.1.3.2 Must be accomplished every three years for these categories of emission limits:

4.3.1.3.2.1 The mercury (Hg) and carbon monoxide (CO) limits applicable to boilers combusting solid fossil fuel.

4.3.1.3.2.2 Those emission limits that only apply to units that began construction or reconstruction after June 4, 2010 (i.e., emission limits with footnote numbers 8 or 12 in Table 4.2).

4.3.1.4 Boiler units must also comply with the applicable emission limits and monitoring requirements in Tables 4.24, 4.26, and 4.28.[45]

4.3.2 Work Practice Standards, Emission Reduction Measures, and Management Practices

4.3.2.1 Tune-up Requirements. Unless specifically exempted, conduct a boiler tune-up in accordance with manufacturer specifications, but no less frequently than specified in Table 4.3 (every two years or every five years).

4.3.2.2 Energy Assessment Recommendations. The purpose of the energy assessment is to identify energy conservation measures that can be implemented to reduce system and facility energy demand, which would reduce fuel use and emissions. Energy assessment recommendations for boilers are detailed in Table 4.4. Unless specifically exempted in Table 4.4, a one-time energy assessment should be performed for all existing boilers with a maximum design heat input capacity greater than or equal to 10.56 GJ/hr [10 MMBtu/hr]. A one-time energy assessment should also be performed for any energy use systems associated with those boilers that equal or exceed specified energy use levels (i.e., equal or exceed a specified percentage of a regulated boiler's total energy production). As an alternative to performing the one-time energy assessment, facilities can demonstrate that the facility energy program is compatible with International Organization for Standardization 50001.[46]

## 4.4 INCINERATORS

Installations must ensure that incinerators meet the standards of this paragraph, as applicable. The following requirements apply to all incinerators except those combusting hazardous waste or munitions. Refer to JEGS Chapter 16 for information regarding hazardous waste management. Emission limits do not apply during periods of startup, shutdown, or malfunction.

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[45] In the case where two standards for the same contaminant are given, the more protective standard will prevail.

[46] International Organization for Standardization: ISO 50001, Energy Management.

4.4.1 Municipal Waste Combustion (MWC) Units. Each MWC unit must comply with the applicable emission limits and monitoring requirements in Table 4.5 and Tables 4.25 through 4.28.[47] If more than one MWC unit is at the same location, their capacities should be considered in aggregate to determine their emission limits.

4.4.2 Hospital and Infectious Medical Waste Incinerator (HIMWI). Each HIMWI unit must comply with the applicable emission limits and monitoring requirements in Table 4.6 and Tables 4.25 through 4.28.[47] These requirements do not apply to pyrolysis units, or units that burn only pathology waste, low-level radioactive waste, or chemotherapeutic waste. Refer to JEGS Chapter 17 for medical waste management requirements.

4.4.3 Incineration Ash. Installations will monitor the ash from incinerators, and the ash must have dioxin levels of 3.0 ng-TEQ/g or less.[48] Ash not meeting this limit must be disposed of as a hazardous waste in accordance with JEGS Chapter 16.

4.4.4 Operator Training. No incinerators can be operated unless a fully trained and qualified unit operator is accessible at the facility or able to be at the facility within one hour. The trained unit operator may operate the unit directly or be the direct supervisor of one or more other plant personnel who operate the unit. Operators must have completed a training course that includes:

4.4.4.1 Environmental concerns, including types of emissions.

4.4.4.2 Basic combustion principles, including products of combustion.

4.4.4.3 Operation of the specific type of incinerator to be used by the operator, including proper startup, waste charging, and shutdown procedures.

4.4.4.4 Combustion controls and monitoring.

4.4.4.5 Operation of air pollution control equipment and factors affecting performance, if applicable.

4.4.4.6 Inspection and maintenance of the incinerator and air pollution control devices.

4.4.4.7 Methods to monitor pollutants, including monitoring of incinerator and control device operating parameters, and monitoring equipment calibration procedures, where applicable.

4.4.4.8 Actions to correct malfunctions or conditions that may lead to malfunction.

4.4.4.9 Bottom and fly ash characteristics and handling procedures.

4.4.4.10 Applicable regulations.

4.4.4.11 Pollution prevention.

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[47] In the case where two standards for the same contaminant are given, the more protective standard will prevail.

[48] GOJ Enforcement Regulation for the Act on Special Measures Against Dioxins, Article 7-2.

4.4.4.12 Waste management practices.

4.4.4.13 Recordkeeping requirements.

## 4.5 PERCHLOROETHYLENE (PCE) DRY CLEANING MACHINES

Installations must ensure that PCE dry cleaning machines meet the standards of this paragraph, as applicable. The following requirements apply to all dry cleaning machines, except for coin-operated machines.

4.5.1 Emissions from PCE dry cleaning machines installed before September 22, 1993, must be controlled with a refrigerated condenser, unless a carbon adsorber was already installed. The temperature of the refrigerated condenser must be maintained at 7.0 degrees Celsius (°C) [45 degrees Fahrenheit (°F)] or less.

4.5.2 All PCE dry cleaning systems installed between September 22, 1993 and December 21, 2005 must be of the dry-to-dry design with emissions controlled by a refrigerated condenser. The temperature of the refrigerated condenser must be maintained at 7.0°C [45°F] or less.

4.5.3 All PCE dry cleaning systems installed on or after December 21, 2005 must route the air-PCE gas-vapor stream contained within each dry cleaning machine through a refrigerated condenser and pass the air-PCE gas-vapor stream from inside the dry cleaning machine drum through a non-vented carbon adsorber or equivalent control device immediately before the door of the dry cleaning machine is opened. The carbon adsorber must be desorbed in accordance with manufacturer’s instructions. The temperature of the refrigerated condenser must be maintained at 7.0°C [45°F] or less.

4.5.4 Emissions from PCE dry cleaning machines with a processing capacity greater than 30 kg (66 lbs) per batch must be maintained within 500 mg/dscm if installed before April 1997 or 300 mg/dscm if installed after April 1997.[49]

## 4.6 HALOGENATED SOLVENT CLEANING MACHINES

Installations must ensure that halogenated solvent cleaning machines meet the standards of this paragraph, as applicable. These requirements apply to all solvent cleaning machines that use solvents containing more than 5 percent by weight of the following halogenated solvents: methylene chloride (Chemical Abstracts Service (CAS) No. 75-09-2), PCE (CAS No. 127-18-4), trichloroethylene (TCE, CAS No. 79-01-6), 1,1,1-trichloroethane (CAS No. 71-55-6), carbon tetrachloride (CAS No. 56-23-5), chloroform (CAS No. 67-66-3), or any combination of these halogenated solvents.

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[49] GOJ Supplementary Provisions No. 3 of Order for Enforcement of the Air Pollution Control Act; GOJ Ministry of the Environment Standards for Controlling Designated Substances Based on Prescription of Supplementary Provisions No. 9 of the Air Pollution Control Act.

4.6.1 Cold Solvent Cleaning Machines

4.6.1.1 When not in use, cover all cold cleaning machines (remote reservoir and immersion tanks). Covers must be free of cracks, holes, and other defects.

4.6.1.2 Maintain a 2.5-centimeter (cm) [1.0-inch] water layer or a freeboard ratio of at least 0.75 for immersion type cold cleaning machines.

4.6.1.3 Collect and store waste solvent in closed containers.

4.6.1.4 If a flexible hose or flushing device is used, only perform flushing within the freeboard area of the solvent cleaning machine.

4.6.1.5 Drain solvent cleaned parts.

4.6.1.6 Maintain solvent level at or below the fill line.

4.6.1.7 Immediately wipe up spills that occur during solvent transfer. Store used wipe rags in covered containers in accordance with JEGS Paragraph 16.8.5.

4.6.1.8 When an air- or pump-agitated solvent bath is used, operate the agitator to produce a rolling motion of the solvent but not observable splashing against tank walls or parts being cleaned.

4.6.1.9 When the cover is open, do not expose the cold cleaning machine to drafts.

4.6.1.10 Emissions of PCE and TCE, using solvent cleaning machines with a surface where the solvent comes in contact with the air over 3.0 $m^2$ must be maintained within 500 mg/dscm if installed before April 1997 or 300 mg/dscm if installed after April 1997.[50]

4.6.2 Vapor Cleaning Machines (Vapor Degreasers). All vapor cleaning machines (vapor degreasers) must incorporate control designs and meet solvent idling emission limits found in Table 4.7. In addition, these work practices must be observed:

4.6.2.1 Use covers across the cleaning machine opening(s) during idling and down times, or limit the flow of air across the top of the freeboard area. Covers must be free of cracks, holes, and other defects.

4.6.2.2 In an open-top batch vapor cleaning machine, do not occupy more than 50 percent of the solvent/air interface area with parts baskets or the parts being cleaned.

4.6.2.3 Perform spraying operations within the vapor zone or within a section of the solvent cleaning machine that is not directly exposed to the ambient air (i.e., a baffled or enclosed area of the solvent cleaning machine).

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[50] GOJ Supplementary Provisions No. 3 of the Order for Enforcement of the Air Pollution Control Act; GOJ Ministry of the Environment Standards for Controlling Designated Substances Based on Prescription of Supplementary Provisions No. 9 of the Air Pollution Control Act.

4.6.2.4 Orient parts so that the solvent drains from them freely. Tip or rotate parts with cavities or blind holes before removing them from a solvent cleaning machine.

4.6.2.5 Do not remove parts baskets or parts from any solvent cleaning machine until dripping has stopped.

4.6.2.6 During startup of each vapor cleaning machine, turn on the primary condenser before the sump heater.

4.6.2.7 During shutdown of each vapor cleaning machine, turn off the sump heater and allow the solvent vapor layer to collapse before turning off the primary condenser.

4.6.2.8 When solvent is added or drained from any solvent cleaning machine, transfer the solvent using threaded or other leak-proof couplings and locate the end of the pipe in the solvent sump beneath the liquid solvent surface.

4.6.2.9 Collect and store waste solvent, still bottoms, and sump bottoms in closed containers and mange in accordance with JEGS Chapter 16.

4.6.2.10 Sponges, fabric, wood, and paper products must not be cleaned.

## 4.7 STATIONARY COMBUSTION TURBINES (STATIONARY GAS TURBINES)

Installations must ensure that stationary combustion turbines meet the standards of this paragraph, as applicable.

4.7.1 Operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with manufacturer specifications and industry standards and practices for minimizing emissions at all times, including during startup, shutdown, and malfunction.

4.7.2 The following requirements apply to all stationary combustion turbines with a heat input at peak load equal to or greater than 10.56 GJ/hr [10 MMBtu/hr], based on the lower heating value (LHV) of the fuel fired that began construction, modification, or reconstruction after October 3, 1977 but before February 18, 2005. Emergency gas turbines, military gas turbines installed for use at military training facilities, and firefighting gas turbines are exempt from $NO_x$ emission limits, as are units with a heat input at peak load less than 105.6 GJ/hr [100 MMBtu/hr] based on the LHV of the fuel fired, that began construction before October 3, 1982.

4.7.2.1 Each unit must comply with the $NO_X$ emission limits in Table 4.8.

4.7.2.2 The maximum sulfur content for any fuel burned in a stationary gas turbine must not exceed 0.8 percent by weight [8,000 ppm by weight].

4.7.3 The following requirements apply to stationary combustion turbines with a heat input at peak load equal to or greater than 10.56 GJ/hr [10 MMBtu/hr], based on the higher heating value (HHV) of the fuel, which began construction, modification, or reconstruction after February 18, 2005. Combustion turbine test cells and stands are exempt. Emergency combustion turbines are exempt from the $NO_x$ emission limits.

4.7.3.1 Each unit must meet the applicable $NO_x$ emission limits in Table 4.10.

4.7.3.2 The total sulfur content for any liquid fuel burned must not exceed 0.4 percent by weight (4,000 ppm by weight). The total sulfur content for natural gas must not exceed 9.1 grams [140 grains] of sulfur per 2.8 kiloliters [100 standard cubic feet].

4.7.4 Stationary combustion (gas) turbines must also comply with the applicable emission limits and monitoring requirements in Table 4.24.

## 4.8 STATIONARY RECIPROCATING INTERNAL COMBUSTION ENGINES (RICE)

Installations must ensure that stationary RICE meet the standards of this paragraph, as applicable.

### 4.8.1 Operation and Maintenance

4.8.1.1 Operate and maintain RICE and air pollution control equipment according to manufacturer's specifications or in a manner consistent with industry standards and practices for minimizing emissions.

4.8.1.2 Minimize idle time during startup and ensure startup time does not exceed 30 minutes, the point at which RICE become subject to applicable emission limits.

### 4.8.2 Compression Ignition RICE

4.8.2.1 Each compression ignition RICE must meet the emission limits or work practices identified in Tables 4.11 through 4.16, as appropriate. RICE with a national security exemption are not subject to these requirements but must follow manufacturer specifications for operation and maintenance. RICE used in test cells and test stands are exempt. Existing residential, commercial, or institutional emergency RICE that were purchased prior to June 12, 2006 are exempt from the requirements of Table 4.16.

4.8.2.2 All non-exempt diesel compression ignition RICE must operate solely on fuel having a maximum sulfur content of 50 ppm [0.005 percent by weight].

4.8.2.3 For all model year 2007 and later RICE, model year 2006 RICE manufactured after April 1, 2006 (July 1, 2006 for fire pump RICE), and all RICE reconstructed after July 11, 2005, compliance with emission limits must be demonstrated by purchasing a certified RICE or conducting testing to show that the RICE's emissions meet the limits of Tables 4.11 through 4.15, as appropriate. For all other RICE with emission limits, compliance is demonstrated by purchasing a certified RICE, keeping records of engine manufacturer data indicating compliance with the limits of Tables 4.11 through 4.15, as appropriate, or conducting an initial performance test to demonstrate compliance with the emission limits of Tables 4.11 through 4.15, as appropriate. For RICE with work practice standards, compliance is demonstrated by documenting that the work practices have been accomplished.

4.8.2.4 Emergency RICE must be equipped with a non-resettable hour meter, and RICE operating hours should be recorded by type of use (e.g., emergency, maintenance and testing, other non-emergency).

4.8.3 Spark Ignition RICE

4.8.3.1 Spark ignition RICE must meet the emission limits identified in Tables 4.17 through 4.20, as appropriate. RICE with a national security exemption are not subject to these requirements, but must follow manufacturer specifications and industry standards and practices for operation and maintenance. RICE used in test cells and test stands are exempt. Existing residential, commercial, or institutional emergency RICE are exempt from the requirements of Table 4.20. Existing RICE are those that commenced construction or reconstruction before June 12, 2006.

4.8.3.2 For RICE manufactured after July 1, 2007, compliance with emission limits must be demonstrated by purchasing a certified RICE or conducting testing to show that the RICE's emissions meet the limits of Table 4.17 and 4.18, as appropriate.

4.8.4 Stationary RICE. Stationary RICE must comply with the emission limits and monitoring requirements of Tables 4.24 and 4.28. Stationary backup power equipment, such as emergency generators, are exempt from these requirements.[51]

## 4.9 UNITS CONTAINING ODSs AND SUBSTITUTES FOR ODSs

Installations must ensure that units containing ODSs meet the standards of this paragraph, as applicable. ODSs are listed in Table 4.21 (Class I), Table 4.22 (Class II), and Table 4.23 (Blend). The standards in Paragraphs 4.9.2 through 4.9.5 apply to direct atmospheric emissions of ODSs from refrigeration and fire suppression equipment. These standards also apply to substitutes for ODSs, such as hydrofluorocarbons (HFCs), where indicated.

4.9.1 Substitutes Exempt from Refrigerant Management Requirements. The following substitutes are exempt from the refrigerant management requirements:

4.9.1.1 Carbon dioxide in any application.

4.9.1.2 Nitrogen in any application.

4.9.1.3 Water in any application.

4.9.1.4 Ammonia in commercial or industrial process refrigeration or absorption units.

4.9.1.5 Chlorine in industrial process refrigeration (processing of chlorine and chlorine compounds).

4.9.1.6 Hydrocarbons in industrial process refrigeration (processing of hydrocarbons).

4.9.1.7 Ethane (R-170) in very low temperature refrigeration equipment and equipment for non-mechanical heat transfer.

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[51] GOJ Supplementary Provisions No. 53 of Order for Enforcement of the Air Pollution Control Act, Article 2; GOJ Supplementary Provisions No. 58 of Order for Enforcement of the Air Pollution Control Act, Article 2.

4.9.1.8 Propane (R-290) in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; self-contained room air conditioners for residential and light commercial air-conditioning and heat pumps; vending machines; and effective January 3, 2017, self-contained commercial ice machines, very low temperature refrigeration equipment, and water coolers.

4.9.1.9 Isobutane (R-600a) in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; and vending machines.

4.9.1.10 R-441A in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; self-contained room air conditioners for residential and light commercial air-conditioning; heat pumps; and vending machines.

4.9.2 Production and Use of Class I and II ODSs. Production of Class I ODSs has been banned. Production of Class II ODSs is being phased out and no Class II ODSs will be produced after January 1, 2030.[52] All existing commercial systems using Class I and Class II ODSs must be phased out at the end of their life cycle. No new commercial systems may be purchased containing these substances. Use of Class I ODSs is only permitted for weapons systems and when supplied by Defense Logistics Agency (DLA) Aviation from the DoD stockpile. Use of Class II ODSs is permitted only in existing air-conditioning and refrigeration equipment until the end of their life cycle.

4.9.3 Labeling. All containers or products containing a Class I or Class II substance must bear the warning statement, in English and Japanese, shown in Figure 4.1. The label must be clearly legible and conspicuous and not interfere with, detract from, or obscure any labeling information required to be on the equipment or container. Alternative placement of the warning such as on hang tags, invoices, bills of lading, package inserts, or other supplemental printed materials is also acceptable. Containers and products must comply with labeling and other requirements for hazardous materials in JEGS Chapter 10, as applicable.

**Figure 4.1: Class I or Class II Warning Label**

| |
|---|
| WARNING: Contains [or Manufactured with, if applicable] [insert name of substance], a substance which harms public health and environment by destroying ozone in the upper atmosphere. |

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[52] 40 CFR §82.16: Protection of Stratospheric Ozone, Production and Consumption Controls, Phaseout Schedule of Class II Controlled Substances.

### 4.9.4 Refrigerants

4.9.4.1 Refrigerant Recovery and Recycling. All repairs, including leak repairs or services to appliances, industrial process refrigeration units, air-conditioning units, or motor vehicle air conditioners containing ODS refrigerants, must be performed using commercially available refrigerant recovery and recycling equipment operated by trained personnel. Refrigerant technicians must be trained in proper recovery and recycling procedures, leak detection, safety, shipping, and disposal in accordance with recognized industry standards and practices or Japanese equivalent. Use of refrigerant recovery and recycling equipment is not required for ammonia, carbon dioxide, and pure hydrocarbon refrigerants.

4.9.4.2 Refrigerant Venting Prohibition. Any ODS refrigerants and their substitutes (such as HFCs) must not be intentionally released in the course of maintaining, servicing, repairing, or disposing of appliances, industrial process refrigeration units, air-conditioning units, or motor vehicle air conditioners. *De minimis* releases associated with good faith attempts to recycle or recover ODS or substitute refrigerants are not subject to this prohibition. Ammonia, carbon dioxide, and pure hydrocarbon refrigerants are not subject to the venting prohibition.

4.9.4.3 Refrigerant Leak Monitoring and Repair. Monitor refrigeration equipment containing 22.7 kg [50 lbs] or more of ODS refrigerant for leakage and, if found to be leaking, repair in accordance with the following standards within 30 days.

4.9.4.3.1 Commercial Refrigeration Equipment. Commercial refrigeration equipment and industrial process refrigeration equipment normally containing 22.7 kg [50 lbs] or more of refrigerant in any single circuit must have leaks repaired if the appliance is leaking at a rate such that the loss of refrigerant will exceed 35 percent of the total charge during a 12-month period.

4.9.4.3.2 Industrial Process Refrigeration (IPR) Equipment. IPR equipment normally containing 22.7 kg [50 lbs] or more of refrigerant in any single circuit must have leaks repaired if the appliance is leaking at a rate such that the loss of refrigerant will exceed 35 percent of the total charge during a 12-month period.

4.9.4.3.3 Comfort Cooling and Other Appliances. Comfort cooling and other appliances normally containing more than 22.7 kg [50 lbs] of refrigerant in any single circuit and not covered by Paragraphs 4.9.4.3.1 and 4.9.4.3.2 must have leaks repaired if the appliance is leaking at a rate such that the loss of refrigerant will exceed 15 percent of the total charge during a 12-month period.

4.9.4.3.4 Leak Rate Calculation. Leak rates must be calculated every time an ODS refrigerant is added to an appliance with a full charge of 22.7 kg [50 lbs] or more of refrigerant in any single circuit unless the addition qualifies as a seasonal variance or is made immediately after a retrofit or the installation of a new appliance.

4.9.4.3.5 Verification Testing. Both an initial verification test (conducted prior to adding refrigerant back into equipment) and a follow-up verification test (conducted after the equipment returns to normal operating conditions) must be conducted to verify leak repairs.

4.9.5 Fire Suppression Agent (Halon)

4.9.5.1 Technician Training. Technicians who test, maintain, service, repair, or dispose of halon-containing equipment must be trained in halon emission reduction within 30 days of hire.

4.9.5.2 Venting Prohibition. Halon must not be intentionally released into the environment while testing, maintaining, servicing, repairing, or disposing of halon-containing equipment or using such equipment for technician training. This venting prohibition does not apply to the following halon releases:

4.9.5.2.1 *De minimis* releases associated with good faith attempts to recycle or recover halons (i.e., release of residual halon contained in fully discharged total flooding fire extinguishing systems).

4.9.5.2.2 Emergency releases for the legitimate purpose of fire extinguishing, explosion inertion, or other emergency applications for which the equipment or systems were designed.

4.9.5.2.3 Releases during the testing of fire extinguishing systems, if all of the following are true:

4.9.5.2.3.1 Systems or equipment employing suitable alternative fire extinguishing agents are not available.

4.9.5.2.3.2 Release of extinguishing agent is essential to demonstrate equipment functionality.

4.9.5.2.3.3 Failure of system or equipment would pose great risk to human safety or the environment.

4.9.5.2.3.4 A simulant agent cannot be used.

## 4.10 MOTOR VEHICLES

Installations must ensure that DoD-owned and -leased motor vehicles:

4.10.1 Use only unleaded gasoline, if available on the local economy, in vehicles that are designed for this fuel.

4.10.2 Use lowest sulfur content diesel available (not to exceed 50 ppm) in diesel-fueled vehicles.

## 4.11 VOLATILE ORGANIC COMPOUNDS (VOCs)

Installations must incorporate procedures that minimize the direct release of VOCs into the atmosphere at painting facilities, printing facilities, cleaning facilities, storage tanks, and drying facilities (to include resin dryers). Installations will ensure emissions from facilities using organic solvents do not exceed the limits indicated in Table 4.29.

## Table 4.2: Emission Limits for Boilers(1)

| FUEL TYPE | MAXIMUM DESIGN HEAT INPUT CAPACITY | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10.56 to 105.6 GJ/hr [10 to 100 MMBtu/hr] | | | | | Greater than 105.6 GJ/hr [100 MMBtu/hr] | | | | | |
| | PM(2) (kg/GJ) [lb/MMBtu] | $SO_2$ (kg/GJ) [lb/MMBtu] | Hg(3) (kg/GJ) [lb/MMBtu] | CO(4) (ppm) | Opacity(5) (%) | PM(2) (kg/GJ) [lb/MMBtu] | $SO_2$ (kg/GJ) [lb/MMBtu] | $NO_X$ (kg/GJ) [lb/MMBtu] | Hg(3) (kg/GJ) [lb/MMBtu] | CO(4) (ppm) | Opacity (%) |
| Gaseous Fuel | | | | | | | 0.21 [0.50](6) | 0.09 [0.20] | | | |
| Gaseous Coal-Derived Fuel | | | | | | | 0.21 [0.50] | 0.21 [0.50] | | | |
| Liquid Fossil Fuel | 0.01 [0.03](7,8) | 0.21 [0.50](7) | | | 20 | 0.04 [0.10](9)<br>or<br>0.01 [0.03](6) | 0.21 [0.50] | 0.17 [0.40] | | | 20 |
| Solid Fossil Fuel | 0.04 [0.10](10)<br>0.01 [0.03](11)<br>or<br>0.18 [0.42](12) | 0.506 [1.2] | 0.000009 [0.000022] | 420 | 20 | 0.04 [0.10](9)<br>or<br>0.01 [0.03](6) | 0.506 [1.2] | 0.30 [0.70] | 0.000009 [0.000022] | 420 | 20 |
| Biomass Fuel | 0.13 [0.30](10)<br>0.01 [0.03](11)<br>or<br>0.03 [0.07](12) | | | | 20(13) | 0.09 [0.20](9)<br>or<br>0.01 [0.03](6) | | | | | 20(13) |

kg/GJ = kilogram per gigajoules
lb/MMBtu = pound per million British thermal units
ppm = parts per million
CO = carbon monoxide
Hg = mercury
$NO_X$ = nitrogen oxide

**Table 4.2: Emission Limits for Boilers,(1) Continued**

| FUEL TYPE | MAXIMUM DESIGN HEAT INPUT CAPACITY | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10.56 to 105.6 GJ/hr [10 to 100 MMBtu/hr] | | | | | Greater than 105.6 GJ/hr [100 MMBtu/hr] | | | | | |
| | PM(2) (kg/GJ) [lb/MMBtu] | $SO_2$ (kg/GJ) [lb/MMBtu] | Hg(3) (kg/GJ) [lb/MMBtu] | CO(4) (ppm) | Opacity(5) (%) | PM(2) (kg/GJ) [lb/MMBtu] | $SO_2$ (kg/GJ) [lb/MMBtu] | $NO_X$ (kg/GJ) [lb/MMBtu] | Hg(3) (kg/GJ) [lb/MMBtu] | CO(4) (ppm) | Opacity (%) |

<u>Notes</u>:

1. Unless otherwise specified, emission limits for units with a design capacity in the range of 10.56 to 105.6 GJ/hr [10 to 100 MMBtu/hr] apply to units that began construction, modification, or reconstruction after June 9, 1989, while emission limits for units with a design capacity greater than 105.6 GJ/hr [100 MMBtu/hr] apply to units that began construction, modification, or reconstruction after June 19, 1984. The PM and opacity emission limits apply at all times, except during periods of startup, shutdown, or malfunction. The $SO_2$, $NO_X$, Hg, and CO emission limits apply at all times, including periods of startup, shutdown, and malfunction.2. Boilers combusting the following fuels are not subject to PM standards:
   (a) oil that contains no more than 0.5 weight percent sulfur;
   (b) coke oven gas;
   (c) a mixture of the first two fuels; or
   (d) either of the first two fuels (or a mixture of the first two fuels) in combination with other fuels not subject to a PM standard and not using a post-combustion technology (except a wet scrubber) to reduce $SO_2$ or PM emissions.
3. Compliance with Hg emission limits may be met by using fuel analysis.
4. CO emission limits are on a dry basis corrected to 3.0 percent oxygen ($O_2$).
5. Opacity limits do not apply to boilers less than 31.65 GJ/hr [30 MMBtu/hr].
6. Limit only applies to units that began construction, modification, or reconstruction after February 28, 2005.
7. Limit must be met by combusting oil containing no more than 0.50 weight percent sulfur as demonstrated by fuel certification.
8. Limit only applies to units that began construction or reconstruction after June 4, 2010.
9. Limit applies to units that began construction, modification, or reconstruction after June 19, 1984 but before or on February 28, 2005.
10. Limit applies to units greater than or equal to 31.65 GJ/hr [30 MMBtu/hr] that began construction, modification, or reconstruction after June 9, 1989 but before or on February 28, 2005.
11. Limit applies to units greater than or equal to 31.65 GJ/hr [30 MMBtu/hr] that began construction, modification, or reconstruction after February 28, 2005.
12. Limit applies to units between 10.56 and 31.65 GJ/hr [10 and 30 MMBtu/hr] that began construction or reconstruction after June 4, 2010.
13. Limit only applies to wood fuel (i.e., wood products and wood residue).

## Table 4.3: Tune-up Requirements for Boilers

| EXEMPT UNITS | |
|---|---|
| The following types of units are exempt from all tune-up requirements:<br>- Gas-fired boilers(1)<br>- Boilers that burn solid or hazardous waste<br>- Hot water heaters(2)<br>- Waste heat boilers(3)<br>- Temporary boilers(4)<br>- Residential boilers<br>- Electric boilers(5)<br>- Electric utility steam generating units | |
| APPLICABILITY | |
| Biennial Tune-up | Required for the following boilers:<br>- Oil-fired boilers with a heat input capacity greater than 5.28 GJ/hr [5 MMBtu/hr]<br>- Coal-fired boilers with a heat input capacity less than 10.56 GJ/hr [10 MMBtu/hr]<br>- Biomass boilers (all sizes) |
| 5-Year Tune-up | Required for the following boilers:<br>- Oil-fired boilers with a heat input capacity less than or equal to 5.28 GJ/hr [5 MMBtu/hr]<br>- Seasonal boilers(6)<br>- Limited-use boilers(7)<br>- Boilers with an $O_2$ trim system(8) that maintains an optimum air-to-fuel ratio |
| DATE FOR INITIAL OR FIRST TUNE-UP | |
| Biennial Tune-up | As soon as possible, but within 25 months after publication of this manual or within 25 months of initial startup, whichever is later. |
| 5-Year Tune-up | As soon as possible, but within 61 months after publication of this manual or within 61 months of initial startup, whichever is later. |
| REQUIRED TUNE-UP FREQUENCY | |
| Biennial Tune-up | Within 25 months of previous tune-up. |
| 5-Year Tune-up | Within 61 months of previous tune-up. |
| TUNE-UP REQUIREMENTS | |
| 1. As applicable, inspect the burner and clean or replace any components of the burner as necessary. For units requiring a biennial tune-up, the burner inspection may be delayed until the next scheduled unit shutdown, not to exceed 36 months from the previous inspection. For units requiring a 5-year tune-up, the burner inspection may be delayed until the next scheduled unit shutdown, but each burner must be inspected at least once every 72 months. | |
| 2. Inspect the flame pattern, as applicable, and adjust the burner as necessary to optimize the flame pattern. The adjustment should be consistent with the manufacturer's specifications, if available. | |
| 3. Inspect the system controlling the air-to-fuel ratio, as applicable, and ensure that it is correctly calibrated and functioning properly. For units requiring a biennial tune-up, the inspection may be delayed until the next scheduled unit shutdown, not to exceed 36 months from the previous inspection. For units requiring a 5-year tune-up, the inspection may be delayed until the next scheduled unit shutdown, but each system controlling the air-to-fuel ratio must be inspected at least once every 72 months. | |

## Table 4.3: Tune-up Requirements for Boilers, Continued

| TUNE-UP REQUIREMENTS, continued |
|---|
| 4. Optimize total emissions of CO. This optimization should be consistent with the manufacturer's specifications, if available, and with any $NO_X$ requirement to which the unit is subject. |
| 5. Measure the concentrations in the effluent stream of CO in ppm, by volume, and $O_2$ in volume percent, before and after the adjustments are made (measurements may be either on a dry or wet basis, as long as it is the same basis before and after the adjustments are made). Measurements may be taken using a portable CO analyzer. |
| 6. Maintain a report on site that contains the following information:<br>(i) The concentrations of CO in the effluent stream in ppm, by volume, and $O_2$ in volume percent, measured at high fire or typical operating load, before and after the tune-up.<br>(ii) A description of any corrective actions taken as a part of the tune-up.<br>(iii) The type and amount of fuel used over the 12 months before the tune-up, but only if the unit was physically and legally capable of using more than one type of fuel during that period. Units sharing a fuel meter may estimate the fuel use by each unit. |
| 7. If the unit is not operating on the required date for a tune-up, the tune-up must be conducted within 30 calendar days of startup. |
| Notes:<br>1. Includes any boiler that burns gaseous fuels not combined with any solid fuels and burns liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or periodic testing on liquid fuel. Periodic testing of liquid fuel must not exceed a combined total of 48 hours during any calendar year.<br>2. A closed vessel with a capacity of no more than 454 liters [120 gallons] in which water is heated by combustion of fuel and hot water is withdrawn for use external to the vessel. Hot water boilers (i.e., boilers not generating steam) with a heat input capacity of less than 1.69 GJ/hr [1.6 MMBtu/hr] are included in this definition. The 454 liters [120 gallons] capacity threshold to be considered a hot water heater is independent of the 1.69 GJ/hr [1.6 MMBtu/hr] heat input capacity threshold for hot water boilers. Hot water heater also means a tankless unit that provides on-demand hot water.<br>3. A device that recovers normally unused energy (e.g., hot exhaust gas) and converts it to usable heat. Waste heat boilers are also referred to as heat recovery steam generators.<br>4. A boiler that is designed to, and is capable of, being carried or moved from one location to another and does not remain at one location for 12 consecutive months or longer.<br>5. A boiler in which electric heating serves as the source of heat. Electric boilers that burn gaseous or liquid fuel during periods of electrical power curtailment or failure are included in this definition.<br>6. A boiler that undergoes a shutdown for a period of at least seven consecutive months (or 210 consecutive days) each 12-month period due to seasonal conditions, except for periodic testing. Periodic testing must not exceed a combined total of 15 days during the 7-month shutdown. This definition only applies to boilers combusting oil or biomass.<br>7. A boiler that burns any amount of solid, liquid, or gaseous fuels and has an enforceable average "annual capacity factor" of no more than 10 percent. Annual capacity factor is the ratio between the actual heat input to a boiler from the fuels burned during a calendar year and the potential heat input to the boiler had it been operated for 8,760 hours during a year at the maximum steady state design heat input capacity.<br>8. A system of monitors that is used to maintain excess air at the desired level in a combustion device. A typical system consists of a flue gas $O_2$ and/or CO monitor that automatically provides a feedback signal to the combustion air controller. |

## Table 4.4: Energy Assessment for Boilers

| | |
|---|---|
| EXEMPT UNITS | |
| The following types of units are exempt from all energy assessment requirements:<br>- Gas-fired boilers<br>- Boilers that burn solid or hazardous waste<br>- Hot water heaters<br>- Waste heat boilers<br>- Temporary boilers<br>- Residential boilers<br>- Electric boilers<br>- Electric utility steam generating units<br>- Limited-use boilers | |
| APPLICABILITY | |
| Recommended for existing boilers(1) greater than or equal to 10.56 GJ/hr [10 MMBtu/hr]. | |
| ENERGY ASSESSMENT RECOMMENDATIONS | |
| A one-time energy assessment should be performed by a qualified energy assessor. The energy assessment should include all of the affected boiler systems(2) and consist of the following: | |
| 1. A visual inspection of the boiler system. | |
| 2. An evaluation of operating characteristics of the affected boiler systems, specifications of energy use systems, operating and maintenance procedures, and unusual operating constraints. | |
| 3. An inventory of major energy use systems consuming energy from affected boiler(s) and which are under control of the boiler owner or operator. | |
| 4. A review of available architectural and engineering plans, facility operation and maintenance procedures and logs, and fuel usage. | |
| 5. A list of major and cost-effective energy conservation measures that are within the facility's control. | |
| 6. A list of the energy savings potential of the energy conservation measures identified. | |
| 7. A comprehensive report detailing the ways to improve efficiency, the cost of specific improvements, benefits, and the time frame for recouping those investments. | |
| SCOPE OF ENERGY ASSESSMENT | |
| Facilities with affected boilers with a combined heat input capacity of < 316,761 gigajoules per year (GJ/yr) [0.3 trillion Btu/year (TBtu/yr)] | • Length: 8 on-site technical labor hours maximum, but may be longer at the discretion of the owner or operator of the affected source.<br>• Systems: The boiler system(s) and any on-site energy use system(s) accounting for at least 50 percent of the affected boiler(s) energy (e.g., steam, hot water, process heat, or electricity) production, as applicable. |
| Facilities with affected boilers with a combined heat input capacity of 316,761 to 1,055,870 GJ/yr [0.3 to 1.0 TBtu/yr] | • Length: 24 on-site technical labor hours maximum, but may be longer at the discretion of the owner or operator of the affected source.<br>• Systems: The boiler system(s) and any on-site energy use system(s) accounting for at least 33 percent of the affected boiler(s) energy (e.g., steam, hot water, process heat, or electricity) production, as applicable. |

## Table 4.4: Energy Assessment for Boilers, Continued

| SCOPE OF ENERGY ASSESSMENT | |
|---|---|
| Facilities with affected boilers with a combined heat input capacity of > 1,055,870 GJ/yr [1.0 TBtu/yr] | • Length: Up to 24 on-site technical labor hours in length for the first 1,055,870 GJ/yr [1 TBtu/yr] plus 8 on-site technical labor hours for every additional 1,055,870 GJ/yr [1 TBtu/yr] not to exceed 160 on-site technical hours, but may be longer at the discretion of the owner or operator of the affected source.<br>• Systems: The boiler system(s) and any energy use system(s) accounting for at least 20 percent of the affected boiler(s) energy (e.g., steam, hot water, process heat, or electricity) production, as applicable. |

Notes:

1. Existing boilers began construction or reconstruction on or before June 4, 2010.
2. The boiler and associated components such as feedwater systems, combustion air systems, fuel systems (including burners), blowdown systems, combustion control systems, steam systems, and condensate return systems, directly connected to and serving the energy use systems.

## Table 4.5: Emission Limits for Municipal Waste Combustion (MWC) Units[1]

| UNIT TYPE | LARGE MWC | | | SMALL MWC | | | | OSWI AND AIR CURTAIN INCINERATORS |
|---|---|---|---|---|---|---|---|---|
| | Constructed/ Modified/ Reconstructed between December 20, 1989 and September 20, 1994 | Constructed/ Modified/ Reconstructed between September 20, 1994 and December 19 2005 | Constructed/ Modified/ Reconstructed after December 19, 2005 | Constructed on or before August 30, 1999 | | Constructed after August 30, 1999 or Modified/ Reconstructed after June 6, 2001 | | Began Construction after December 9, 2004 or Modified/ Reconstructed on or after June 16, 2006 |
| RATED CAPACITY | Greater than 227 Mtons/day [(250 tons/day] | | | 32-227 Mtons/day [35-250 tons/day] | | | | Less than 32 Mtons/day [35 tons/day] |
| | | | | Class I[3] | Class II[3] | Class I[3] | Class II[3] | |
| PM | 34 mg/dscm[2,4,6] | 24 mg/dscm[2,4,6] | 20 mg/dscm[2,4,6] | 27 mg/dscm[2,4,6] | 70 mg/dscm[2,4,6] | 24 mg/dscm[2,4,6] | | 29 mg/dscm[2,6] |
| Opacity | 10 percent[2,4,7] | 10 percent[2,4,7] | | 10 percent[2,4,7] | | 10 percent[2,4,7] | | 10 percent[2,6,7] |
| Dioxins/Furans | 30 ng/dscm[2,8] | 30 ng/dscm or 13 ng/dscm[2,8,9] | | 30 ng/dscm (w/o ESP)[2,8,10]<br>60 ng/dscm (w/ ESP)[2,10] | 125 ng/dscm[2,8] | 13 ng/dscm[2,8] | | 33 ng/dscm[2,6] |
| $SO_2$ | 30 ppmv or 80% reduction[4,5,11] | 30 ppmv or 80% reduction[4,5,11] | | 31 ppmv or 75% reduction[4,5,11] | 50 ppmv or 77% reduction[4,5,11] | 30 ppmv or 80% reduction[4,5,11] | | 3.1 ppmv[6] |
| Hydrogen Chloride | 25 ppmv or 95% reduction[2,6,11] | 25 ppmv or 95% reduction[2,6,11] | | 31 ppmv or 95% reduction[2,6,11] | 250 ppmv or 50% reduction[2,6,11] | 25 ppmv or 95% reduction[2,6,11] | | 15 ppmv[2,6] |
| $NO_X$ | 180 ppmv[4,5] | 150 ppmv or 180 ppmv[4,5,12] | | | | 180 ppmv or 150 ppmv[4,5,12] | 500 ppmv[4,5] | 103 ppmv[6] |
| - Mass burn water wall | | | | 200 ppmv[4,5,13] | | | | |
| - Mass burn rotary water wall | | | | 170 ppmv[4,5,13] | | | | |

## Table 4.5: Emission Limits for Municipal Waste Combustion (MWC) Units,(1) Continued

| UNIT TYPE | LARGE MWC | | | SMALL MWC | | | | OSWI AND AIR CURTAIN INCINERATORS |
|---|---|---|---|---|---|---|---|---|
| | Constructed/ Modified/ Reconstructed between December 20, 1989 and September 20, 1994 | Constructed/ Modified/ Reconstructed between September 20, 1994 and December 19, 2005 | Constructed/ Modified/ Reconstructed after December 19, 2005 | Constructed before August 30, 1999 | | Constructed after August 30, 1999 or Modified/ Reconstructed after June 6, 2001 | | Began Construction after December 9, 2004 or Modified/ Reconstructed on or after June 16, 2006 |
| RATED CAPACITY | Greater than 227 Mtons/day [250 tons/day] | | | 32-227 Mtons/day [35-250tons/day] | | | | Less than 32 Mtons/day [35 tons/day] |
| | | | | Class I(3) | Class II(3) | Class I(3) | Class II(3) | |
| - Mass burn refractory | | | | 350 ppmv(4,5,13) | | | | |
| - Mass burn rotary refractory | | | | 350 ppmv(4,5,13) | | | | |
| - RDF | | | | 250 ppmv(4,5,13) | | | | |
| - Fluidized bed | | | | 220 ppmv(4,5,13) | | | | |
| - Modular excess air | | | | 190 ppmv(4,5,13) | | | | |
| - Modular starved air | | | | 380 ppmv(4,5,13) | | | | |
| CO(14) | | | | | | | | 40 ppmv(4,15) |
| - Mass burn water wall | 100 ppmv(4,16) | 100 ppmv(4,16) | | 100 ppmv(4,16) | | 100 ppmv(4,16) | | |
| - Mass burn refractory | 100 ppmv(4,16) | 100 ppmv(4,16) | | 100 ppmv(4,16) | | 100 ppmv(4,16) | | |
| - Mass burn rotary refractory | | | | 100 ppmv(4,16) | | | | |
| - Mass burn rotary water wall | 100 ppmv(4,13) | 100 ppmv(4,13) | | 100 ppmv(4,13) | | 100 ppmv(4,13) | | |
| - Modular starved air | 50 ppmv(4,16) | 50 ppmv(4,16) | | 50 ppmv(4,16) | | 50 ppmv(4,16) | | |

## Table 4.5: Emission Limits for Municipal Waste Combustion (MWC) Units,(1) Continued

| UNIT TYPE | LARGE MWC | | | SMALL MWC | | | | OSWI AND AIR CURTAIN INCINERATORS |
|---|---|---|---|---|---|---|---|---|
| | Constructed/ Modified/ Reconstructed between December 20, 1989 and September 20, 1994 | Constructed/ Modified/ Reconstructed between September 20, 1994 and December 19, 2005 | Constructed/ Modified/ Reconstructed after December 19, 2005 | Constructed before August 30, 1999 | | Constructed after August 30, 1999 or Modified/ Reconstructed after June 6, 2001 | | Began Construction after December 9, 2004 or Modified/ Reconstructed on or after June 16, 2006 |
| RATED CAPACITY | Greater than 227 Mtons/day [250 tons/day] | | | 32-227 Mtons/day [35-250 tons/day] | | | | Less than 32 Mtons/day [35 tons/day] |
| | | | | Class I(3) | Class II(3) | Class I(3) | Class II(3) | |
| - Modular excess air | 50 ppmv(4,16) | 50 ppmv(4,16) | | 50 ppmv(4,16) | | 50 ppmv(4,16) | | |
| - RDF stoker | 150 ppmv(4,13) | 150 ppmv(4,13) | | 200 ppmv(4,13) | | 150 ppmv(4,13) | | |
| Fluidized bed, mixed fuel, (wood/refuse derived fuel) | | | | 200 ppmv(4,16) | | 200 ppmv(4,13) | | |
| Fluidized bed | | | | 100 ppmv(4,16) | | 100 ppmv(4,16) | | |
| Bubbling fluidized bed combustor | 100 ppmv(4,16) | 100 ppmv(4,16) | | | | | | |
| Circulating fluidized bed combustor | 100 ppmv(4,16) | 100 ppmv(4,16) | | | | | | |
| Pulverized coal/RDF mixed fuel-fired combustor | 150 ppmv(4,15) | 150 ppmv(4,16) | | | | 150 ppmv(4,16) | | |

## Table 4.5: Emission Limits for Municipal Waste Combustion (MWC) Units,[1] Continued

| UNIT TYPE | LARGE MWC | | | SMALL MWC | | | | OSWI AND AIR CURTAIN INCINERATORS |
|---|---|---|---|---|---|---|---|---|
| | Constructed/ Modified/ Reconstructed between December 20, 1989 and September 20, 1994 | Constructed/ Modified/ Reconstructed between September 20, 1994 and December 19 2005 | Constructed/ Modified/ Reconstructed after December 19, 2005 | Constructed before August 30, 1999 | | Constructed after August 30, 1999 or Modified/ Reconstructed after June 6, 2001 | | Began Construction after December 9, 2004 or Modified/ Reconstructed on or after June 16, 2006 |
| RATED CAPACITY | Greater than 227 Mtons/day [250 tons/day] | | | 32-227 Mtons/day [35-250 tons/day] | | | | Less than 32 Mtons/day [35 tons/day] |
| | | | | Class I[3] | Class II[3] | Class I[3] | Class II[3] | |
| Spreader stoker coal/RDF mixed fuel-fired | 150 ppmv[4,13] | 150 ppmv[4,13] | 200 ppmv[4,13] | 150 ppmv[4,13] | | | | |
| Cadmium | | 20 µg/dscm[2] | 10 µg/dscm[2] | 0.040 mg/dscm[2] | 0.10 mg/dscm[2] | 0.020 mg/dscm[2] | | 18 µg/dscm[2,6] |
| Lead | | 200 mg/dscm[2] | 140 mg/dscm[2] | 0.49 mg/dscm[2] | | 1.6 mg/dscm[2] | | 0.20 mg/dscm[2] |
| Mercury | | 80 µg/dscm or 85% reduction[2,17] | 50 µg/dscm or 85% reduction[2,17] | 0.080 mg/dscm or 85% reduction[2,17] | | 0.080 mg/dscm or 85% reduction[2,17] | | 74 µg/dscm[2,6] |
| Fugitive Ash | | 5% of hourly observation period[2,6] | | 5% of hourly observation period[2,6] | | 5% of hourly observation period[2,6] | | |

dscm = dry standard cubic meter
mg = milligram
Mton = metric ton
ppmv = parts per million by volume
µg = microgram
ESP = electrostatic precipitator
OSWI = other solid waste incinerator
RDF = refuse-derived fuel

### Table 4.5: Emission Limits for Municipal Waste Combustion (MWC) Units,(1) Continued

| UNIT TYPE | LARGE MWC | | | SMALL MWC | | | | OSWI AND AIR CURTAIN INCINERATORS |
|---|---|---|---|---|---|---|---|---|
| | Constructed/ Modified/ Reconstructed between December 20, 1989 and September 20, 1994 | Constructed/ Modified/ Reconstructed between September 20, 1994 and December 19 2005 | Constructed/ Modified/ Reconstructed after December 19, 2005 | Constructed before August 30, 1999 | | Constructed after August 30, 1999 or Modified/ Reconstructed after June 6, 2001 | | Began Construction after December 9, 2004 or Modified/ Reconstructed on or after June 16, 2006 |
| RATED CAPACITY | Greater than 227 Mtons/day [250 tons/day] | | | 32-227 Mtons/day [35-250 tons/day] | | | | Less than 32 Mtons/day [35 tons/day] |
| | | | | Class I(3) | Class II(3) | Class I(3) | Class II(3) | |

Notes:

1. Emission limit concentrations (mg/dscm, ppmv) are corrected to 7.0 percent $O_2$, dry basis at standard conditions.
2. Requires annual demonstration of compliance, except for Class II and OSWI pollutants that have shown compliance with emission limits for three consecutive years. For these pollutants, demonstration of compliance can be demonstrated every three years.
3. Class I units mean small MWC units that are located at MWC plants with an aggregate plant combustion capacity more than 227 Mtons/day [250 ton/day] of municipal solid waste (MSW). Class II units mean small MWC units that are located at MWC plants with an aggregate plant combustion capacity no more than 227 Mtons/day [250 ton/day] of MSW.
4. Emission rate and parameters measured using a CEMS, except for OSWI units, which only require CEMS for CO monitoring.
5. 1-hour (hr) average.
6. Average over three 1-hr minimum runs.
7. 6-minute average.
8. Average over three 4-hr runs.
9. 30 ng/dscm for first three years following the date of initial startup, for facilities constructed, modified, or reconstructed or before November 20, 1997, 13 ng/dscm thereafter.
10. ESP = electrostatic precipitator.
11. Comply with less stringent requirement; reduced by weight or volume from potential emissions.
12. 180 ppmv during first year, 150 ppmv thereafter.
13. 24-hr average.
14. Measured at the combustor outlet.
15. 12-hr average.
16. 4-hr average.
17. Comply with less stringent requirement; reduced by weight from potential emissions.

### Table 4.6: Emission Limits for Hospital and Infectious Medical Waste Incinerators (HIMWI)(1)

| RATED CAPACITY | HIMWI CONSTRUCTED BETWEEN JUNE 20, 1996 AND DECEMBER 1, 2008, OR MODIFIED BETWEEN MARCH 16, 1998 AND APRIL 6, 2010 | | | HIMWI CONSTRUCTED AFTER DECEMBER 1, 2008 OR MODIFIED AFTER APRIL 6, 2010 | | |
|---|---|---|---|---|---|---|
| | Small Continuous or Intermittent: < 90 kg/hr [200 lb/hr] Batch: < 726 kg/day [1,600 lb/day] | Medium Continuous or Intermittent: 91-226 kg/hr [201-499 lb/hr] Batch: 726-1,814 kg/day [1,601-3,999 lb/day] | Large Continuous or Intermittent: > 227 kg/hr [500 lb/hr] Batch: > 1,814 kg/day [4,000 lb/day] | Small Continuous or Intermittent: < 90 kg/hr [200 lb/hr] Batch: < 726 kg/day [1,600 lb/day] | Medium Continuous or Intermittent: 91-226 kg/hr [201-499 lb/hr] Batch: 726-1,814 kg/day [1,601-3,999 lb/day] | Large Continuous or Intermittent: > 227 kg/hr [500 lb/hr] Batch: > 1,814 kg/day [4,000 lb/day] |
| PM(5,7,9) | 69 mg/dscm | 34 mg/dscm | | 66 mg/dscm | 22 mg/dscm | 18 mg/dscm |
| Opacity(5) | 10 percent(2) | | | 6 percent(2) | | |
| Dioxins/Furans(8,9) | 125 ng/dscm or 2.3 ng/dscm TEQ | 25 ng/dscm or 0.6 ng/dscm TEQ | | 16 ng/dscm or 0.013 ng/dscm TEQ | 0.47 ng/dscm or 0.014 ng/dscm TEQ | 9.3 ng/dscm or 0.035 ng/dscm TEQ |
| $SO_2$(10) | 55 ppmv | | | 1.4 ppmv | | 8.1 ppmv |
| Hydrogen Chloride(5,7,9) | 15 ppmv or 99% reduction(3) | | | 15 ppmv | 7.7 ppmv | 5.1 ppmv |
| $NO_X$(10) | 250 ppmv | | | 67 ppmv | | 140 ppmv |
| CO(4,5,7,9) | 40 ppmv | | | 20 ppmv | 1.8 ppmv | 11 ppmv |
| Cadmium(7,9) | 0.16 mg/dscm or 65% reduction(3) | 0.04 mg/dscm or 90% reduction(3) | | 0.017 mg/dscm | 0.0098 mg/dscm | 0.00013 mg/dscm |
| Lead(7,9) | 1.2 mg/dscm or 70% reduction(3) | 0.07 mg/dscm or 98% reduction(3) | | 0.31 mg/dscm | 0.018 mg/dscm | 0.0069 mg/dscm |
| Mercury(7,9) | 0.55 mg/dscm or 85% reduction(3) | | | 0.014 mg/dscm | 0.0035 mg/dscm | 0.00013 mg/dscm |
| Fugitive Ash | 5% of hourly observation period(6) | | | 5% of hourly observation period(6) | | |

## Table 4.6: Emission Limits for Hospital and Infectious Medical Waste Incinerators (HIMWI),(1) Continued

| RATED CAPACITY | HIMWI CONSTRUCTED BETWEEN JUNE 20, 1996 AND DECEMBER 1, 2008, OR MODIFIED BETWEEN MARCH 16, 1998 AND APRIL 6, 2010 | | | HIMWI CONSTRUCTED AFTER DECEMBER 1, 2008 OR MODIFIED AFTER APRIL 6, 2010 | | |
|---|---|---|---|---|---|---|
| | Small Continuous or Intermittent:<br>< 90 kg/hr<br>[200 lb/hr]<br>Batch:<br>< 726 kg/day<br>[1,600 lb/day] | Medium Continuous or Intermittent:<br>91-226 kg/hr<br>[201-499 lb/hr]<br>Batch:<br>726-1,814 kg/day<br>[1,601-3,999 lb/day] | Large Continuous or Intermittent:<br>> 227 kg/hr<br>[500 lb/hr]<br>Batch:<br>> 1,814 kg/day<br>[4,000 lb/day] | Small Continuous or Intermittent:<br>< 90 kg/hr<br>[200 lb/hr]<br>Batch:<br>< 726 kg/day<br>[1,600 lb/day] | Medium Continuous or Intermittent:<br>91-226 kg/hr<br>[201-499 lb/hr]<br>Batch:<br>726-1,814 kg/day<br>[1,601-3,999 lb/day] | Large Continuous or Intermittent:<br>> 227 kg/hr<br>[500 lb/hr]<br>Batch:<br>> 1,814 kg/day<br>[4,000 lb/day] |

TEQ = toxic equivalence

Notes:

1. Emission limit concentrations (mg/dscm, ppmv) are corrected to 7.0 percent $O_2$, dry basis at standard conditions. Conduct an initial performance test to determine compliance with emission and opacity limits, and to establish operating parameters.
2. 6-minute average.
3. Comply with less stringent requirement; reduced by weight or volume from potential emissions.
4. Measured at the combustor outlet in conjunction with a measurement of $O_2$ concentration.
5. Conduct annual performance tests to determine compliance. Facilities may conduct performance tests for PM, CO, and hydrochloride every third year if the previous three HIMWI performance tests demonstrate that the facility is in compliance with the emission limits for PM, CO, or hydrochloride.
6. Perform annual fugitive testing (large HIMWI only).
7. 3-run average, 1-hr minimum per run. Unless equipped with CEMS.
8. 3-run average, 4-hr minimum per run. Unless equipped with CEMS.
9. If equipped with CEMS, determine compliance using a 12-hr rolling average.
10. Testing not required.

### Table 4.7: Vapor Cleaning Machine Control Combinations and Solvent Idling Emission Limits(1)

| UNIT TYPE | SOLVENT/AIR INTERFACE AREA | CONTROL COMBINATION OPTIONS | SOLVENT IDLING EMISSION LIMITS |
|---|---|---|---|
| Batch Vapor Cleaning Machine (New and Existing) | < 1.21 $m^2$ [13 $ft^2$] | Working-mode Cover(2)/Freeboard Ratio of 1.0/Superheated Vapor(3) | 0.22 kg/hr/$m^2$<br>[0.045 lb/hr/$ft^2$](2) |
| | | Freeboard Refrigeration Device(4)/Superheated Vapor(3) | |
| | | Working-mode Cover(2)/Freeboard Refrigeration Device(4) | |
| | | Reduced Room Draft(5)/Freeboard Ratio of 1.0/Superheated Vapor(3) | |
| | | Freeboard Refrigeration Device(4)/Reduced Room Draft | |
| | | Freeboard Refrigeration Device(4)/Freeboard Ratio of 1.0 | |
| | | Freeboard Refrigeration Device(4)/Dwell(6) | |
| | | Reduced Room Draft/Dwell(7)/Freeboard Ratio of 1.0 | |
| | | Freeboard Refrigeration Device(4)/Carbon Adsorber(7) | |
| | | Freeboard Ratio of 1.0/Superheated Vapor(3)/Carbon Adsorber(7) | |
| | > 1.21 $m^2$ [13 $ft^2$] | Freeboard Refrigeration Device(4)/Freeboard Ratio of 1.0/Superheated Vapor(3) | 0.22 kg/hr/$m^2$<br>[0.045 lb/hr/$ft^2$] |
| | | Dwell(6)/Freeboard Refrigeration Device(4)/Reduced Room Draft | |
| | | Working-mode Cover(2)/Freeboard Refrigeration Device(3)/Superheated Vapor(3) | |
| | | Freeboard Ratio of 1.0/Reduced Room Draft/Superheated Vapor(3) | |
| | | Freeboard Refrigeration Device(4)/Reduced Room Draft/Superheated Vapor(3) | |
| | | Freeboard Refrigeration Device(4)/Reduced Room Draft/Freeboard Ratio of 1.0 | |
| | | Freeboard Refrigeration Device(4)/Superheated Vapor(3)/Carbon Adsorber(7) | |
| Existing In-line Cleaning Machines | | Superheated Vapor(3)/Freeboard Ratio of 1.0 | 0.10 kg/hr/$m^2$<br>[0.021 lb/hr/$ft^2$] |
| | | Freeboard Refrigeration Device(4)/Freeboard Ratio of 1.0 | |
| | | Dwell(7)/Freeboard Refrigeration Device(4) | |
| | | Dwell(7)/Carbon Adsorber(7) | |
| New In-line Cleaning Machines | | Superheated Vapor(3)/Freeboard Refrigeration Device(4) | 0.10 kg/hr/$m^2$<br>[0.021 lb/hr/$ft^2$] |
| | | Freeboard Refrigeration Device(4)/Carbon Adsorber(7) | |
| | | Superheated Vapor(3)/Carbon Adsorber(7) | |

**Table 4.7: Vapor Cleaning Machine Control Combinations and Solvent Idling Emission Limits,(1) Continued**

| UNIT TYPE | SOLVENT/AIR INTERFACE AREA | CONTROL COMBINATION OPTIONS | SOLVENT IDLING EMISSION LIMITS |
|---|---|---|---|
| m$^2$ = square meter<br>ft$^2$ = square foot<br>Notes:<br>1. Compliance is shown by employing one of the approved control combinations for a unit or demonstrating that the cleaning machine can achieve and maintain the solvent idling emission limit.<br>2. Cover opens only for part entrance and removal and completely covers the cleaning machine openings when closed; working-mode cover free of cracks, holes, and other defects.<br>3. Maintain solvent vapor temperature at the center of the superheated vapor zone greater than 5.6°C [10°F] above the solvent's boiling point, and follow manufacturer specified minimum dwell time.<br>4. Maintain the chilled air blanket temperature at less than 30 percent of the solvent's boiling point, as measured at the center of the air blanket.<br>5. Limit the movement of air across the top of the freeboard area of the solvent cleaning machine or within the solvent cleaning machine enclosure to less than 15.2 meters per minute [50 feet (ft) per minute], at any time.<br>6. Determine and use appropriate dwell time for each part type (or parts basket), or determine and use the maximum dwell time using the most complex part type (or parts basket).<br>7. Limit organic solvent emissions to less than 100 ppm of any halogenated hazardous air pollutant (HAP) compound; do not bypass the carbon adsorber during desorption; and locate the lip exhaust above the solvent cleaning machine cover so that the cover closes below the lip exhaust level. | | | |

### Table 4.8: $NO_X$ Emission Limits for Stationary Gas Turbines – Non-Emergency Engines that Began Construction, Modification, or Reconstruction after October 3, 1977 but on or before February 18, 2005(1,2)

| GAS TURBINE HEAT INPUT AT PEAK LOAD | Y(3) | $NO_X$ EMISSION CONCENTRATION(4) |
|---|---|---|
| ≥ 10.56 GJ/hr [10 MMBtu/hr] and < 105.6 GJ/hr [100 MMBtu/hr](5) | Manufacturer's rated heat rate at manufacturer's **rated load** (kilojoules per watt hour) or actual measured heat rate based on LHV of fuel as measured at actual peak load for the facility. | 0.0075(14.4)/Y + F(6) |
| > 105.6 GJ/hr [100 MMBtu/hr](5) | Manufacturer's rated heat rate at manufacturer's **rated peak load** (kilojoules per watt hour) or actual measured heat rate based on LHV of fuel as measured at actual peak load for the facility. | 0.0150(14.4)/Y + F(6) |

Notes:

1. Except as exempted in accordance with Paragraph 4.7.2
2. To ensure compliance with these limits, for units using water or steam injection to control $NO_X$ emissions, install, calibrate, maintain, and operate a continuous monitoring system to monitor and record the fuel consumption and the ratio of water or steam to fuel being fired in the turbine to ensure the average steam or water to fuel ratio falls within the acceptable ratio needed to demonstrate compliance. As an alternative, install, certify, maintain, operate, and quality-assure a CEMS consisting of $NO_X$ and $O_2$ monitors or use a carbon dioxide ($CO_2$) monitor to adjust the measured $NO_X$ concentration to 15 percent $O_2$. For any turbine that does not use water or steam to control $NO_X$ emissions, a CEMS may be used but is not required.
3. The value of Y must not exceed 14.3 kilojoules [13.6 British thermal units (BTU)] per watt hour.
4. Allowable $NO_X$ emission concentration (percent by volume at 15 percent $O_2$ and on a dry basis).
5. Based on the LHV of the fuel fired.
6. F = $NO_X$ emission allowance for fuel-bound nitrogen. The use of F is optional but, if used, is defined according to the nitrogen content of the fuel in Table 4.9.

### Table 4.9: $NO_X$ Emission Allowance for Fuel-Bound Nitrogen

| N (FUEL-BOUND NITROGEN PERCENT BY WEIGHT) | F ($NO_X$ PERCENT BY VOLUME) |
|---|---|
| $N \leq 0.015$ | 0 |
| $0.015 < N \leq 0.1$ | 0.04(N) |
| $0.1 < N \leq 0.25$ | 0.004 + 0.0067(N – 0.1) |
| $N > 0.25$ | 0.005 |

### Table 4.10: $NO_X$ Emission Limits for Stationary Gas Turbines that Began Construction, Modification, or Reconstruction after February 18, 2005[1,2]

| COMBUSTION TURBINE TYPE | COMBUSTION TURBINE HEAT INPUT (EXCEPT AS NOTED) AT PEAK LOAD (HHV) | $NO_X$ EMISSION LIMITS |
|---|---|---|
| New turbine firing natural gas, electric generating | ≤ 53 GJ/hr [50 MMBtu/hr] | 42 ppm at 15 percent $O_2$ or 290 ng/J of useful output [2.3 lb/MWh] |
| New turbine firing natural gas, mechanical drive | ≤ 53 GJ/hr [50 MMBtu/hr] | 100 ppm at 15 percent $O_2$ or 690 ng/J of useful output [5.5 lb/MWh] |
| New turbine firing natural gas | > 53 GJ/hr [50 MMBtu/hr] and 897 GJ/hr [850 MMBtu/hr] | 25 ppm at 15 percent $O_2$ or 150 ng/J of useful output [1.2 lb/MWh] |
| New, modified, or reconstructed turbine firing natural gas | > 897 GJ/hr [850 MMBtu/hr] | 15 ppm at 15 percent $O_2$ or 54 ng/J of useful output [0.43 lb/MWh] |
| New turbine firing fuels other than natural gas, electric generating | ≤ 53 GJ/hr [50 MMBtu/hr] | 96 ppm at 15 percent $O_2$ or 700 ng/J of useful output [5.5 lb/MWh] |
| New turbine firing fuels other than natural gas, mechanical drive | ≤ 53 GJ/hr [50 MMBtu/hr] | 150 ppm at 15 percent $O_2$ or 1,100 ng/J of useful output [8.7 lb/MWh] |
| New turbine firing fuels other than natural gas | > 53 GJ/hr [50 MMBtu/hr] and 897 GJ/hr [850 MMBtu/hr] | 74 ppm at 15 percent $O_2$ or 460 ng/J of useful output [3.6 lb/MWh] |
| New, modified, or reconstructed turbine firing fuels other than natural gas | > 897 GJ/hr [850 MMBtu/hr] | 42 ppm at 15 percent $O_2$ or 160 ng/J of useful output [1.3 lb/MWh] |
| Modified or reconstructed turbine | ≤ 53 GJ/hr [50 MMBtu/hr] | 150 ppm at 15 percent $O_2$ or 1,100 ng/J of useful output [8.7 lb/MWh] |
| Modified or reconstructed turbine firing natural gas | > 53 GJ/hr [50 MMBtu/hr] and 897 GJ/hr [850 MMBtu/hr] | 42 ppm at 15 percent $O_2$ or 250 ng/J of useful output [2.0 lb/MWh] |
| Modified or reconstructed turbine firing fuels other than natural gas | > 53 GJ/hr [50 MMBtu/hr] and 897 GJ/hr [850 MMBtu/hr] | 96 ppm at 15 percent $O_2$ or 590 ng/J of useful output [4.7 lb/MWh] |
| Turbines operating at less than 75 percent of peak load and turbines operating at less than 0°F | ≤ 108 GJ/hr [30 MW] output | 150 ppm at 15 percent $O_2$ or 1,100 ng/J of useful output [8.7 lb/MWh] |

## Table 4.10: $NO_X$ Emission Limits for Stationary Gas Turbines that Began Construction, Modification, or Reconstruction after February 18, 2005,(1,2) Continued

| COMBUSTION TURBINE TYPE | COMBUSTION TURBINE HEAT INPUT (EXCEPT AS NOTED) AT PEAK LOAD (HHV) | $NO_X$ EMISSION LIMITS |
|---|---|---|
| Turbines operating at less than 75 percent of peak load and turbines operating at less than 0°F | > 108 GJ/hr [30 MW] output | 96 ppm at 15 percent $O_2$ or 590 ng/J of useful output [4.7 lb/MWh] |
| Heat recovery units operating independent of the combustion turbine | All sizes | 54 ppm at 15 percent $O_2$ or 110 ng/J of useful output [0.86 lb/MWh] |

ng/J = nanograms per joule
lb/MWh = pound per megawatt-hour
MW = megawatt

Notes:

1. Except as exempted in accordance with Paragraph 4.7.3.
2. To ensure compliance with these limits, if using water or steam injection to control $NO_X$ emissions, install, calibrate, maintain, and operate a continuous monitoring system to monitor and record the fuel consumption and the ratio of water or steam to fuel being fired in the turbine to ensure the average steam or water to fuel ratio falls within the acceptable ratio needed to demonstrate compliance. If not using water or steam injection to control $NO_X$ emissions, conduct annual performance tests (no more than 14 calendar months following the previous performance test) or use continuous parameter monitoring to demonstrate continuous compliance. As an alternative for either case, install, calibrate, maintain, and operate a CEMS.

### Table 4.11: Emergency Compression Ignition RICE Model Years 2007 and After – Emission Limits(1)

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | EMISSIONS LIMITS g/kW-hr [g/HP-hr] | | | | | SMOKE OPACITY (ACCELERATION, LUGGING, PEAK OF LUGGING OR ACCELERATION)(2) |
|---|---|---|---|---|---|---|---|
| | | NMHC | NMHC + NO$_X$ | NO$_X$ | PM | CO | |
| kW < 8<br>HP < 11] | 2007 | | 7.5 [5.6] | | 0.8 [0.6] | 8 [6.0] | 20/15/50% |
| | 2008 and later | | | | 0.4 [0.3] | | |
| 8 ≤ kW < 19<br>[11 ≤ HP < 25] | 2007 | | 7.5 [5.6] | | 0.8 [0.6] | 6.6 [4.9] | |
| | 2008 and later | | | | 0.4 [0.3] | | |
| 19 ≤ kW < 37<br>[25 ≤ HP < 50] | 2007 | | 7.5 [5.6] | | 0.6 [0.4] | 5.5 [4.1] | |
| | 2008 and later | | | | 0.3 [0.22] | | |
| 37 ≤ kW < 56<br>[50 ≤ HP < 75] | 2007 | | 7.5 [5.6] | | 0.4 [0.3] | 5.0 [3.7] | |
| | 2008 and later | | 4.7 [3.5] | | | | |
| 56 ≤ kW < 75<br>[75 ≤ HP < 101] | 2007 | | 7.5 [5.6] | | 0.4 [0.3] | 5.0 [3.7] | |
| | 2008 and later | | 4.7 [3.5] | | | | |
| 75 ≤ kW < 130<br>[101 ≤ HP < 171] | 2007 and later | | 4.0 [3.0] | | 0.3 [0.22] | 5.0 [3.7] | |
| 130 ≤ kW < 225<br>[171 ≤ HP < 302] | | | 4.0 [3.0] | | 0.2 [0.15] | 3.5 [2.6] | |
| 225 ≤ kW < 450<br>[302 ≤ HP < 603] | | | 4.0 [3.0] | | 0.2 [0.15] | 3.5 [2.6] | |
| 450 ≤ kW < 560<br>[603 ≤ HP < 751] | | | 4.0 [3.0] | | 0.2 [0.15] | 3.5 [2.6] | |
| 560 ≤ kW < 900<br>[751 ≤ HP < 1207] | | | 6.4 [4.8] | | 0.2 [0.15] | 3.5 [2.6] | |
| 900 ≤ kW < 2,237<br>[1207 ≤ HP < 3,000] | | | 6.4 [4.8] | | 0.2 [0.15] | 3.5 [2.6] | |
| kW ≥ 2,237<br>[HP ≥ 3,000 ] | 2007 – 2010 | 1.3 [1.0] | 6.4 [4.8] | 9.2 [6.9] | 0.54 [0.4] | 11.4 [8.5] | |
| | 2011 and later | | | | 0.2 [0.15] | 3.5 [2.6] | |

## Table 4.11: Emergency Compression Ignition RICE Model Years 2007 and After – Emission Limits,(1) Continued

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | EMISSIONS LIMITS g/kW-hr [g/HP-hr] | | | | | SMOKE OPACITY (ACCELERATION, LUGGING, PEAK OF LUGGING OR ACCELERATION)(2) |
|---|---|---|---|---|---|---|---|
| | | NMHC | NMHC + $NO_X$ | $NO_X$ | PM | CO | |

HP = horsepower
kW = kilowatt
NMHC = nonmethane hydrocarbons
g/HP-hr = grams per horsepower hour
g/kW-hr = grams per kilowatt hour

Notes:

1. Emissions limits in this table do not apply to fire pump engines; refer to Table 4.15.
2. Exhaust smoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak).

**Table 4.12: Non-Emergency Compression Ignition RICE Model Years 2007 and After – Emission Limits**

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | EMISSIONS LIMITS g/kW-hr [g/HP-hr] | | | | | SMOKE OPACITY (ACCELERATION, LUGGING, PEAK OF LUGGING, OR ACCELERATION)(1) |
|---|---|---|---|---|---|---|---|
| | | NMHC | NMHC + $NO_X$ | $NO_X$ | PM | CO | |
| kW < 8<br>[HP < 11] | 2007 | | 7.5 [5.6] | | 0.8 [0.6] | 8.0 [6.0] | 20/15/50% |
| | 2008 – 2014 | | | | 0.4 [0.3] | | |
| | 2015 and later | | | | 0.4 [0.3] | | |
| 8 ≤ kW < 19<br>[11 ≤ HP < 25] | 2007 | | 7.5 [5.6] | | 0.8 [0.6] | 6.6 [4.9] | |
| | 2008 – 2014 | | | | 0.4 [0.3] | | |
| | 2015 and later | | | | 0.4 [0.3] | | |
| 19 ≤ kW < 37<br>[25 ≤ HP < 50] | 2007 | | 7.5 [5.6] | | 0.6 [0.4] | 5.5 [4.1] | |
| | 2008 – 2012 | | 7.5 [5.6] | | 0.3 [0.22] | | |
| | 2013 – 2014 | | 7.5 [5.6] | | 0.03 [0.02] | | |
| | 2015 and later | | 4.7 [3.5] | | 0.03 [0.02] | | |
| 37 ≤ kW < 56<br>[50 ≤ HP < 75] | 2007 | | 7.5 [5.6] | | 0.4 [0.3] | 5.0 [3.7] | |
| | 2008 – 2012 | | 4.7 [3.5] | | 0.3 [0.22] | | |
| | 2013 – 2014 | | 4.7 [3.5] | | 0.03 [0.02] | | |
| | 2015 and later | | 4.7 [3.5] | | 0.03 [0.02] | | |
| 56 ≤ kW < 75<br>[75 ≤ HP < 101] | 2007 | | 7.5 [5.6] | | 0.4 [0.3] | 5.0 [3.7] | |
| | 2008 – 2011 | | 4.7 [3.5] | | 0.4 [0.3] | | |
| | 2012 – 2013 | 0.19 [0.14] | | 0.4 [0.3] | 0.2 [0.15] | | |
| | 2014 and later | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| 75 ≤ kW < 130<br>[101 ≤ HP < 171] | 2007 – 2011 | | 4.0 [3.0] | | 0.3 [0.22] | 5.0 [3.7] | 20/15/50% |
| | 2012 – 2013 | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| | 2014 and later | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| 130 ≤ kW < 225<br>[171 ≤ HP < 302] | 2007 – 2010 | | 4.0 [3.0] | | 0.2 [0.15] | 3.5 [2.6] | |
| | 2011 – 2013 | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| | 2014 and later | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |

## Table 4.12: Non-Emergency Compression Ignition RICE Model Years 2007 and After – Emission Limits, Continued

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | EMISSIONS LIMITS g/kW-hr [g/HP-hr] | | | | | SMOKE OPACITY (ACCELERATION, LUGGING, PEAK OF LUGGING OR ACCELERATION)(1) |
|---|---|---|---|---|---|---|---|
| | | NMHC | NMHC + $NO_X$ | $NO_X$ | PM | CO | |
| 225 ≤ kW < 450<br>[302 ≤ HP < 603] | 2007 – 2010 | | 4.0 [3.0] | | 0.2 [0.15] | 3.5 [2.6] | 20/15/50% |
| | 2011 – 2013 | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| | 2014 and later | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| 450 ≤ kW < 560<br>[603 ≤ HP < 751] | 2007 – 2010 | | 4.0 [3.0] | | 0.2 [0.15] | 3.5 [2.6] | |
| | 2011 – 2013 | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| | 2014 and later | 0.19 [0.14] | | 0.4 [0.3] | 0.02 [0.015] | | |
| 560 ≤ kW < 900<br>[751 ≤ HP < 1207] | 2007 – 2010 | | 6.4 [4.8] | | 0.2 [0.15] | 3.5 [2.6] | |
| | 2011 – 2014 | 0.4 [0.3] | | 3.5 [2.6] | 0.1 [0.075] | | |
| | 2015 and later | 0.19 [0.14] | | 0.67 [0.5] | 0.03 [0.02] | | |
| 900 ≤ kW < 2,237<br>[1207 ≤ HP < 3,000] | 2007 – 2010 | | 6.4 [4.8] | | 0.2 [0.15] | 3.5 [2.6] | |
| | 2011 – 2014 | 0.4 [0.3] | | 0.67 [0.5] | 0.1 [0.075] | | |
| | 2015 and later | 0.19 [0.14] | | 0.67 [0.5] | 0.03 [0.02] | | |
| 2,237 ≤ kW<br>[3,000 ≤ HP] | 2007 – 2010 | 1.3 [1.0] | | 9.2 [6.9] | 0.54 [0.4] | 11.4 [8.5] | |
| | 2011 – 2014 | | 6.4 [4.8] | | 0.2 [0.15] | 3.5 [2.6] | |
| | 2015 and later | 0.19 [0.14] | | 0.67 [0.5] | 0.03 [0.02] | 3.5 [2.6] | |

Note:
1. Exhaust smoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak).

### Table 4.13: Compression Ignition RICE Pre 2007a Model Year and 2007 to 2010 Model Years Rated > 2,237 kW [3,000 HP](1) – Emission Limits(2)

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | EMISSION LIMITS g/kW-hr [g/HP-hr] | | | | |
|---|---|---|---|---|---|---|
| | | NMHC + $NO_X$ | HC | $NO_X$ | CO | PM |
| kW < 8<br>[HP < 11] | 2006 and earlier | 10.5 [7.8] | | | 8.0 [6.0] | 1.0 [0.75] |
| 8 ≤ kW < 19<br>[11 ≤ HP < 25] | 2006 and earlier | 9.5 [7.1] | | | 6.6 [4.9] | 0.80 [0.60] |
| 19 ≤ kW < 37<br>[25 ≤ HP < 50] | 2006 and earlier | 9.5 [7.1] | | | 5.5 [4.1] | 0.80 [0.60] |
| 37 ≤ kW < 56<br>[50 ≤ HP < 75] | 2006 and earlier | | | 9.2 [6.9] | | |
| 56 ≤ kW < 75<br>[75 ≤ HP < 101] | 2006 and earlier | | | 9.2 [6.9] | | |
| 75 ≤ kW < 130<br>[101 ≤ HP < 175] | 2006 and earlier | | | 9.2 [6.9] | | |
| 130 ≤ kW < 225<br>[175 ≤ HP < 300] | 2006 and earlier | | 1.3 [1.0] | 9.2 [6.9] | 11.4 [8.5] | 0.54 [0.40] |
| 225 ≤ kW < 450<br>[300 ≤ HP < 600] | 2006 and earlier | | 1.3 [1.0] | 9.2 [6.9] | 11.4 [8.5] | 0.54 [0.40] |
| 450 ≤ kW < 560<br>[600 ≤ HP < 750] | 2006 and earlier | | 1.3 [1.0] | 9.2 [6.9] | 11.4 [8.5] | 0.54 [0.40] |
| kW ≥ 560<br>[HP ≥ 750] | 2006 and earlier | | 1.3 [1.0] | 9.2 [6.9] | 11.4 [8.5] | 0.54 [0.40] |
| kW ≥ 2,237<br>[HP ≥ 3,000] | 2007 – 2010 | | 1.3 [1.0] | 9.2 [6.9] | 11.4 [8.5] | 0.54 [0.40] |

HC = hydrocarbon

Notes:

1. The pre-2007 model year RICE subject to these emission limits include model year 2006 RICE manufactured after April 1, 2006 and any pre-2007 RICE reconstructed after July 11, 2005. For this table, “reconstructed” means the replacement of components to such an extent that the fixed capital cost of the new components exceeds 75 percent of the fixed capital cost that would be required to construct a comparable new engine.
2. Emission limits in this table do not apply to fire pump engines.

**Table 4.14: Non-Emergency Compression Ignition RICE Manufactured On or Before April 1, 2006 – Emission Limits(1)**

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | CO(2) |
|---|---|---|
| $225 \leq kW < 373$<br>$[300 \leq HP < 500]$ | 2006 and earlier | 49 ppmvd at 15% $O_2$ or 70% reduction |
| $kW \geq 373$<br>$[HP \geq 500]$ | 2006 and earlier | 23 ppmvd at 15% $O_2$ or 70% reduction |

ppmvd = parts per million by volume, dry basis

Notes:

1. Pre-2007 model year RICE that are reconstructed after July 11, 2005 are subject to the emission limits in Table 4.13 instead of Table 4.14. For this table, "reconstructed" means the replacement of components to such an extent that the fixed capital cost of the new components exceeds 75 percent of the fixed capital cost that would be required to construct a comparable new engine.
2. Compliance with the CO emission limits typically requires installation of a control device, such as an oxidation catalyst.

### Table 4.15: Fire Pump Compression Ignition RICE Model Years 2007 and After – Emission Limits

| ENGINE POWER RANGE | ENGINE MODEL YEAR RANGE | EMISSIONS LIMITS g/kW-hr [g/HP-hr] | | | SMOKE OPACITY (ACCELERATION, LUGGING, PEAK OF LUGGING OR ACCELERATION)[1] |
|---|---|---|---|---|---|
| | | NMHC + NOx | PM | CO | |
| kW < 8 [HP < 11] | 2007 – 2010 | 10.5 [7.8] | 1.0 [0.75] | 8.0 [6.0] | 20/15/50% |
| | 2011 and later | 7.5 [5.6] | 0.4 [0.3] | | |
| 8 ≤ kW < 19 [11 ≤ HP < 25] | 2007 – 2010 | 9.5 [7.1] | 0.8 [0.6] | 6.6 [4.9] | |
| | 2011 and later | 7.5 [5.6] | 0.4 [0.3] | | |
| 19 ≤ kW < 37 [25 ≤ HP < 50] | 2007 – 2010 | 9.5 [7.1] | 0.8 [0.6] | 5.5 [4.1] | |
| | 2011 and later | 7.5 [5.6] | 0.3 [0.22] | | |
| 37 ≤ kW < 56 [50 ≤ HP < 75] | 2007 – 2010 | 10.5 [7.8] | 0.8 [0.6] | 5.0 [3.7] | |
| | 2011 and later | 4.7 [3.5] | 0.4 [0.3] | | |
| 56 ≤ kW < 75 [75 ≤ HP < 101] | 2007 – 2010 | 10.5 [7.8] | 0.8 [0.6] | 5.0 [3.7] | |
| | 2011 and later | 4.7 [3.5] | 0.4 [0.3] | | |
| 75 ≤ kW < 130 [101 ≤ HP < 171] | 2007 – 2009 | 10.5 [7.8] | 0.8 [0.6] | 5.0 [3.7] | |
| | 2010 and later | 4.0 [3.0] | 0.3 [0.22] | | |
| 130 ≤ kW < 225 [171 ≤ HP < 302] | 2007 – 2008 | 10.5 [7.8] | 0.54 [0.40] | 3.5 [2.6] | |
| | 2009 and later | 4.0 [3.0] | 0.2 [0.15] | | |
| 225 ≤ kW < 450 [302 ≤ HP < 603) | 2007 – 2008 | 10.5 [7.8] | 0.54 [0.40] | 3.5 [2.6] | |
| | 2009 and later | 4.0 [3.0] | 0.2 [0.15] | | |
| 450 ≤ kW < 560 [603 ≤ HP < 751) | 2007 – 2008 | 10.5 [7.8] | 0.54 [0.40] | 3.5 [2.6] | |
| | 2009 and later | 4.0 [3.0] | 0.2 [0.15] | | |
| kW ≥ 560 [HP ≥ 751] | 2007 | 10.5 [7.8] | 0.54 [0.40] | 3.5 [2.6] | |
| | 2008 and later | 6.4 [4.8] | 0.2 [0.15] | | |

Note:

1. Exhaust smoke opacity is expressed in percentage for acceleration, lugging, and peak modes (acceleration/lugging/peak).

### Table 4.16: Compression Ignition RICE Purchased Before June 12, 2006 – Work Practice Standards

| ENGINE POWER RANGE | WORK PRACTICE STANDARDS<br>Perform annually or at the frequency listed below, whichever comes first | | |
|---|---|---|---|
| | Change Oil and Filter[(1)] | Inspect Air Cleaner; Replace As Necessary | Inspect All Hoses and Belts; Replace as Necessary |
| Emergency Engines – All Power Ranges | 500 hours | 1,000 hours | 500 hours |
| Non-Emergency Engines<br>kW ≤ 225<br>[HP ≤ 300] | 1,000 hours | 1,000 hours | 500 hours |

Note:

1. The oil change requirement specified in this table may be extended through the use of an oil analysis program performed at the same frequency specified in the table for changing the oil. At a minimum, the oil analysis program must analyze the following parameters for compression ignition engines: total base number, viscosity, and percent water content. The oil life may be extended if the analysis indicates the oil meets the following specifications: the total base number is not less than 30 percent of the total base number of the oil when new; the viscosity of the oil has not changed by more than 20 percent from the viscosity of the oil when new; and the percent water content (by volume) is not greater than 0.5.

### Table 4.17: Emergency Spark Ignition RICE Purchased or Reconstructed On or After June 12, 2006 – Emission Limits

| FUEL TYPE | ENGINE POWER RANGE | MANUFACTURED DATE(1) | EMISSION LIMITS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | g/kW-hr [g/HP-hr] | | | | ppmvd at 15% $O_2$ | | |
| | | | HC + $NO_X$ | $NO_X$ | CO | VOC | $NO_X$ | CO | VOC |
| All | kW < 19 [HP < 25] | July 1, 2008 to December 31, 2010 | 13.4 [10.0] | | 519 [387] | | | | |
| | | On or After January 1, 2011 | 8.0 [6.0] | | 610 [455] | | | | |
| Natural Gas and Liquefied Petroleum Gas (LPG)(2) | 19 ≤ kW < 99 [25 ≤ HP < 130] | On or After January 1, 2009 | 13.4 [10.0] | | 519 [387] | | | | |
| | kW ≥ 99 [HP ≥ 130] | On or After January 1, 2009 | | 2.7 [2.0] | 5.4 [4.0] | 1.3 [1.0] | 160 | 540 | 86 |
| Gasoline | 19 ≤ kW < 99 [25 < HP < 130] | On or After January 1, 2009 | 13.4 [10.0] | | 519 [387] | | | | |
| | kW ≥ 99 [HP ≥ 130] | On or After January 1, 2009 | 2.7 [2.0] | | 4.4 [3.3] | | | | |

VOC = volatile organic compound
ppmvd = parts per million by volume, dry basis

Notes:

1. Reconstructed engines with a manufactured date prior to July 1, 2009 (prior to July 1, 2008 for engines < 19 kW) must meet the standards applicable to engines manufactured on January 1, 2009 (on July 1, 2008 for engines < 19 kW).
2. Demonstrate compliance in either g/kW-hr or ppmvd at 15 percent $O_2$.

**Table 4.18: Non-Emergency Spark Ignition RICE Purchased or Reconstructed On or After June 12, 2006 – Emission Limits**

| ENGINE TYPE AND FUEL | ENGINE POWER RANGE | MANUFACTURED ON OR AFTER[1] | EMISSION LIMITS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | g/kW-h [g/HP-hr] | | | | ppmvd at 15% $O_2$ | | |
| | | | HC + $NO_X$ | $NO_X$ | CO | VOC[2] | $NO_X$ | CO | VOC[2] |
| All | kW < 19<br>[HP < 25] | July 1, 2008 to December 31, 2010 | 13.4<br>[10.0] | | 519<br>[387] | | | | |
| | | January 1, 2011 | 8.0<br>[6.0] | | 610<br>[455] | | | | |
| Rich Burn LPG | kW ≥ 19<br>[HP ≥ 25] | July 1, 2008 | 2.7<br>[2.0] | | 4.4<br>[3.3] | | | | |
| Natural Gas[2,3] and Lean Burn LPG[2,3] (except Lean Burn 500 ≤ HP < 1,350) | 19 ≤ kW < 75<br>[25 ≤ HP < 100] | July 1, 2008 | 2.7<br>[2.0] | | 4.4<br>[3.3] | | | | |
| | 75 ≤ kW < 373<br>[100 ≤ HP < 500] | July 1, 2008 | | 2.7<br>[2.0] | 5.4<br>[4.0] | 1.3<br>[1.0] | 160 | 540 | 86 |
| | | January 1, 2011 | | 1.3<br>[1.0] | 2.7<br>[2.0] | 0.9<br>[0.7] | 82 | 270 | 60 |
| | kW ≥ 373<br>[HP ≥ 500] | July 1, 2007 | | 2.7<br>[2.0] | 5.4<br>[4.0] | 1.3<br>[1.0] | 160 | 540 | 86 |
| | | July 1, 2010 | | 1.3<br>[1.0] | 2.7<br>[2.0] | 0.9<br>[0.7] | 82 | 270 | 60 |
| Lean Burn Natural Gas[2] and LPG[2] | 373 ≤ kW < 1007<br>[500 ≤ HP < 1,350] | January 1, 2008 | | 2.7<br>[2.0] | 5.4<br>[4.0] | 1.3<br>[1.0] | 160 | 540 | 86 |
| | | July 1, 2010 | | 1.3<br>[1.0] | 2.7<br>[2.0] | 0.9<br>[0.7] | 82 | 270 | 60 |

### Table 4.18: Non-Emergency Spark Ignition RICE Purchased or Reconstructed On or After June 12, 2006 – Emission Limits, Continued

| ENGINE TYPE AND FUEL | ENGINE POWER RANGE | MANUFACTURED ON OR AFTER(1) | EMISSION LIMITS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | g/kW-h [g/HP-hr] | | | | ppmvd at 15% $O_2$ | | |
| | | | HC + $NO_X$ | $NO_X$ | CO | VOC(2) | $NO_X$ | CO | VOC(2) |
| Gasoline(4) | kW ≥ 19<br>[HP ≥ 25] | July 1, 2008 | 2.7 [2.0](4) | | 4.4<br>[3.3] | NA | | | |

ppmvd = parts per million by volume, dry basis

Notes:

1. Reconstructed engines with a manufactured date prior to July 1, 2008 (prior to July 1, 2007 for natural gas and lean burn LPG engines > 373 kW or prior to January 1, 2008 for lean burn natural gas and LPG engines in the range of 373 to 1007 kW) must meet the standards applicable to engines manufactured on July 1, 2008 (on July 1, 2007 for natural gas and lean burn LPG engines > 373 kW or on January 1, 2008 for lean burn natural gas and LPG engines in the range of 373 to 1007 kW).
2. Demonstrate compliance in units of g/HP-hr or ppmvd at 15 percent $O_2$.
3. Excluding emissions of formaldehyde.
4. Can demonstrate compliance by either meeting the numeric limit or $(HC + NO_X) \times CO^{0.784}$ less than or equal to 8.57, where the maximum $NO_X$ is 2.7 g/kW-hr and maximum CO is 20.6 g/kW-hr.

## Table 4.19: Non-Emergency Spark Ignition RICE Manufactured Before July 1, 2007[(1)] – Pollution Control Requirements

| ENGINE POWER RANGE | ANNUAL OPERATION TIME | BURN TYPE | POLLUTION CONTROL REQUIRED TO BE INSTALLED |
|---|---|---|---|
| kW ≥ 373<br>[HP ≥ 500] | > 24 hours per year | 4SLB | Install an oxidation catalyst to reduce HAP emissions |
| | | 2SLB or 4SRB | |
| | ≤ 24 hours per year | 4SRB | Install non-selective catalytic reduction to reduce HAP emissions |
| | | 2SLB or 4SLB | |

2SLB = 2-stroke lean burn
4SLB = 4-stroke lean burn
4SRB = 4-stroke rich burn

Note:

1. Manufactured before July 1, 2008 for lean burn engines with a maximum engine power greater than or equal to 373 kW [500 HP] and less than 1,007 kW [1,350 HP].

### Table 4.20: Spark Ignition RICE Manufactured Before June 12, 2006 – Work Practice Standards

| ENGINE POWER RANGE | ENGINE IGNITION TYPE | WORK PRACTICE STANDARDS Perform annually or at the frequency listed below, whichever comes first | | | |
|---|---|---|---|---|---|
| | | Change Oil and Filter(1) | Inspect Air Cleaner; Replace As Necessary | Inspect All Hoses and Belts; Replace as Necessary | Inspect Spark Plugs; Replace as Necessary |
| Emergency Engines – All Power Ranges | | 500 hours | 1,000 hours | 500 hours | |
| Non-Emergency Engines – All Power Ranges | 2 SLB | 4,320 hours | | 4,320 hours | 4,320 hours |
| Non-Emergency Engines kW ≤ 373 [HP ≤ 500] | 4SLB or 4SRB | 1,440 hours | | 1,440 hours | 1,440 hours |
| Non-Emergency Engines kW > 373 [HP > 500] | 4SLB or 4SRB | 500 hours | | 500 hours | 1,000 hours |

Note:

1. The oil change requirement specified in this table may be extended through the use of an oil analysis program, performed at the same frequency specified in the table for changing the oil. At a minimum, the oil analysis program must analyze the following parameters for spark ignition engines: total acid number, viscosity, and percent water content. The oil life may be extended if the analysis indicates the oil meets the following specifications: The total acid number does not increase by more than 3.0 mg of potassium hydroxide per gram from the total acid number of the oil when new; the viscosity of the oil has not changed by more than 20 percent from the viscosity of the oil when new; and the percent water content (by volume) is not greater than 0.5.

**Table 4.21: Class I ODS Chemicals**

| CHEMICAL NAME[(1)] | SYMBOL | CAS NO. | REF NO. | COMMON NAME |
|---|---|---|---|---|
| FIRE SUPPRESSANTS | | | | |
| Bromochlorodifluoromethane | $CF_2ClBr$ | 353-59-3 | Halon 1211 | |
| Bromotrifluoromethane | $CF_3Br$ | 75-63-8 | Halon 1301 | |
| Dibromotetrafluoroethane | $C_2F_4Br_2$ | 124-73-2 | Halon 2402 | |
| Chlorobromomethane | $CH_2BrCl$ | 74-97-5 | Halon 1011 | CBM |
| Bromodifluoromethane | HBFC-12B1 | 1511-62-2 | Halon 1201 | FM-100 |
| REFRIGERANTS | | | | |
| Trichlorofluoromethane | CFC-11 | 75-69-4 | R-11 | Freon 11 |
| Dichlorodifluoromethane | CFC-12 | 75-71-8 | R-12 | Freon 12 |
| Chlorotrifluoromethane | CFC-13 | 75-72-9 | R-13 | Freon 13 |
| Pentachlorofluoroethane | CFC-111 | 354-58-5 | R-111 | |
| Tetrachlorodifluoroethane | CFC-112 | 76-12-0 | R-112 | |
| Dichlorotetrafluoroethane | CFC-114 | 76-14-2 | R-114 | |
| Chloropentafluoroethane | CFC-115 | 76-15-3 | R-115 | |
| Heptachlorofluoropropane | CFC-211 | 422-78-6 | | |
| Hexachlorodifluoropropane | CFC-212 | 3182-26-1 | | |
| Pentachlorotrifluoropropane | CFC-213 | 2354-06-5 | | |
| Tetrachlorotetrafluoropropane | CFC-214 | 29255-31-0 | | |
| Trichloropentafluoropropane | CFC-215 | 4259-43-2 | | |
| Dichlorohexafluoropropane | CFC-216 | 661-97-2 | | |
| Chloroheptafluoropropane | CFC-217 | 422-86-6 | | |
| REFRIGERANT BLENDS | | | | |
| R-12 (74%) and HFC-152a (26%) | | | R-500 | |
| R-12 (25%) and R-22 (75%) | | | R-501 | |
| R-115 (51%) and R-22 (49%) | | | R-502 | |
| R-13 (59.9%) and HFC-23 (40.1%) | | | R-503 | |

## Table 4.21: Class I ODS Chemicals, Continued

| CHEMICAL NAME[1] | SYMBOL | CAS NO. | REF NO. | COMMON NAME |
|---|---|---|---|---|
| OTHERS | | | | |
| Tetrachloromethane | $CCl_4$ | 56-23-5 | solvent | Carbon tetrachloride |
| 1,1,1 Trichloroethane | TCA | 71-55-6 | solvent | Methyl chloroform |
| Trichlorotrifluoroethane | CFC-113 | 76-13-1 | solvent | Freon 113 |
| Bromomethane | MBX | 74-83-9 | pesticide | Methyl bromide |

<u>Note</u>:

1. All isomers of these chemicals are ODSs, except isomers of 1,1,1-trichloroethane (also known as methyl chloroform) such as 1,1,2-trichloroethane.

## Table 4.22: Class II ODS Chemicals

| CHEMICAL NAME(1) | HCFC | SYMBOL | CAS NO. | REF NO. | COMMON NAME |
|---|---|---|---|---|---|
| FIRE SUPPRESSANTS | | | | | |
| Dichlorotrifluoroethane | HCFC-123 | $C_2HF_3Cl_2$ | 306-83-2 | R-123 | Halotron I |
| REFRIGERANTS | | | | | |
| Dichlorofluoromethane | HCFC-21 | $CHFCl_2$ | 75-43-4 | R-21 | Freon 21 |
| Monochlorodifluoromethane | HCFC-22 | $CHF_2Cl$ | 75-45-6 | R-22 | Freon 22,<br>Genetron 22,<br>Forane 22,<br>Refron 22 |
| Monochlorofluoromethane | HCFC-31 | $CH_2FCl$ | 593-70-4 | R-31 | Genetron 31 |
| Dichlorotrifluoroethane | HCFC-123 | $C_2HF_3Cl_2$ | 306-83-2 | R-123 | Suva 123,<br>Freon 123,<br>Genetron 123,<br>Halotron I |
| Monochlorotetrafluoroethane | HCFC-124 | $C_2HF_4Cl$ | 2837-89-0 | R-124 | Suva 124,<br>Freon 124,<br>Genetron 124, FE-241 |
| Trichlorofluoroethane | HCFC-131 | $C_2H_2FCl_3$ | 359-28-4 | | |
| Dichlorodifluoroethane | HCFC-132b | $C_2H2F_2Cl_2$ | 1649-08-7 | | |
| Monochlorotrifluoroethane | HCFC- 133a | $C_2H_2F_3Cl$ | 75-88-7 | | |
| Monochlorodifluoroethane | HCFC- 142b | $C_2H_3F_2Cl$ | 75-68-3 | R-142b | Genetron 142b |
| Hexachlorofluoropropane | HCFC-221 | $C_3HFCl_6$ | 422-26-4 | | |
| Pentachlorodifluoropropane | HCFC-222 | $C_3HF_2Cl_5$ | 422-49-1 | | |
| Tetrachlorotrifluoropropane | HCFC-223 | $C_3HF_3Cl_4$ | 422-52-6 | | |
| Trichlorotetrafluoropropane | HCFC-224 | $C_3HF_4Cl_3$ | 422-54-8 | | |
| Monochlorohexafluoropropane | HCFC-226 | $C_3HF_6Cl$ | 431-87-8 | | |
| Pentachlorofluoropropane | HCFC-231 | $C_3H_2FCl_5$ | 421-94-3 | | |
| Tetrachlorodifluoropropane | HCFC-232 | $C_3H_2F_2Cl_4$ | 460-89-9 | | |
| Trichlorotrifluoropropane | HCFC-233 | $C_3H_2F_3Cl_3$ | 7125-84-0 | | |

## Table 4.22: Class II ODS Chemicals, Continued

| CHEMICAL NAME[(1)] | HCFC | SYMBOL | CAS NO. | REF NO. | COMMON NAME |
|---|---|---|---|---|---|
| REFRIGERANTS, continued | | | | | |
| Dichlorotetrafluoropropane | HCFC-234 | $C_3H_2F_4Cl_2$ | 425-94-5 | | |
| Monochloropentafluoropropane | HCFC-235 | $C_3H_2F_5Cl$ | 460-92-4 | | |
| Tetrachlorofluoropropane | HCFC-241 | $C_3H_3FCl_4$ | 666-27-3 | | |
| Trichlorodifluoropropane | HCFC-242 | $C_3H_3F_2Cl_3$ | 460-63-9 | | |
| Dichlorotrifluoropropane | HCFC-243 | $C_3H_3F_3Cl_2$ | 460-69-5 | | |
| Monochlorotetrafluoropropane | HCFC-244 | $C_3H_3F_4Cl$ | 134190-50-5 | | |
| Trichlorofluoropropane | HCFC-251 | $C_3H_4FCl_3$ | 421-41-0 | | |
| Dichlorodifluoropropane | HCFC-252 | $C_3H_4F_2Cl_2$ | 819-00-1 | | |
| Monochlorotrifluoropropane | HCFC-253 | $C_3H_4F_3Cl$ | 460-35-5 | | |
| Dichlorofluoropropane | HCFC-261 | $C_3H_5FCl_2$ | 420-97-3 | | |
| Monochlorodifluoropropane | HCFC-262 | $C_3H_5F_2Cl$ | 421-02-3 | | |
| Monochlorofluoropropane | HCFC-271 | $C_3H_6FCl$ | 430-55-7 | | |
| OTHERS | | | | | |
| Tetrachlorofluoroethane | HCFC-121 | | 354-14-3 | | lubricant |
| Trichlorodifluoroethane | HCFC-122 | | 41834-16-6 | | lubricant |
| Dichlorofluoroethane | HCFC-141b | | 1717-00-6 | | solvent |
| Dichloropentafluoropropane | HCFC-225ca | | 422-56-0 | | solvent |
| Dichloropentafluoropropane | HCFC-225cb | | 507-55-1 | | solvent |

HCFC = hydrochlorofluorocarbon

Note:

1. All isomers of these chemicals are ODSs, except isomers of 1,1,1-trichloroethane (also known as methyl chloroform) such as 1,1,2-trichloroethane.

### Table 4.23: Class II ODS Blend Chemicals

| CHEMICAL NAME(1) | SYMBOL | CAS NO. | REF NO. | COMMON NAME |
|---|---|---|---|---|
| FIRE SUPPRESSANT BLENDS | | | | |
| R-22 (82%), R-124 (9.5%) and R-123 (4.75%) | | | NAF S III | |
| R-123 (55%), R-124 (31%) and R-134a | | | NAF P III | |
| REFRIGERANT BLENDS | | | | |
| R-22 (53%), R-124 (34%) and R-152a | | | R-401A | MP-39 |
| R-22 (61%), R-124 (28%) and R-152a | | | R-401B | MP-66 |
| R-22 (33%), R-124 (52%) and R-152a | | | R-401C | MP-52 |
| R-22 (38%), R-125 and propane | | | R-402A | HP-80 |
| R-22 (60%), R-125 and propane | | | R-402B | HP-81 |
| R-22 (75%), octafluoropropane and propane | | | R-403A | |
| R-22 (55%), octafluoropropane and propane | | | R-403B | |
| R-22 (45%), R-142b (5.5%), R-152a and octafluorocyclobutane | | | R-405A | G2015 |
| R-22 (55%), R-142b (41%) and isobutene | | | R-406A | Autofrost |
| R-22 (47%), R-143a and R-125 | | | R-408A | |
| R-22 (60%), R-124 (25%) and R-142b (15%) | | | R-409A | FX-56 |
| R-22 (65%), R-124 (25%) and R-142b (10%) | | | R-409B | FX-57 |
| R-22 (87.5%), R-152a and propylene | | | R-411A | G2018A |
| R-22 (94%), R-152a and propylene | | | R-411B | G2018B |
| R-22 (70%), R-142b (25%) and octafluoropropane | | | R-412A | |

**Table 4.23: Class II ODS Blend Chemicals, Continued**

| CHEMICAL NAME(1) | SYMBOL | CAS NO. | REF NO. | COMMON NAME |
|---|---|---|---|---|
| REFRIGERANT BLENDS, continued | | | | |
| R-22 (51%), R-124 (28.5%), R-142b (16.5%) and isopropane | | | R-414A | GHG-X4 |
| R-22 (50%), R-124 (39%), R-142b (9.5%) and isopropane | | | R-414B | Hot Shot |
| R-22 (82%) and R-152a | | | R-415A | |
| R-22 (25%) and R-152a | | | R-415B | |
| R-124 (39.5%), R-134a and butane | | | R-416A | FR-12, FRIG-C |
| R-22 (96%), R-152a and propane | | | R-418A | |
| R-142b (12%) and R-134a | | | R-420A | |
| R-22 (44%) and octafluoropropane | | | R-509 | |

Note:
1. All isomers of these chemicals are ODSs, except isomers of 1,1,1-trichloroethane (also known as methyl chloroform) such as 1,1,2-trichloroethane.

# APPENDIX 4A: JAPANESE AIR EMISSION STANDARDS

## Table 4.24: Emission Standards for Soot/Dust and $NO_X$ (Boilers and Stationary RICE/Turbines)

| FACILITY TYPE | SPECIFICATION | SOOT AND DUST(1) | | | | $NO_X$(1) | | |
|---|---|---|---|---|---|---|---|---|
| | | TOTAL EMISSION ($Nm^3$/hr) | GENERAL AREA(2) ($g/Nm^3$) | SPECIAL AREA(3) ($g/Nm^3$) | STANDARD OXYGEN % (On)(4) | TOTAL EMISSION ($Nm^3$/hr) | STANDARD (ppm) | STANDARD OXYGEN % (On)(4) |
| Boiler(5) | Gas boiler (heating area ≥ 10 $m^2$) | ≥ 40,000 | 0.05 | 0.03 | 5.0 | ≥ 500,000 | 60 | 5.0 |
| | | | | | | ≥ 40,000 but < 500,000 | 100 | |
| | | < 40,000 | 0.10 | 0.05 | | ≥ 10,000 but < 40.000 | 130 | |
| | | | | | | < 10,000 | 150 | |
| | Liquid boiler or gas and liquid boiler (heating area ≥ 10 $m^2$) | ≥ 200,000 | 0.05 | 0.04 | 4.0 | ≥ 500,000 | 130 | 4.0 |
| | | ≥ 40,000 but < 200,000 | 0.15 | 0.05 | | ≥ 10,000 but < 500,000 | 150 | |
| | | ≥ 10,000 but < 40,000 | 0.25 | 0.15 | | | | |
| | | < 10,000 | 0.30 | 0.15 | | < 10,000 | 180 | |
| | Black liquid boiler or black liquid and gas or liquid fuel boiler (heating area ≥ 10 $m^2$) | ≥ 200,000 | 0.15 | 0.10 | | ≥ 500,000 | 130 | 4.0 |
| | | ≥ 40,000 but < 200,000 | 0.25 | 0.15 | | ≥ 10,000 but < 500,000 | 150 | |
| | | < 40,000 | 0.30 | 0.15 | | < 10,000 | 180 | |

### Table 4.24: Emission Standards for Soot/Dust and $NO_X$ (Boilers and Stationary RICE/Turbines), Continued

| FACILITY TYPE | SPECIFICATION | SOOT AND DUST(1) | | | | $NO_X$(1) | | |
|---|---|---|---|---|---|---|---|---|
| | | TOTAL EMISSION ($Nm^3$/hr) | GENERAL AREA(2) ($g/Nm^3$) | SPECIAL AREA(3) ($g/Nm^3$) | STANDARD OXYGEN % (On)(4) | TOTAL EMISSION ($Nm^3$/hr) | STANDARD (ppm) | STANDARD OXYGEN % (On)(4) |
| Boiler(5) | Liquid fuel boiler (heating area < 10 $m^2$) | | 0.30 | 0.15 | | | 260 | 4.0 |
| | Coal boiler (heating area ≥ 10 $m^2$) | ≥ 200,000 | 0.10 | 0.05 | 6.0 | ≥ 700,000 | 200 | 6.0 |
| | | ≥ 40,000 but < 200,000 | 0.20 | 0.10 | | ≥ 40,000 but < 700,000 | 250 | |
| | | < 40,000 | 0.30 | 0.15 | | < 40,000 | 300 | |
| | Coal boiler (heating area < 10 $m^2$) | | 0.30 | 0.15 | | | 350 | 6.0 |
| | Solid fuel boiler (heating area ≥ 10 $m^2$) | ≥ 40,000 | 0.30 | 0.15 | 6.0 | ≥ 700,000 | 200 | 6.0 |
| | | | | | | ≥ 40,000 but < 700,000 | 250 | |
| | | < 40,000 | 0.30 | 0.20 | | < 40,000 | 300 | |
| | Solid fuel boiler (heating area < 10 $m^2$) | | 0.30 | 0.20 | | | 350 | 6.0 |
| | Boilers (others) | ≥ 40,000 | 0.30 | 0.15 | | ≥ 500,000 | 130 | 4.0 |
| | | < 40,000 | 0.30 | 0.20 | | ≥ 10,000 but < 500,000 | 150 | |
| | | | | | | < 10,000 | 180 | |

### Table 4.24: Emission Standards for Soot/Dust and $NO_X$ (Boilers and Stationary RICE/Turbines), Continued

| FACILITY TYPE | SPECIFICATION | SOOT AND DUST[(1)] | | | | $NO_X$[(1)] | | |
|---|---|---|---|---|---|---|---|---|
| | | TOTAL EMISSION ($Nm^3$/hr) | GENERAL AREA[(2)] (g/$Nm^3$) | SPECIAL AREA[(3)] (g/$Nm^3$) | STANDARD OXYGEN % (On)[(4)] | TOTAL EMISSION ($Nm^3$/hr) | STANDARD (ppm) | STANDARD OXYGEN % (On)[(4)] |
| Stationary RICE/Turbines | Gas Turbine (Fuel combustion rate ≥ 50 L/hr)[(6)] | | 0.05 | 0.04 | 16.0 | | 70 | 16.0 |
| | Diesel Engine (Fuel combustion rate ≥ 50 L/hr)[(6)] | | 0.10 | 0.08 | 13.0 | | 950 | 13.0 |
| | Gaseous Engine (Fuel combustion rate ≥ 35 L/hr) | | 0.05 | 0.04 | 0.0 | | 600 | 0.0 |
| | Gasoline Engine (Fuel combustion rate ≥ 35 L/hr) | | 0.05 | 0.04 | 0.0 | | 600 | 0.0 |

Sources: Air Pollution Control Act, Act No. 97 of 1968, revised 5 June 2020; Ordinance for Enforcement of the Air Pollution Control Act, Ordinance of the Ministry of Health and Welfare/Ministry of International Trade and Industry No. 1 of 1971, revised 7 October 2020.
$Nm^3$ = normal cubic meter at 0°C and atmospheric pressure
ppm = parts per million

Notes:

1. Monitoring frequency: Once every two months (burning ability ≥ 4,000 kg/hr); twice a year (burning ability < 4,000 kg/hr); once every five year (boilers and Stationary RICE/Turbines that use gaseous fuel).
2. Soot and dust emission standard per $Nm^3$ of emitting gas in general area (refer to Table 4.28).
3. Soot and dust emission standard per $Nm^3$ of emitting gas in special area (refer to Table 4.28). These standards apply for facilities built after 1 June 1982 in Tokyo Metropolitan area (special wards), Yokohama and Yokosuka.
4. For those facilities with On listed, normalize the concentration to standard oxygen percentage using the following equation:
   $Cn = Cs \times (21 - On) / (21 - Os)$ where Cn = normalized concentration, Cs = measured concentration, and Os = measured oxygen percentage.
5. Fuel combustion rate ≥ 50 L/hr (calculation in terms of heavy oil). Heating area is horizontal projection area. Hot blast boilers are included; boilers which use electricity or waste heat alone are excluded.
6. Calculation in terms of heavy oil.

### Table 4.25: Emission Standards for Soot/Dust, NO$_X$ and HCl (Incinerators)

| FACILITY TYPE | SPECIFICATION | TYPE | SOOT AND DUST(1) | | | NO$_X$(2) | | HCl(2) |
|---|---|---|---|---|---|---|---|---|
| | | | SIZE (metric tons/hr) | GENERAL AREA(3) (mg/Nm$^3$) | SPECIAL AREA(4) (mg/Nm$^3$) | TOTAL EMISSION (Nm$^3$/hr) | STANDARD (ppm) | STANDARD (mg/Nm$^3$) |
| Waste incinerator | Grate area: ≥ 2.0 m$^2$ (5)<br>Incineration rate: ≥ 200 kg/hr | Waste material continuous incinerator (by vortex combustion method) | ≥ 4 | 40 | | All | 450 | 700 |
| | | | ≥ 2 but < 4 | 80 | | | | |
| | | Peculiar(6) waste continuous material incinerator | ≥ 4 | 40 | | ≥ 40,000 | 250 | |
| | | | ≥ 2 but < 4 | 80 | | < 40,000 | 700 | |
| | | Waste material continuous incinerator (others) | ≥ 4 | 40 | | All | 250 | |
| | | | ≥ 2 but < 4 | 80 | | | | |
| | | Waste material incinerator (others) | < 2 | 150 | | ≥ 40,000 | 250 | |
| | | | | | | < 40,000 | -- | |

Sources: Air Pollution Control Act, Act No. 97 of 1968, revised 5 June 2020; Ordinance for Enforcement of the Air Pollution Control Act, Ordinance of the Ministry of Health and Welfare/Ministry of International Trade and Industry No. 1 of 1971, revised 7 October 2020.

Nm$^3$ = normal cubic meter at 0°C and atmospheric pressure

ppm = parts per million

Notes:

1. Monitoring frequency: Once every two months (burning ability ≥ 4,000 kg/hr); twice a year (burning ability < 4,000 kg/hr).
2. Monitoring frequency: Once every two months (total emission ≥ 40,000 Nm$^3$/hr); twice a year (total emission < 40,000 Nm$^3$/hr).
3. Soot and dust emission standard per Nm$^3$ of emitting gas in general area (refer to Table 4.28).
4. Soot and dust emission standard per Nm$^3$ of emitting gas in special area (refer to Table 4.28). These standards apply for facilities built after 1 June 1982 in Tokyo Metropolitan area (special wards), Yokohama and Yokosuka.
5. Horizontal projected area.
6. A "peculiar" incinerator refers to an incinerator that burns waste generated from a process that produces or uses nitro-, amino-, or cyano-compounds or their derivatives, or from a process that treats wastewater using ammonia.

## Table 4.26 Emission Standards for Mercury and Mercury Compounds (Boilers and Incinerators)

| FACILITY TYPE | SPECIFICATION | TYPE | EMISSION STANDARD[1,2] (µg/Nm$^3$) | |
|---|---|---|---|---|
| | | | NEW FACILITIES | EXISTING FACILITIES[3] |
| Boiler | Heating area: ≥ 10 m$^2$<br>Burner combustion rate: ≥ 50 L/hr[4] | Coal boiler or coal/biomass boiler | 8 | 10 |
| | | Coal/biomass boiler (as converted fuel) combustion rate ≥ 100,000 L/hr | 10 | 15 |
| Waste Incinerator | Grate area: ≥ 2.0 m$^2$ [5] or Incineration rate: ≥ 200 kg/hr | Incinerator (municipal solid waste, industrial waste, sewage sludge) | 30 | 50 |
| | Facilities treat industrial waste of which mercury is obligated to be recovered,[6] or Mercury-Containing Recyclable Resources[7] (limited to facilities including heating step) | Incinerator (sludge constituent mercury) | 50 | 100 |

Sources: Air Pollution Control Act, Act No. 97 of 1968, revised 5 June 2020; Act on Preventing Environmental Pollution of Mercury, Act No. 42 of 14 June 2019.

Nm$^3$ = normal cubic meter at 0°C and atmospheric pressure

Notes:

1. Monitoring frequency: Once every four months (total emission ≥ 40,000 Nm$^3$/hr); once every six months (total emission < 40,000 Nm$^3$/hr).
2. Emission standards of new facilities must be applied to existing facilities if which was repaired significantly (changes of the structure has increased scale of facilities by 50 percent or more).
3. Existing facilities (including those under installation work) as of 1 April 2018.
4. Calculation in terms of heavy oil.
5. Horizontal projected area.
6. Switch and relay, barometer, hygrometer, liquid manometer, elastic barometer (limited to diaphragm-type), pressure transmitter (limited to diaphragm-type), vacuum gauge, glass temperature gauge, mercury charge pressure type thermometer, mercury thermometer, mercury-type blood-pressure gauge, rotating equipment of lighthouse, mercury trim and heel adjustment equipment, pressure type flow meter, floating hail density meter, tilt meter, total time meter, strain gauge type sensor, fuel gauge, gyro compass, grip gauge; those become industrial waste, soot and dust, cinder, sludge or slag; those containing mercury with more than 1,000 milligrams per 1.0 kilogram of said soot and dust, cinder, sludge or slag, waste acid or waste alkali; those containing mercury with more than 1,000 milligrams per 1.0 liter of said waste acid or waste alkali.
7. Non-ferrous metal metallurgy sludge, dental amalgam, mercury used in analysis, silver oxide cell, etc.; those are to be reused such as mercury is to be recovered, and which is useful.

## Table 4.27: Emission Standards for Dioxins (Incinerators)

| INCINERATING CAPACITY (metric tons/hr) | EMISSION STANDARDS FOR NEW WASTE INCINERATORS(1) | | EMISSION STANDARDS FOR EXISTING WASTE INCINERATORS(1) | |
|---|---|---|---|---|
| | Grate area: ≥ 2.0 m$^2$ or Incineration Capacity: ≥ 200 kg/hr (The installation work was launched after 2 December 1997) | Heating area: ≥ 0.5 m$^2$ or Incineration Capacity: ≥ 50 kg/hr (The installation work was launched after 16 January 2000) | Grate area: ≥ 2.0 m$^2$ or Incineration Capacity: ≥ 200 kg/hr (Built or under construction as of 1 December 1997) | Heating area: ≥ 0.5 m$^2$ and < 2.0 m$^2$ or Incineration Capacity: ≥ 50 kg/hr and < 200 kg/hr |
| ≥ 4 | 0.1 ng-TEQ/Nm$^3$ | | 1 ng-TEQ/Nm$^3$ | |
| ≥ 2 but < 4 | 1 ng-TEQ/Nm$^3$ | | 5 ng-TEQ/Nm$^3$ | |
| < 2 | 5 ng-TEQ/Nm$^3$ | | 10 ng-TEQ/Nm$^3$ | |

Sources: Air Pollution Control Act, Act No. 97 of 1968, revised 5 June 2020; Act on Special Measures Against Dioxins, Act No. 105 of 1999, revised 17 June 2022; Enforcement Order for Act on Special Measures Against Dioxins, Cabinet Order No. 433 of 1999, revised 10 August 2018.
TEQ = Toxic equivalence
Nm$^3$ = normal cubic meter at 0°C and atmospheric pressure
Note:
1. Monitoring Frequency: Once a year.

## Table 4.28: Emission Standards for Sulfur Oxides ($SO_X$) (Boilers, Stationary RICE, Incinerators)(1)

| | AREA | K-VALUE |
|---|---|---|
| SPECIAL | Yokohama, Yokosuka, Wards of Tokyo | 1.17 |
| | Kisarazu | 1.75 |
| | Iwakuni, Otake | 2.34 |
| GENERAL | Kure | 5.0 |
| | Hachinohe | 6.0 |
| | Fussa, Musashimurayama, Kiyose, Tachikawa, Akishima, Hamura, Fuchu, Inagi, Tama, Hachioji, Mizuho | 6.42 |
| | Fukuoka | 8.76 |
| | Wako, Tokorozawa, Niiza, Sayama, Kin, Naha, Urasoe, Ishikawa Region of Uruma, Ginowan, Chatan, Kitanakagusuku | 9.0 |
| | Sasebo | 10.0 |
| | Ayase, Sagamihara, Yamato, Ebina, Zushi, Zama | 11.5 |
| | Kadena, Numazu, Ginoza, Onna, Yomitan, Katsuren Region of Uruma, Itoman, Okinawa City | 13.0 |
| | Misawa, Gushikawa Region of Uruma, Nago, Motobu, Higashi, Kunigami, Ie, Gotenba, Tomiyachi, Tango | 17.5 |

Calculate maximum emission limits for sulfur oxides emitted from an outlet of a facility (q), as follows:

$$q = K \times 10^{-3} H_e^2$$

$q$ is the hourly volume of $SO_X$ emitted ($Nm^3/hr$); $Nm^3/hr$ represents $m^3/hr$ at a normal temperature of 0°C and a pressure of 1.0 atmosphere

$K$ is a constant value assigned to each designated region; the most protective value (e.g., the smallest K-value) applicable to the region must be used

$H_e$ is the effective stack height calculated as follows:

$$H_e = H_o + 0.65(H_m + H_t)$$

$$H_m = \frac{0.795\sqrt{Q \cdot V}}{1.0 + \frac{2.58}{V}}$$

$$H_t = 2.01 \times 10^{-3} \cdot Q \cdot (T - 288) \cdot (2.30 \, log \, J + \frac{1}{J} - 1.0)$$

$$J = \frac{1.0}{\sqrt{Q \cdot V}}(1460 - 296 \times \frac{V}{T - 288}) + 1.0$$

Sources: Air Pollution Control Act, Act No. 97 of 1968, revised 5 June 2020; Order for Enforcement of the Air Pollution Control Act, Cabinet Order No. 329 of 1968, revised 27 November 2017; Ordinance for Enforcement of the Air Pollution Control Act, Ordinance of the Ministry of Health and Welfare/Ministry of International Trade and Industry No. 1 of 1971, revised 7 October 2020.

Note:

1. Monitoring frequency: Once every two months.

## Table 4.29: Emission Standards for Volatile Organic Compounds (VOCs)

| FACILITY TYPE | VENTILATION CAPACITY (m$^3$/hr) | AREA(1) (m$^2$) | SIZE (kilo liters) | EMISSION STANDARD(2,3) (ppmC) |
|---|---|---|---|---|
| Drying facilities for manufacture of chemical products | ≥ 3,000 | | | 600 |
| Painting facilities for spray coating | ≥ 100,000 | | | 700 |
| Drying facilities for painting (other than spray coating and electrostatic painting) | ≥ 10,000 | | | 1,000(4) |
| | | | | 600(5) |
| Drying facilities for manufacture of adhesive bonding of copper-clad laminate for printed-circuit board, adhesive tape or sheet, release coated paper or wrapping material | ≥ 5,000 | | | 1,400 |
| Drying facilities for adhesive bonding | ≥ 15,000 | | | 1,400 |
| Drying facilities using rotary offset printing | ≥ 7,000 | | | 400 |
| Drying facilities using gravure printing | ≥ 27,000 | | | 700 |
| VOC cleaning facilities | | ≥ 5 | | 400 |
| VOC storage tanks(6) | | | ≥ 1,000 | 60,000 |

Sources: Air Pollution Control Act, Act No. 97 of 1968, revised 5 June 2020; Order for Enforcement of the Air Pollution Control Act, Cabinet Order No. 329 of 1968, revised 7 October 2020; Ordinance for Enforcement of the Air Pollution Control Act, Ordinance of the Ministry of Health and Welfare/Ministry of International Trade and Industry No. 1 of 1971, revised 15 October 2020.

ppmC = parts per million carbon

<u>Notes</u>:

1. Area is the VOC accessible surface area exposed to the air.
2. Emission standards are calculated in terms cubic centimeters per cubic meter (parts per million by volume) and converted as carbon, i.e., ppmC.
3. Monitoring frequency: once a year.
4. Wood product manufacturing.
5. Others than wood product manufacturing.
6. VOC storage tanks are those tanks containing volatile organic compounds (e.g., gasoline, crude oil or naphtha) with a vapor pressure of more than 20 kilopascals at a temperature of 37.8°C (except enclosed type and floating roof type (including internal floating roof).

# CHAPTER 5: ASBESTOS

## 5.1 INTRODUCTION

This chapter contains standards on the control of threats to human health from asbestos. It covers the identification and abatement of asbestos containing material (ACM) when the asbestos poses a threat and during activities that may disturb asbestos, such as demolition or renovation. Policy requirements for a comprehensive occupational health and safety program are not covered in this chapter. To protect personnel from asbestos exposure, refer to DoDI 6055.01, DoD Safety and Occupational Health (SOH) Program and DoDI 6055.05, Occupational and Environmental Health (OEH).

## 5.2 PERSONNEL QUALIFICATION

Installations must ensure that:

5.2.1 The asbestos program manager, custodial staff, maintenance staff, and individuals involved in asbestos management are trained consistent with their responsibilities and DoDI 6055.01 and DoDI 6055.05.

5.2.2 Training includes, as appropriate:

5.2.2.1 Asbestos hazards and worker protection, to include the use of proper personal protective equipment.

5.2.2.2 Notifications.

5.2.2.3 Material identification.

5.2.2.4 Control procedures for removals including, at least, wetting, local exhaust ventilations, negative pressure enclosures, glove-bag procedures, and high-efficiency particulate air filters.

5.2.2.5 Waste disposal work practices and recordkeeping.

## 5.3 ASBESTOS CONTROL

Installations must:

5.3.1 Appoint an asbestos program manager to serve as the single point of contact for all asbestos-related activities.

5.3.2 Prepare and implement an Asbestos Management Plan. At a minimum, the plan must include:

5.3.2.1 A list of known and presumed ACM, by location, on the installation.

5.3.2.2 A notification and education program to inform all persons affected (e.g., workers, tenants, building occupants) where potentially friable ACM is located, and how and why to avoid disturbing the ACM.

5.3.2.3 Regular ACM surveillance to note, assess, and document any changes in the ACM's condition.

5.3.2.4 Work control or permit systems to control activities that might disturb ACM.

5.3.2.5 Operations and maintenance work practices to avoid or minimize fiber release during activities affecting ACM.

5.3.2.6 Recordkeeping to document operations and maintenance activities related to asbestos identification management and abatement.

5.3.2.7 Training for the asbestos program manager, custodial staff, maintenance staff, and those involved in asbestos management activities.

5.3.2.8 Procedures to assess and prioritize identified hazards for abatement.

5.3.2.9 Procedures to prevent the use of ACM in new construction.

## 5.4 ASBESTOS ABATEMENT

Installations must perform asbestos abatement in accordance with the standards of this paragraph.

5.4.1 Asbestos Determination. Before demolition or renovation of a facility, determine whether or not the activity will remove or disturb ACM, and record it on the project authorization document (e.g., work order).

5.4.2 Asbestos Assessment. When removing or disturbing friable ACM, prepare and display a written assessment of the action at the location to ensure affected personnel are aware of the potential hazards and the actions being undertaken.[53] A copy of the assessment must also be maintained on permanent file. The assessment must include:

5.4.2.1 Type of operation: demolition or renovation.

5.4.2.2 Description of the facility or affected part of the facility including the size, age, and present and past use of the facility.

5.4.2.3 Procedure, including analytical methods, used to detect the presence of ACM.

5.4.2.4 Estimated amount of:

5.4.2.4.1 ACM to be removed from the facility.

5.4.2.4.2 ACM in the affected part of the facility that will not be removed before demolition.

5.4.2.5 Location, street address, and building number (if applicable) of the facility being demolished or renovated.

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[53] Commonly called an Asbestos Hazard Abatement Plan. Refer to UFGS-02 82 00 Unified Facilities Guide Specifications, Asbestos Remediation, Part 1.3.10.

5.4.2.6 Scheduled starting and completion dates of asbestos removal work, or any other activity such as site preparation, that would break up, dislodge, or similarly disturb asbestos material.

5.4.2.7 Scheduled starting and completion dates of demolition or renovation.

5.4.2.8 Description of planned demolition or renovation work and method(s) to be used, including a description of affected facility components.

5.4.2.9 Description of work practices and engineering controls, including asbestos removal and waste-handling emission control procedures.

5.4.2.10 Name and location of the waste disposal site where the asbestos-containing waste material will be deposited.

5.4.2.11 Description of procedures to follow if unexpected ACM is found or becomes crumbled, pulverized, or reduced to powder.

#### 5.4.3 Asbestos Removal

5.4.3.1 Remove friable ACM when it poses a threat to release airborne asbestos fibers and can't be reliably repaired or isolated.

5.4.3.2 Before disturbing or demolishing a facility or part of a facility, remove all ACM in the area to be disturbed.

5.4.3.3 Remove ACM according to the following procedures:

5.4.3.3.1 Adequately wet all ACM exposed during cutting or disjoining operations.

5.4.3.3.2 Carefully lower each unit or section to the floor and to ground level, not dropping, throwing, sliding, or otherwise damaging or disturbing the ACM.

5.4.3.3.3 When ACM is stripped from a facility component while it remains in place in the facility, adequately wet the ACM during the stripping operation.

5.4.3.3.4 Wetting is not required in renovation operations if the following emission control methods are used. Installations must document such situations.

5.4.3.3.4.1 A local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping and removal of the asbestos materials. The system must exhibit no visible emissions to the outside air.

5.4.3.3.4.2 A glove-bag system designed and operated to contain the particulate asbestos material produced by the stripping of the asbestos materials.

5.4.3.3.4.3 Leak-tight wrapping to contain all ACM before dismantlement.

5.4.3.3.4.4 Other methods equivalent to wetting, when wetting would result in equipment damage or a safety hazard and the methods in Paragraphs 5.4.3.3.4.1 through 5.4.3.3.4.3 can't be used.

5.4.3.4 After ACM removal from the facility, ensure the ACM is stripped or contained in leak-tight wrapping, except for large facility components as identified in Paragraph 5.4.3.4.2.

5.4.3.4.1 If stripped, either:

5.4.3.4.1.1 Adequately wet the ACM during stripping, or

5.4.3.4.1.2 Use a local exhaust ventilation and collection system designed and operated to capture the particulate asbestos material produced by the stripping. The system must exhibit no visible emissions to the outside air.

5.4.3.4.2 For large facility components such as reactor vessels, large tanks, and steam generators (but not beams), the ACM is not required to be stripped if the component is removed, transported, stored, disposed of, or reused without disturbing or damaging the ACM and the component is encased in leak-tight wrapping. The leak-tight wrapping must be labeled during all loading and unloading operations as well as during storage and displayed in a manner that a person can easily read. Use the language, in English and Japanese, shown in Figure 5.1.

**Figure 5.1: Leak-Tight Wrapping Label**

DANGER
ASBESTOS DUST HAZARD
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

危険

アスベスト粉塵の危険性

癌および肺疾患の危険性

関係者以外立入禁止

5.4.3.4.3 For all ACM, including material that has been removed or stripped:

5.4.3.4.3.1 Adequately wet the material and ensure that it remains wet until collected and contained or treated in preparation for disposal.

5.4.3.4.3.2 Carefully lower the material to the ground and floor, not dropping, throwing, sliding, or otherwise damaging or disturbing the material.

5.4.3.4.3.3 Transport the material to the ground using leak-tight chutes or containers if it has been removed or stripped more than 15.24 meter [50 ft] above ground level and was not removed as units or in sections.

5.4.3.4.4 When the temperature at the point of wetting is below 0°C (32°F), the wetting provisions identified in Paragraphs 5.4.3.3.1 and 5.4.3.3.3 need not be followed.

5.4.3.4.5 If a facility component contains or is coated or covered with ACM, it must be removed as units or in sections, to the maximum extent possible.

5.4.3.4.6 If a facility will be demolished by intentional burning, all ACM must be removed before burning.

## 5.5 ASBESTOS DISPOSAL

Installations must dispose of asbestos waste in accordance with these standards.

5.5.1 Segregate all asbestos waste into Type I and Type II asbestos waste.

5.5.2 When disposing of asbestos waste, adequately wet and seal it (including any wastewater containing ACM) or solidify asbestos waste using cement. Seal each segregated type of asbestos waste in a double high-strength plastic bag.

5.5.3 Separately collect and transport asbestos waste using a method in which it will not be crushed in order to prevent it from comingling with any other kind of waste.[54]

5.5.4 Properly dispose each type of asbestos waste in a facility or landfill approved and licensed by the appropriate governmental authority. Installations may also melt, solidify, and dispose of Type I asbestos waste in a landfill designated by the appropriate governmental authority to receive treated asbestos waste.[55]

5.5.5 Label containers in English and Japanese, as shown in Figures 5.2 and 5.3, depending on whether it is a Type I or Type II asbestos waste. In addition, because Type I asbestos waste is a specified hazardous industrial waste (SHIW) in Japan,[56] installations will also label Type I asbestos waste as a hazardous waste per JEGS Appendix 16C.

5.5.6 Maintain permanent records documenting the disposal action and site.

## 5.6 DOD SCHOOL COMPLIANCE

Installations must ensure that DoD schools comply with applicable requirements of Title 15 United States Code (USC) Section 2643,[57] and implementing regulations Title 40 Code of Federal Regulations (CFR) Part 763,[58] replacing all references to 1.0 percent asbestos with 0.1 percent asbestos.

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[54] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Articles 4-2, 6.

[55] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 6-5; Methods Specified by the GOJ Minister of the Environment as Being Disposal or Recycling Methods of Specially Controlled Solid Waste and Specially Controlled Industrial Waste, GOJ Ministry of Health and Welfare Notification No. 194.

[56] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4.

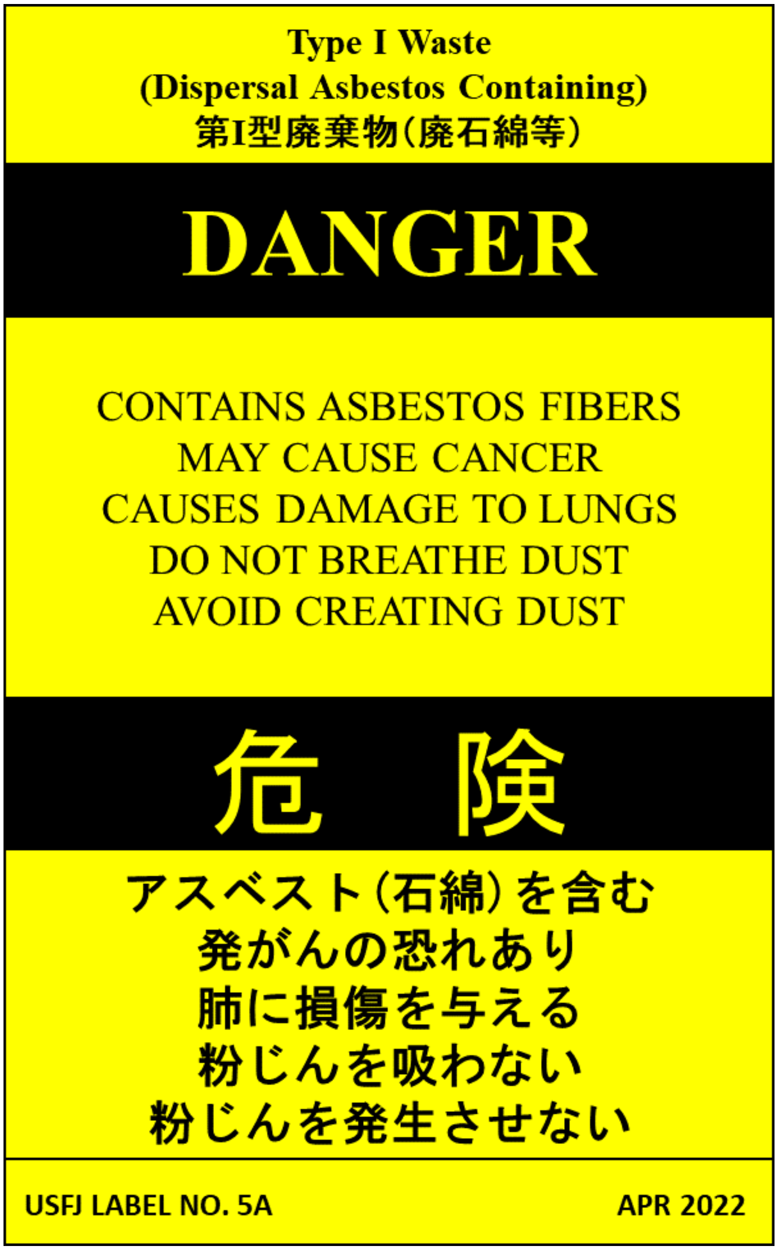
[57] 15 USC Chapter 53, Subchapter II §2643: Commerce and Trade, Toxic Substances Control, Asbestos Hazard Emergency Response, EPA Regulations.

[58] 40 CFR §763 Subpart E: Asbestos, Asbestos-Containing Materials in Schools.

## 5.7 RECORDKEEPING

Installations must maintain records of asbestos operation and maintenance activities consistent with the asbestos management plan, including at a minimum, records of asbestos determinations and disposal.

**Figure 5.2: Type I Asbestos Waste Label**



**Type I Waste**
**(Dispersal Asbestos Containing)**
**第I型廃棄物（廃石綿等）**

**DANGER**

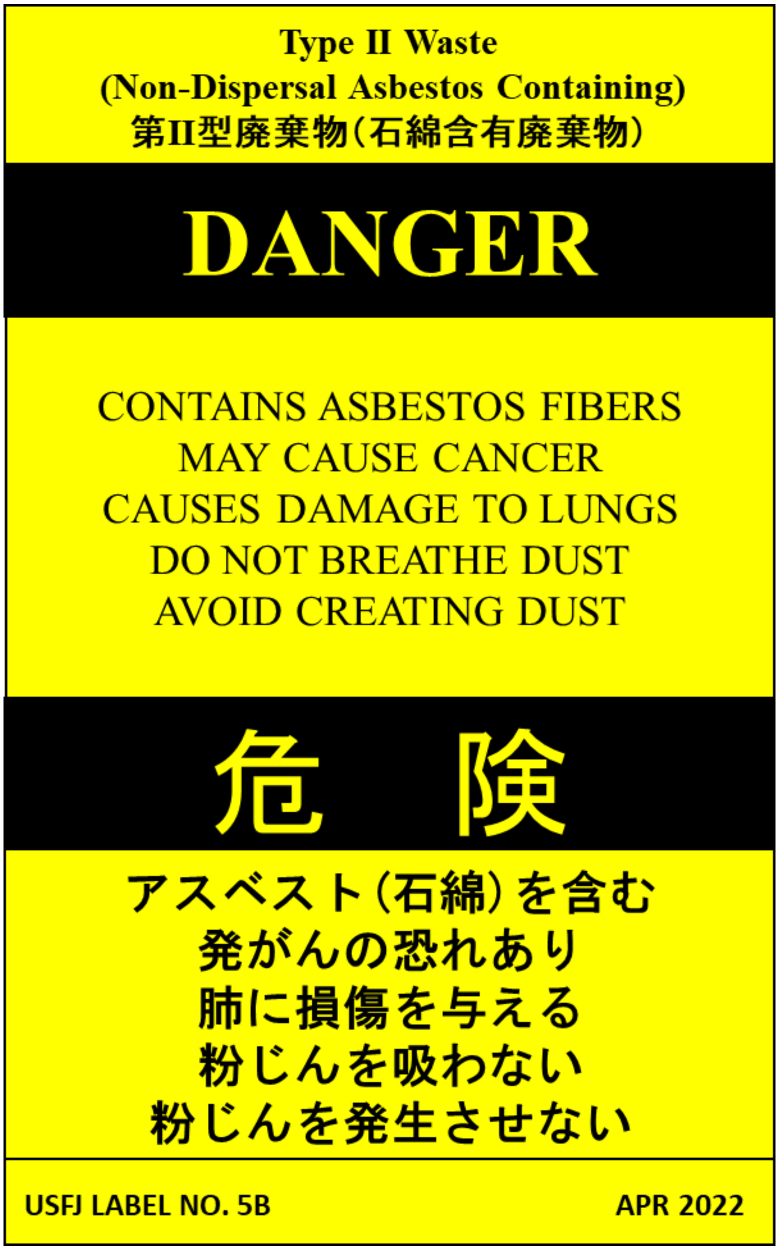
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

**危　険**

**アスベスト（石綿）を含む**
**発がんの恐れあり**
**肺に損傷を与える**
**粉じんを吸わない**
**粉じんを発生させない**

**USFJ LABEL NO. 5A** **APR 2022**

**Figure 5.3: Type II Asbestos Waste Label**



**Type II Waste**
**(Non-Dispersal Asbestos Containing)**
**第II型廃棄物（石綿含有廃棄物）**

**DANGER**

CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

**危　険**

**アスベスト（石綿）を含む**
**発がんの恐れあり**
**肺に損傷を与える**
**粉じんを吸わない**
**粉じんを発生させない**

**USFJ LABEL NO. 5B** **APR 2022**

# CHAPTER 6: LEAD-BASED PAINT (LBP)

## 6.1 INTRODUCTION

This chapter contains standards on the identification, control, or elimination of lead-based paint (LBP) hazards in child-occupied facilities and military family housing through interim controls or abatement. To protect personnel from lead exposure, refer to guidance found in DoDI 6055.01, DoD Safety and Occupational Health (SOH) Program and DoDI 6055.05, Occupational and Environmental Health (OEH).

## 6.2 PERSONNEL QUALIFICATIONS

Installations must ensure that all personnel participating in activities that involve LBP, including paint inspection, risk assessment, specification or design, supervision, and abatement, are properly trained.

## 6.3 USE OF LEAD-CONTAINING PAINT IN CONSUMER PRODUCTS

6.3.1 Installations must ensure that they do not use consumer products with lead-containing paint. Consumer products include those customarily produced or distributed for sale that are used by consumers in or around a household, in schools, or in recreation. Specific banned hazardous products are:

6.3.1.1 Toys and other articles intended for use by children that are labeled “lead-containing paint.”

6.3.1.2 Furniture that is labeled “lead-containing paint.”

## 6.4 USE OF LEAD-BASED PAINT IN CONSTRUCTION ACTIVITIES

Installations must ensure LBP is not used for any new construction or renovation project. All materials purchased and used for projects must be evaluated, especially for projects involving family housing and schools.

## 6.5 LBP HAZARD ABATEMENT PROGRAM

Installations must develop and implement a multi-disciplinary LBP hazard management program to identify, evaluate, and reduce LBP hazards in child-occupied facilities and military family housing.

6.5.1 Identify and maintain a record of LBP hazards in child-occupied facilities and military family housing using these methods:

6.5.1.1 LBP risk assessment screening. If the screening identifies dust-lead levels greater than 107 $\mu g/m^2$ [10 $\mu g/ft^2$] for floors or greater than 1,076 $\mu g/m^2$ [100 $\mu g/ft^2$] for interior window sills, perform an LBP risk assessment.

6.5.1.2 LBP risk assessments.

6.5.1.3 Routine facility inspection for fire and safety.

6.5.1.4 Occupant, facility manager, and worker reports of deteriorated paint.

6.5.1.5 Results of childhood blood lead screening or reports of children identified to have a confirmed concentration of lead in whole blood of 20 µg/deciliter for a single test or 15-19 µg/deciliter in two tests taken at least three months apart.

6.5.1.6 LBP re-evaluations.

6.5.1.7 Review of construction, painting, and maintenance histories.

6.5.2 Manage identified LBP hazards through interim controls or abatement.

6.5.3 Disclose the presence of any known LBP or LBP hazards to occupants of child-occupied facilities and military family housing and provide information on LBP hazard reduction.

6.5.4 Before conducting remodeling or renovation projects, inform occupants of military family housing of the hazards associated with these activities and provide information on protecting family members from the hazards of LBP.

6.5.5 Ensure occupant and worker protection measures are taken during all maintenance, repair, and renovation activities that disturb areas known or assumed to have LBP.

## 6.6 DISPOSAL OF LEAD-CONTAMINATED WASTE

Installations must dispose of lead-contaminated waste that meets the definition of a hazardous waste in accordance with JEGS Chapter 16.

# CHAPTER 7: POLYCHLORINATED BIPHENYLS (PCBs)

## 7.1 INTRODUCTION

This chapter contains standards on the control and abatement of threats to human health and the environment from the handling, use, storage, and disposal of PCBs. These standards include specific requirements for most uses of PCBs, including, but not limited to, transformers, capacitors, heat transfer systems, hydraulic systems, electromagnets, switches and voltage regulators, circuit breakers, reclosers, fluorescent light ballasts, and cables.

## 7.2 GENERAL

Installations must comply with the following standards:

7.2.1 Minimize the use of PCBs and PCB items without degrading mission performance.

7.2.2 Do not purchase or otherwise take control of PCBs or PCB items for use.

7.2.3 Ensure all procurement of transformers or any other equipment containing dielectric or hydraulic fluid includes a manufacturer's certification that the equipment contains no detectable PCBs (less than 0.5 ppm).

7.2.4 Affix permanent labels, in English and Japanese, to newly procured transformers and equipment stating they are PCB-free (no detectable PCBs).

7.2.5 Maintain a written inventory if PCB items are located on the installation:

7.2.5.1 Include a current list, by type, of all marked PCB items in use and PCB items (whether or not marked) placed into storage for disposal or disposed of during that year.

7.2.5.2 Include in the inventory: item type, country of origin, manufacturer, date of manufacture, model number, rated capacity (if applicable), number and weight of item, and PCB concentration (high- or low-level).[59]

7.2.5.3 Maintain the inventory for a period of at least three years from the disposal of the last item on the list.

7.2.6 Document all required PCB periodic inspections at the installation. Maintain the inspection records and maintenance history for at least three years after disposal.

7.2.7 Prominently mark all PCB large high-voltage capacitors, equipment, items, and transformers that contain PCBs greater than 0.5 ppm, and containers used to store the preceding items, as well as rooms, vaults, and storage areas containing, storing, or accumulating PCB items and transformers for disposal. Marking must be in English and Japanese and may be painted, affixed using an adhesive label, or accomplished using any other method that meets these standards:

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[59] GOJ Ordinance for Enforcement of the Act on Special Measures Concerning Promotion of Disposal of Polychlorinated Biphenyl Waste, Article 9.

7.2.7.1 Identifies the item as containing PCBs.

7.2.7.2 Identifies the descriptive name, instructions, cautions, or other information applied to PCBs and PCB items.

7.2.7.3 Warns against improper disposal and handling.

7.2.7.4 Provides a phone number in case of spills or if questions arise about disposal.

7.2.8 If not already marked, mark PCB large low-voltage capacitors and equipment containing a PCB transformer or PCB large high-voltage capacitor in accordance with Paragraphs 7.2.7.1 through 7.2.7.4.

## 7.3 SPILL PREVENTION AND RESPONSE

Installations must:

7.3.1 Ensure the installation Spill Prevention and Response Plan addresses PCB items, including temporary storage items. JEGS Chapter 13 provides standards for Spill Prevention and Response Plans.

7.3.2 Immediately respond to spills of PCB liquids at concentrations of greater than 0.5 ppm and clean up in accordance with the following:

7.3.2.1 Clean surfaces in substantial contact areas to 10 µg per 100 square centimeters ($cm^2$) [0.065 µg per 100 square inches].

7.3.2.2 Clean surfaces in all other contact areas to 100 µg per 100 $cm^2$ [0.65 µg per 100 square inches].

7.3.2.3 Remove contaminated soil in restricted access areas until the soil tests no higher than 25 ppm PCBs and backfill with clean soil containing less than 0.5 ppm PCBs. For restricted access areas where PCB spills have been cleaned up, annotate installation real property records to note the level of PCBs remaining in the soil, including the extent of sampling, date and type of sampling, and a reference to any reports documenting the site conditions.

7.3.2.4 Remove contaminated soil in unrestricted access areas to a minimum depth of 22.4 cm [10 inches] or until the soil tests no higher than 10 ppm PCBs, whichever is deeper, and backfill with clean soil containing less than 0.5 ppm PCBs.

## 7.4 PCB TRANSFORMER MANAGEMENT

Installations must comply with the following standards:

7.4.1 Consider and treat all transformers as PCB transformers unless there is information to the contrary.

7.4.2 Do not use PCB transformers in any application that poses a risk of contamination to food, water, or feed.

7.4.3 Register all PCB transformers with the servicing fire department.

7.4.4 For any PCB transformer, evaluate replacement with a non-PCB transformer as a long-term, cost-saving measure. If replacement with a non-PCB item is not possible or practicable, equip the PCB transformers in use in or near commercial buildings, or located in sidewalk vaults, with electrical protection to minimize transformer failure that would result in the release of PCBs.

7.4.5 Once PCB transformers are removed, they must be disposed. Reuse of PCB transformers is prohibited.

7.4.6 Service PCB transformers as follows:

7.4.6.1 Only service transformers classified as PCB-contaminated electrical equipment with dielectric fluid containing less than 500 ppm PCBs.

7.4.6.2 Do not perform any servicing of PCB transformers that requires removal of the transformer coil.

7.4.6.3 Capture and reuse dielectric fluids removed during servicing as dielectric fluid for PCB transformers or dispose of fluids in accordance with Paragraph 7.7. Do not mix dielectric fluid from a PCB transformer with the dielectric fluid from PCB-contaminated electrical equipment.

7.4.6.4 Do not use in any electrical equipment dielectric fluids containing less than 500 ppm PCBs that are mixed with fluids containing 500 ppm or greater PCBs, regardless of the resulting PCB concentration. Consider the entire mixture to be greater than 500 ppm PCBs.

7.4.7 Inspect all in-service PCB transformers for evidence of damage, leaks, or spills at least every three months, except for those transformers that must only be inspected every 12 months:

7.4.7.1 PCB transformers with an impervious, undrained secondary containment capacity of 100 percent of dielectric fluid.

7.4.7.2 PCB transformers tested and found to contain less than 60,000 ppm PCBs at least every 12 months.

7.4.8 Manage leaking PCB transformers in a manner that minimizes exposure and contamination. Perform appropriate spill response in accordance with Paragraph 7.3. Capture and dispose of leaking PCB fluids in accordance with Paragraph 7.7.

7.4.8.1 If any PCB transformer is involved in a fire and was subjected to heat or pressure sufficient to result in violent or nonviolent rupture, take measures to contain and control any potential releases of PCBs and incomplete combustion products into water. These measures may include:

7.4.8.1.1 Blocking of all floor drains in the vicinity of the transformer.

7.4.8.1.2 Containing water runoff.

7.4.8.1.3 Controlling and treating (prior to release) any water used in subsequent cleanup operations.

7.4.8.2 Leaking PCB transformers must be:

7.4.8.2.1 Repaired or replaced within 48 hours of discovery of a leak, or as soon as possible thereafter.

7.4.8.2.2 Inspected daily until repaired or replaced.

## 7.5 MANAGEMENT OF OTHER PCB ITEMS

Installations must:

7.5.1 Service electromagnets, switches, and voltage regulators that may contain PCBs at any concentration as follows:

7.5.1.1 Only service PCB-contaminated electrical equipment with dielectric fluid containing less than 500 ppm PCBs.

7.5.1.2 Do not service any electromagnet, switch, or voltage regulator with a PCB concentration of greater than or equal to 500 ppm that requires the removal and rework of the internal components.

7.5.1.3 Capture PCBs removed during servicing and either reuse them as dielectric fluid or dispose of them properly in accordance with Paragraph 7.7.

7.5.1.4 Do not mix or add PCBs from electromagnets, switches, and voltage regulators with a PCB concentration of greater than or equal to 500 ppm to dielectric fluid from PCB-contaminated electrical equipment.

7.5.2 Manage capacitors containing PCBs at any concentration by prohibiting:

7.5.2.1 Use and storage for reuse of PCB large high-voltage capacitors and PCB large low-voltage capacitors that pose an exposure risk to food, water, or feed.

7.5.2.2 Use of PCB large high-voltage and PCB large low-voltage capacitors unless the capacitor is used within a restricted-access electrical substation or in a contained and restricted-access indoor installation. The indoor installation must not have public access and must have an adequate roof, walls, and floor to contain any release of PCBs.

7.5.3 Mark any PCB item removed from service with the date it was removed.

## 7.6 STORAGE

7.6.1 Installations must store PCBs and PCB items awaiting disposal in facilities that have:

7.6.1.1 Roofs and walls that exclude precipitation.

7.6.1.2 A containment berm at least 15.24 cm [6.0 inches] high, sufficient to contain twice the internal volume of the largest PCB article, or 25 percent of the total internal volume of all PCB articles or containers stored, whichever is greater, or a container with two times the internal volume of the item.

7.6.1.3 Continuous, smooth, and impervious flooring material that contains no drain valves, floor drains, expansion joints, sewer line, or other opening that would permit liquids to flow from the curbed area.

7.6.1.4 To the maximum extent practicable, been located to minimize the risk of release due to seismic activity, floods, or other natural events. For facilities located where there is a high possibility of such risks, the installation Spill Prevention and Response Plan (JEGS Chapter 13) must address the risk.

7.6.2 Installations may temporarily store these items in an area that does not comply with Paragraph 7.6.1 for up to 30 days from the date of removal from service, subject to weekly inspection:

7.6.2.1 Non-leaking PCB items, marked to indicate whether it is a PCB article or PCB equipment.

7.6.2.2 Leaking PCB articles and PCB equipment in a leak-proof PCB container that contains sufficient absorbent material to absorb the fluid contained in the leaking article or equipment.

7.6.2.3 PCB containers in which non-liquid PCBs have been placed.

7.6.2.4 PCB containers in which:

7.6.2.4.1 PCBs at a concentration between 0.5 to 499 ppm have been placed.

7.6.2.4.2 The containers are marked to indicate there is less than 500 ppm PCBs.

7.6.3 Installations must store non-leaking and structurally undamaged large high-voltage PCB capacitors and PCB-contaminated electric equipment that have not been drained of free-flowing dielectric fluid on pallets or raised platforms, next to a storage area meeting the standards of Paragraph 7.6.1 if they are inspected weekly.

7.6.4 Installations must inspect all other PCB storage areas at least monthly.

7.6.5 Installations must ensure containers used for the storage of PCBs are at least as secure as those required for transport for disposal by DLA Disposition Services.

## 7.7 DISPOSAL

7.7.1 Disposal through DLA Disposition Services. Installations must dispose of PCBs through DLA Disposition Services, who will dispose of PCB items in accordance with DoD Manual 4160.21 (Volume 4), Defense Materiel Disposition: Instructions For Hazardous Property and Other Special Processing Materiel, and the disposal requirements of this paragraph. Installations are prohibited from transferring PCBs to a third party in order to avoid the requirement to dispose of PCBs through DLA, without approval from the LEC on a case-by-case basis. Table 7.1 identifies acceptable methods of disposal outside Japan for each PCB waste type. Tables 7.3 and 7.4 identify acceptable methods of disposal inside Japan for each PCB waste type.

7.7.2 Disposal Records. If the installation generates PCB waste, it must maintain an audit trail for the waste that is at least as stringent as that required under the standards in JEGS Paragraph 16.9.3.5.

7.7.3 PCB Disposal in Boilers (Outside Japan). Where PCB fluids, items, or articles are disposed of in a high-temperature boiler, installations must follow these procedures:

7.7.3.1 If the boiler uses natural gas or oil as the primary fuel, the CO concentration in the stack must be 50 ppm or less and the excess $O_2$ at least 3.0 percent when PCBs are being burned.

7.7.3.2 If the boiler uses coal as the primary fuel, the CO concentration in the stack is 100 ppm or less and the excess $O_2$ is at least 3.0 percent when PCBs are being burned.

7.7.3.3 The mineral oil dielectric fluid does not comprise more than 10 percent, by volume, of the total fuel feed rate.

7.7.3.4 The mineral oil dielectric fluid is not fed into the boiler unless the boiler is operating at its normal operating temperature and is not fed during start-up or shut-down operations.

7.7.3.5 The performance of the boiler is continuously monitored for CO and excess $O_2$ percentage in the stack gas while burning mineral oil dielectric fluid or, for boilers burning less than 112,500 liters [30,000 gallons] of mineral oil dielectric fluid per year, monitoring is performed at least every 60 minutes.

7.7.3.6 The primary fuel feed rates, mineral oil dielectric fluid feed rates, and the total quantities of both primary fuel and mineral oil dielectric fluid fed to the boiler are measured and recorded at least every 15 minutes.

7.7.3.7 The flow of mineral oil dielectric fluid is stopped if the standards respecting CO or excess $O_2$ are exceeded.

7.7.4 PCB Disposal in Incinerators (Outside Japan). Where PCB fluids, items or articles are disposed of in an incinerator, installations must follow these procedures:

7.7.4.1 Ensure combustion standards maintain the introduced liquids for a 2.0-second dwell time at 1,200°C plus or minus 100°C [2,200°F +/- 212°F] and 3.0-percent excess $O_2$ in the stack gas, or maintenance of the introduced liquids for a 1.5-second dwell time at 1,600°C plus or minus 100°C [3,050°F +/- 212°F] and 2.0-percent excess $O_2$ in the stack gas.

7.7.4.2 Ensure combustion efficiency, measured by the ratio of the concentration of $CO_2$ to the total concentration of both $CO_2$ and CO, is maintained at least 99.9 percent.

7.7.4.3 Measure and record the rate and quantity of PCBs that are fed to the combustion system at regular intervals not greater than 15 minutes.

7.7.4.4 Continuously measure and record the temperatures of the incineration process.

7.7.4.5 Automatically stop the flow of PCBs to the incinerator if temperature standards are not met.

7.7.4.6 Conduct sufficient monitoring to ensure that the first time an incinerator is used for disposal, it operates within the standards identified in Paragraphs 7.7.4.1 through 7.7.4.5.

7.7.4.7 Conduct continuous monitoring of $O_2$ and CO and periodic monitoring of $CO_2$ during incineration of PCBs.

7.7.5 PCB Containers. After draining all free-flowing liquid, installations must dispose of PCB containers used to contain only PCBs at a concentration less than or equal to 0.5 ppm as an industrial waste.

7.7.6 Retrogrades of PCB Items. Installations must dispose of PCB items through DLA Disposition Services. DLA Disposition Services must return DoD-generated PCB items manufactured in the United States to the United States for delivery to a permitted disposal facility if Japan or third country disposal is not possible, is prohibited, or would not be managed in an environmentally sound manner. Ensure that all PCB items and equipment are marked in accordance with the standards in Paragraph 7.2.7.

7.7.7 PCB-Contaminated Soil. Installations must dispose of PCB-contaminated soil in accordance with the requirements of JEGS Paragraph 15.11.

7.7.8 Labeling. Installations will label PCB waste with the PCB label shown in Figure 7.1. In addition, because PCB waste is a specified hazardous industrial waste (SHIW) in Japan,[60] installations will also label PCB waste as a hazardous waste per JEGS Appendix 16C.

7.7.9 PCB Waste Disposal Guidelines. Installations will dispose of PCB waste in accordance with the following guidelines.

7.7.9.1 Low-Level PCB Waste. Dispose of low-level PCB waste in Japan through 31 March 2027.[61] After this date, dispose of the waste in accordance with Paragraph 7.7.6.

7.7.9.2 High-Level PCB Waste

7.7.9.2.1 For high-level PCB waste generated from PCB items originally manufactured in the United States, dispose of the waste in accordance with Paragraph 7.7.6.

7.7.9.2.2 For high-level PCB waste generated from PCB items originally manufactured in Japan, and the waste or items were identified to USFJ before 1 December 2023, contact the USFJ Command Engineer.

7.7.9.2.3 For high-level PCB waste generated from PCB items originally manufactured in Japan, and the waste or items were not identified to USFJ before 1 December 2023, dispose of the waste in accordance with Paragraph 7.7.6.

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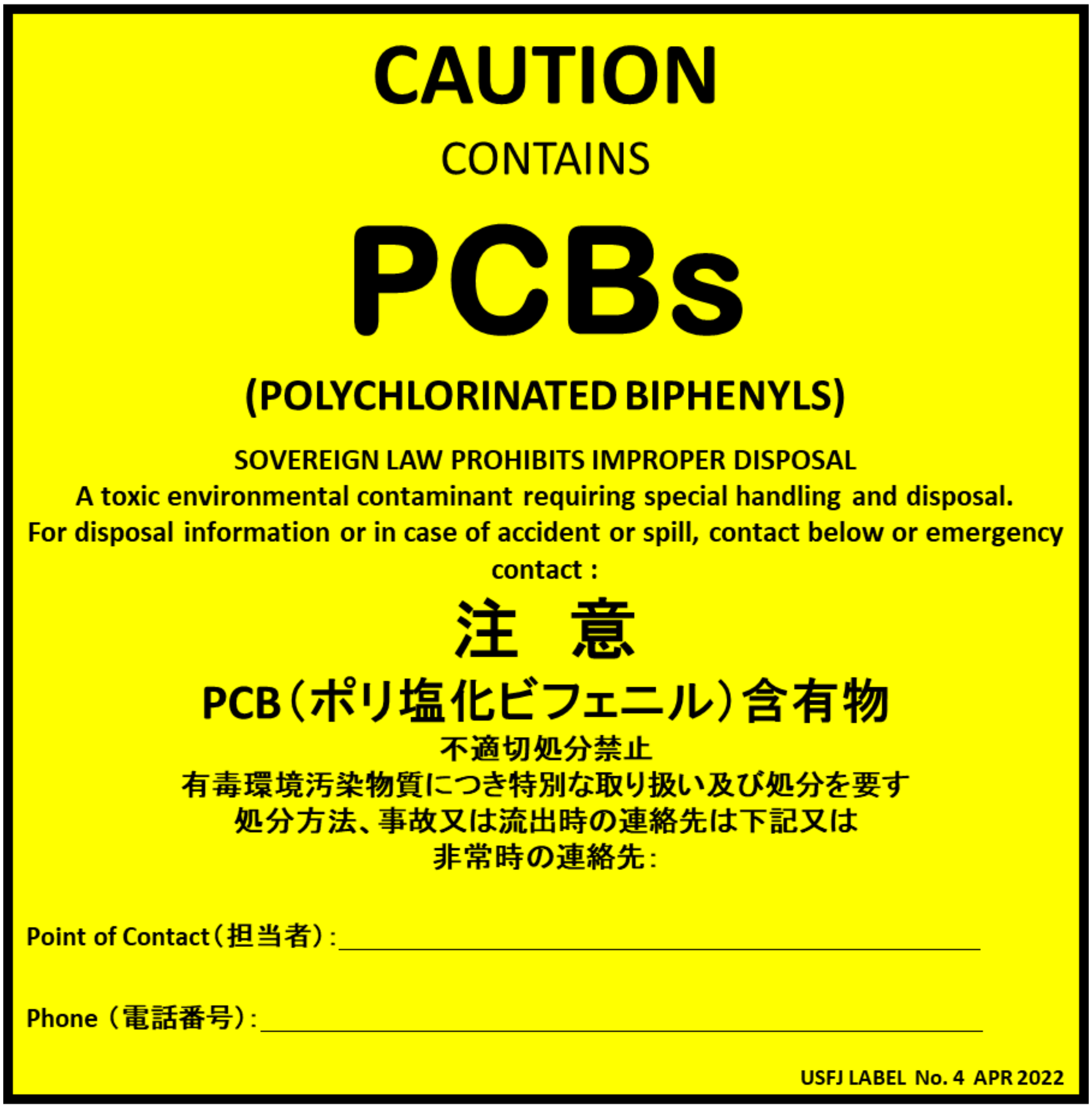
[60] GOJ Act on Waste Management and Public Cleansing, Article 2-4.

[61] GOJ Order for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Article 7.

## 7.8 RECORDKEEPING

Installations must maintain an inventory and inspection records (including maintenance history) for PCB items for at least three years after disposal. Installations must maintain an audit trail for disposal records of PCB items.

**Figure 7.1: PCB Waste Label**



CAUTION

CONTAINS

PCBs

(POLYCHLORINATED BIPHENYLS)

SOVEREIGN LAW PROHIBITS IMPROPER DISPOSAL
A toxic environmental contaminant requiring special handling and disposal.
For disposal information or in case of accident or spill, contact below or emergency contact :

注 意

PCB（ポリ塩化ビフェニル）含有物

不適切処分禁止
有毒環境汚染物質につき特別な取り扱い及び処分を要す
処分方法、事故又は流出時の連絡先は下記又は
非常時の連絡先：

Point of Contact（担当者）：________________________________________

Phone（電話番号）：________________________________________

USFJ LABEL No. 4 APR 2022

## Table 7.1: PCB Waste Disposal Outside of Japan

| CATEGORY | DISPOSAL | | | |
|---|---|---|---|---|
| | Incinerator[1] | High-Efficiency Boiler[2] | Chemical Waste Landfill | Solid Waste Landfill |
| Dielectric Fluid > 500 ppm | X | | | |
| Dielectric Fluid > 50 ppm and ≤ 500 ppm | X | X | | |
| Rags, Soil, Debris > 50 ppm | X | | X | |
| PCB Transformers | X | | X[3] | |
| PCB Capacitors | X | | | X[4] |
| PCB Hydraulic Machines | | | | X[5] |
| PCB Electrical Equipment | | | | X[3] |
| PCB Articles | X | X[3] | | |
| PCB Containers > 500 ppm | X | X[3] | | |

ppm = parts per million

Notes:

1. 99.9 percent combustion efficiency.
2. Minimum rating of 53 GJ/hr [50 MMBtu/hr] and fueled by natural gas, oil, or coal.
3. Transformer, capacitor, article, container, and all inner workings are first drained of free-flowing product.
4. Intact non-leaking small capacitors with total quantity less than 45.4 kg [100 lbs].
5. Machines with concentrations greater than 50 ppm are drained of all free-flowing liquid. Machines with concentrations of greater than 1,000 ppm are flushed, before disposal, with a solvent containing less than 50 ppm.

## APPENDIX 7A: JAPANESE PCB STANDARDS

### Table 7.2: Definition of Low-Level PCB Waste in Japan

| CATEGORY | ELECTRICAL EQUIPMENT CONTAMINATED WITH SMALL AMOUNTS OF PCB(1) | | LOW-LEVEL PCB CONTAINING WASTE | |
|---|---|---|---|---|
| PCB waste oils | Small amount PCB-contaminated insulation oils(2) | 1-2 digit mg/kg | Low-level PCB waste oils(3) | > 0.5 ppm and ≤ 5,000 ppm |
| PCB-contaminated materials | Small amount PCB-contaminated materials(4) | 1-2 digit mg/kg | Low-level PCB flammable materials(5) | > 0.5 ppm and ≤ 100,000 ppm |
| | | | Low-level PCB adhering materials(6) | > 0.5 ppm and ≤ 5,000 ppm |
| PCB-treated materials | Small amount PCB treated materials(7) | 1-2 digit mg/kg | Low-level PCB treated materials(8) | > 0.5 ppm and ≤ 5,000 ppm(9) |

Sources: Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Act No. 65 of 2001, revised 2 May 2016; Order for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Cabinet Order No. 215 of 2001, revised 26 June 2019; Ordinance for the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Cabinet Order No. 23 of 2001, revised 30 March 2020; Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 16 June 2017; Ordinance for Enforcement of the Act on Waste Management and Public Cleansing, Cabinet Order No. 35 of 1971, revised 28 December 2020.

ppm = parts per million

mg/kg = milligrams per kilogram

Notes:

1. Unintentionally contaminated with PCBs.
2. Oils used in electrical equipment and cables, and are contaminated with small amounts of PCBs.
3. Mainly liquefied materials.
4. Refers to the actual electrical equipment that may be contaminated with PCBs, not the insulation oil itself.
5. Sludge, papers, wood, textiles, and plastics.
6. Mainly solid phase materials.
7. Generated by a treatment process on either small amount PCB-contaminated insulation oils or small amount PCB-contaminated materials.
8. Generated by a treatment process on either low-level PCB waste oils, low-level flammable materials, or low-level PCB adhering materials.
9. For metals, concentration refers to the materials adhering to the surface.

## Table 7.3: Low-Level PCB Waste Disposal Inside Japan

| CATEGORY | | DISPOSAL | | | |
|---|---|---|---|---|---|
| | | Incinerator(1) | Flushing(2) | Chemical Decomposition(3) | Flushing and Chemical Decomposition(4) |
| Insulation oils(5) > 0.5 ppm and ≤ 5,000 ppm | | X | | | |
| PCB adhering materials(6) | Small amount PCB-contaminated electrical equipment | X | X | X | X |
| | All others > 0.5 ppm and ≤ 5,000 ppm | X | | | |
| PCB flammable materials(7) > 0.5 ppm and ≤ 100,000 ppm | | X | | | |
| PCB treated materials(8) > 0.5 ppm and ≤ 5,000 ppm | | X | | | |

Sources: Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Act No. 65 of 2001, revised 2 May 2016; Order for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Cabinet Order No. 215 of 2001, revised 26 June 2019; Ordinance for Enforcement of the Act on Special Measures Concerning Promotion of Proper Disposal of Polychlorinated Biphenyl Waste, Cabinet Order No. 23 of 2001, revised 30 March 2020; Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 16 June 2017; Ordinance for Enforcement of the Act on Waste Management and Public Cleansing, Cabinet Order No. 35 of 1971, revised 28 December 2020.

ppm = parts per million

Notes:

1. The incinerator must operate at a minimum temperature of 850°C (1,562°F) with a dwell time of 2.0 seconds if the waste contains less than 5,000 ppm PCBs. The incinerator must operate at a minimum temperature of 1,150°C (2,102°F) with a dwell time of 2.0 seconds if the waste contains greater than or equal to 5,000 ppm PCBs.
2. Rinsing the inside of PCB-contaminated materials with either insulation oil, hydrocarbons, or alcohol detergents.
3. Chemical decomposition through either hydrothermal oxidative decomposition, reduction thermochemical decomposition, photolysis, or plasma decomposition.
4. Combination of flushing followed by chemical decomposition.
5. Includes dielectric fluids.
6. Includes PCB transformers, PCB capacitors, PCB hydraulic machines, PCB electrical equipment, PCB articles, and P PCB containers.
7. Includes rags, debris, sludge, papers, wood, textiles, and plastics.
8. Material that has been previously treated for the removal of PCBs.

**Table 7.4: PCB Waste Treatment Criteria Inside Japan**

| WASTE MATERIAL | PCB CONCENTRATION |
|---|---|
| Oils | ≤ 0.5 mg/kg |
| Acids or alkalis | ≤ 0.03 mg/L |
| Plastics and metals | No attaching or containing PCBs |
| Ceramics | No adhering PCBs |
| Other waste not including the above | ≤ 0.003 mg/L |
| Sources: Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 16 June 2017; Ordinance for Enforcement of the Act on Waste Management and Public Cleansing, Cabinet Order No. 35 of 1971, revised 28 December 2020.<br>mg/L = milligrams per liter<br>mg/kg = milligrams per kilogram | |

# VOLUME III: WATER

## VOLUME III.A: DEFINITIONS

Unless otherwise noted, these terms and their definitions are for the purposes of this volume.

4-day average. The arithmetic mean of pollutant parameter values for samples collected in a period of 4 consecutive days.

7-day average. The arithmetic mean of pollutant parameter values for samples collected in a period of 7 consecutive days.

30-day average. The arithmetic mean of pollutant parameter values for samples collected in a period of 30 consecutive days.

Action level. The concentration of a substance in water that establishes appropriate treatment for a water system.

Alternative water supplies.[62] New water supplies or the treatment and redistribution of existing water supplies that can replace an installation's primary drinking water source in the event the primary source is interrupted.

Appropriate DoD medical authority. The medical professional designated by the Service Component Commander to be responsible for resolving medical issues necessary to provide safe drinking water at the DoD Service Component's installations.

Batch discharge. Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary discharge of industrial wastewater, material or waste of high volume or pollutant concentration that has a reasonable potential to interfere with or pass-through a receiving domestic wastewater treatment plant, or in any other way may violate the plant's regulations, local limits, or sanitary sewer system requirements. Also called a slug discharge.

Best management practice (BMP). Mandatory schedule of activities, prohibition of practices, maintenance procedure, or other management practices to prevent or reduce the pollution of the Waters of Japan. BMPs also include mandatory treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Biochemical oxygen demand, 5-day measure ($BOD_5$). The 5-day measure of the dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter. The pollutant parameter is biochemical oxygen demand (i.e., biodegradable organics in terms of oxygen demand).

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[62] U.S. Environmental Protection Agency, Office of Emergency and Remedial Response: Guidance Document for Providing Alternate Water Supplies, February 1988.

Bottled water. Water that is intended for human consumption and that is sealed in bottles or other containers with no added ingredients except that it may optionally contain safe and suitable antimicrobial agents, and meets the requirements of 21 CFR §165.110,[63] and applicable DoD sanitation standards.

Carbonaceous biochemical oxygen demand, 5-day measure ($CBOD_5$). The 5-day measure of the pollutant parameter, CBOD, used as an alternative to $BOD_5$. Measures the dissolved oxygen consumed by microorganisms in the oxidation of organic matter in a body of water in which the contribution from nitrogenous bacteria has been suppressed.

Cesspool. A drywell that receives untreated sanitary waste and sometimes has an open bottom or perforated sides.

Chemical oxygen demand (COD). The measure of the amount of oxygen required to oxidize the organic and inorganic substances present in water. COD is used to estimate biochemical oxygen demand and determine the dilutions needed for the $BOD_5$ test.

Colony forming unit (CFU). A unit that estimates the number of microbial cells in a sample that are viable and able to multiply via binary fission under controlled conditions.

Community water system (CWS). Refer to the definition of "Public water system (PWS)."

Consumer confidence report (CCR). An annual water quality report that a CWS is required to provide to its customers.

Contingency. A situation requiring installation response to natural disasters and the activities of terrorists or other subversives.

Conventional filtration treatment.[64] A series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

Conventional pollutants. Biochemical oxygen demand ($BOD_5$), total suspended solids (TSS), fecal coliform, pH, and oil and grease.

Cross-connection. Any actual or potential connection between the public water supply and a source of contamination or pollution.

CT. The product of residual disinfectant concentration, C, in mg/L determined before or at the first customer and corresponding disinfectant contact time, T, in minutes and a dimensionless baffling factor that accounts for mixing effects. Baffling factors may be estimated, or obtained from JEGS Table 8.12, or from tracer surveys. CT values appear in JEGS Tables 8.13 through 8.27.

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[63] 21 CFR §165.110: Beverages, Requirements for Specific Standardized Beverages, Bottled Water.
[64] 40 CFR §141.2: National Primary Drinking Water Regulations, Subpart A—General, Definitions.

<u>Daily discharge</u>. The discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement (e.g., concentration), the daily discharge is calculated as the average measurement of the pollutant over the day.

<u>Diatomaceous earth filtration</u>. A water treatment process of passing water through a precoat of diatomaceous earth deposited onto a support membrane while additional diatomaceous earth is continuously added to the feed water to maintain the permeability of the precoat, resulting in substantial particulate removal from the water.

<u>Direct filtration</u>. Water treatment, including chemical coagulation, possibly flocculation and filtration, but not sedimentation.

<u>Discharge of a pollutant</u>. Any addition of any pollutant or combination of pollutants to the Waters of Japan from any point source.

<u>Disinfectant</u>. Any oxidant, including, but not limited to, chlorine, chlorine dioxide, chloramines, and ozone, intended to kill or inactivate pathogenic microorganisms in water.

<u>Distribution system</u>. A network of pipes leading from a treatment plant to customers.

<u>DoD non-public water system (NPWS)</u>. An NPWS that provides water for human consumption to DoD installations. The maintenance and monitoring are the responsibility of DoD (e.g., a DoD-owned and -operated NPWS, a DoD-owned and contractor-operated NPWS, or a DoD-privatized NPWS).

<u>DoD public water system (PWS)</u>. A PWS that provides water for human consumption to DoD installations. The maintenance and monitoring are the responsibility of DoD (e.g., a DoD-owned and -operated PWS, a DoD-owned and contractor-operated PWS, or a DoD-privatized PWS). Under U.S.-Japan Status of Forces Agreement (SOFA) Article II.1.(a), PWS within U.S. installations in Japan, with limited exceptions, are DoD PWS and are subject to the requirements of JEGS Chapter 8.

<u>Domestic wastewater</u>. Wastewater generated principally from households, business buildings, institutions, and the like. Also called sanitary wastewater and domestic sewage.

<u>Domestic wastewater treatment system (DWTS)</u>. Any DoD or Japanese facility designed to treat wastewater before its discharge to the Waters of Japan and where the majority of such wastewater is made up of domestic sewage.

<u>Dual sample set</u>. A set of two samples collected at the same time and location, with one sample analyzed for TTHM and the other sample analyzed for a group of HAA5. Dual sample sets are collected for the purposes of determining compliance with the TTHM and HAA5 MCLs.

<u>Effluent limitation</u>. Any restriction imposed on quantities, discharge rates, and concentrations of pollutants that are ultimately discharged from point sources into the Waters of Japan.

Enduring location.[65] A location is enduring when DoD intends to maintain access and use of that location for the foreseeable future. The following types of sites are considered enduring for U.S. Government purposes: main operating base, forward operating site, and cooperative security location. All three types of locations may be composed of more than one distinct site. Enduring locations are published in the OSD-approved Enduring Location Master List.

Entrainment. Any life stages of fish or shellfish in the intake water flow entering and passing through a cooling water intake structure and into a cooling water system, including the condenser or heat exchanger.

Entry point to the distribution system. The point at which finished water is discharged into the drinking water distribution system and prior to the first service connection. If the installation purchases its drinking water from a local municipality or prefecture and does not provide additional water treatment, the entry point to the distribution system is the entry point to the installation.

*Escherichia coli (E. coli)*. A gram-negative, facultative anaerobic, rod-shaped coliform bacterium that normally live in the intestines of people and animals. Most *E. coli* are harmless but some are pathogenic and can cause disease when transmitted through contaminated water.

First draw sample. A 1.0-liter sample of tap water that has been standing in plumbing at least six hours and is collected without flushing the tap.

Ground water under the direct influence of surface water (GWUDISW). Any water below the surface of the ground with significant occurrence of insects or other microorganisms, algae, or large diameter pathogens, such as *Giardia lamblia*; or significant and relatively rapid shifts in water characteristics, such as turbidity, temperature, conductivity, or pH, which closely correlate to climatological or surface water conditions.

Haloacetic acids, five (HAA5). The sum of the concentrations in mg/L of the haloacetic acid compounds monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.

Harmful substances.[66] Chemical substances contained in industrial wastewater discharges that may negatively affect public health.

Human consumption. The act of drinking, bathing, showering, hand washing, teeth brushing, food preparation, dishwashing, and maintaining oral hygiene.

Illicit discharge. Any discharge to a stormwater system that is not composed entirely of stormwater. Unless identified as a source of contamination, the following discharges are not considered illicit: groundwater, irrigation water, discharges from potable water sources, diverted surface water flows, foundation drains, air conditioning condensation, water from crawl space

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[65] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

[66] GOJ Water Pollution Control Act, Article 2.

pumps, individual residential car washing, dechlorinated swimming pool discharges, and street wash water.

Impingement. The entrapment of any life stages of fish and shellfish on the outer part of an intake structure or against a screening device during periods of intake water withdrawal.

Industrial wastewater. Wastewater generated as a by-product of industrial activities. Includes process wastewater and run-off or leachate from areas that receive pollutants associated with industrial activities.

Industrial wastewater treatment system (IWTS). Any DoD facility or system, other than a DWTS, designed to treat industrial wastewater before its discharge to the Waters of Japan.

Industry standards and practices. Applicable or recognized standards and practices relevant to the design, construction, installation, operation and maintenance, inspection, and repair of facilities and equipment.

Installation.[67] An enduring location consisting of a base, camp, post, station, yard, center, or other DoD activity under the operational control of the Secretary of a Military Department or the Secretary of Defense.

Interference. Any addition of any pollutant or combination of pollutant discharges that inhibits or disrupts the DWTS, its treatment processes or operations, or its sludge-handling processes, use, or disposal.

International agreement.[67] A multilateral or bilateral agreement, such as a base rights or access agreement, a status-of-forces agreement, or any other instrument defined as a binding international agreement in accordance with DoDD 5530.3, International Agreements.

Interservice support agreement (ISSA).[68] A negotiated arrangement between DoD Service Components to provide or receive support. Also called an “inter-agency agreement.”

Lead-free. Containing a maximum lead content of 0.2 percent for solder and flux, and a weighted average of not more than 0.25 percent lead when used with respect to wetted surface material.

Lead service line. A service line made of lead that connects the water main to the building inlet, and any lead pigtail, gooseneck, or other fitting that is connected to such line.

Limit of quantitation (LOQ). The smallest concentration that produces a quantitative result with known and recorded precision and bias.

Local implementing agreement (LIA). A negotiated arrangement between the installation and a local government or other entity allowing the installation to access an on- or off-base water source controlled by the local government or entity.

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[67] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

[68] DoDI 4000.19, Support Agreements.

Locational running annual average (LRAA). The average of sample analytical results for samples taken at a particular monitoring location during the previous four calendar quarters.

Log. The percentage of microorganisms removed or inactivated by a drinking water treatment process (e.g., a 1.0-log reduction relates to a 90-percent reduction, a 2.0-log reduction relates to a 99-percent reduction, a 3.0-log reduction relates to a 99.9-percent reduction).

Maximum contaminant level (MCL). The maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a PWS except for turbidity for which the maximum permissible level is measured after filtration. Contaminants added to the water under circumstances controlled by the user, except those resulting from the corrosion of piping and plumbing caused by water quality, are excluded.

Maximum daily discharge limit. The highest allowable daily discharge based on volume as well as concentration.

Maximum residual disinfectant level (MRDL). The level of a disinfectant added for water treatment measured at the consumer's tap, which may not be exceeded without the possibility of adverse health effects.

Non-community water system (NCWS). Refer to the definition of "Public water system (PWS)."

Non-public water system (NPWS). A water system that provides water for human consumption but does not meet the definition of a PWS.

Non-transient non-community water system (NTNCWS). Refer to the definition of "Public water system (PWS)."

Operational evaluation level (OEL). A coliform limit that, if exceeded, requires the water system to evaluate its operation, maintenance, design, sampling, and monitoring, as applicable, to identify sanitary defects that must be corrected.

pH. A scale used to specify the acidity or basicity of aqueous solutions. The pH scale is logarithmic and inversely indicates the activity of hydrogen ions in a solution.

Point-of-entry treatment device. A treatment device applied to the drinking water entering a facility to reduce contaminants in drinking water throughout the facility.

Point-of-use treatment device. A treatment device applied to a tap to reduce contaminants in drinking water at that tap.

Point source. Any discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Does not include vessels, aircraft, or any conveyance that merely collects natural surface flows of precipitation.

Pollutant. Includes, but is not limited to: dredged soil; solid waste; incinerator residue; filter backwash; sewage; garbage; sewage sludge; munitions; chemical waste; biological material; radioactive material; heat; wrecked or discarded equipment; rock; sand; cellar dirt; and industrial, municipal, and agricultural waste discharged into water.

Process wastewater. Any water that, during manufacturing or processing, comes into direct contact with, or results from the production or use of, any raw material, intermediate product, finished product, by-product, or waste product.

Public water system (PWS).[69] A system for providing piped water to the public for human consumption, if the system has at least 15 service connections or regularly serves a daily average of at least 25 individuals at least 60 days of the year. This includes any collection, treatment, storage, and distribution facilities under control of the operator of these systems and used primarily in connection with such system, and any collection or pretreatment storage facilities not under such control that are used primarily in connection with such system. A PWS is either a CWS or an NCWS:

(1) Community water system (CWS). A PWS that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

(2) Non-community water system (NCWS). A PWS that is not a CWS. An NCWS is either a TNCWS or an NTNCWS.

(3) Non-transient non-community water system (NTNCWS). A PWS that is not a CWS and that regularly serves at least 25 of the same persons over six months per year. Examples include schools, factories, office buildings, and hospitals that have their own water systems.

(4) Transient non-community water system (TNCWS). A PWS that is not a CWS and that does not regularly serve at least 25 of the same persons over six months per year. Examples include, but are not limited to, gas stations, motels, and seasonal campgrounds that have their own water sources.

Regulated facilities. Those facilities with criteria established in JEGS Chapter 9, such as domestic wastewater treatment systems, industrial wastewater treatment systems, or industrial discharges.

Sanitary survey. An on-site review of the water source, facilities, equipment, operation, and maintenance of a PWS to evaluate the adequacy of these elements for producing and distributing water for human consumption.

Secondary maximum contaminant level (MCL). An MCL used to control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At higher concentrations of these contaminants, health implications may exist in addition to aesthetic degradation.

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[69] 40 CFR §141.2: National Primary Drinking Water Regulations, Subpart A—General, Definitions.

Service component. A command consisting of the Service Component Commander and all those Service forces, such as individuals, units, detachments, organizations, and installations under that command, including the support forces that have been assigned to a combatant command or further assigned to a subordinate unified command or joint task force.

Service connection. The point of connection between a facility and a public water system through a constructed conveyance.

Slow sand filtration. Water treatment process where raw water passes through a bed of sand at a low velocity (1.2 feet per hour) resulting in particulate removal by physical and biological mechanisms.

Standards. Substantive elements of U.S. laws and Federal regulations applicable to DoD installations, facilities, and actions in the United States or that have extraterritorial application or are determined necessary to protect human health and the environment on installations outside the United States.

Stormwater. Runoff and drainage from wet weather events such as rain, snow, ice, sleet, and hail.

Surface water. In the context of drinking water standards JEGS Chapter 8, water that is open to the atmosphere and subject to surface runoff. Seawater is not surface water, provided that seawater intakes for a desalination plant are located such that intakes are not influenced by surface water runoff or point source discharges.

Synthetic organic compound (SOC). A man-made compound that contains a carbon atom.

Total coliforms. A group of related bacteria that are, with few exceptions, not harmful to humans but are considered a useful indicator of other pathogens in water. Total coliforms are used to determine the adequacy of water treatment and the integrity of distribution systems.

Total suspended solids (TSS). The insoluble solid matter suspended in water that is separable by filtration.

Total toxic organics (TTO). The summation of all quantifiable values greater than 0.01 mg/L for the toxic organics in JEGS Table 9.4.

Total trihalomethanes (TTHM). The sum of the concentration in mg/L of chloroform, bromoform, dibromochloromethane, and bromodichloromethane.

Toxic equivalence (TEQ). A weighted quantity measure based on the toxicity of each member of the dioxin and dioxin-like compounds category relative to the most toxic member of the category.

Transient non-community water system (TNCWS). Refer to the definition of "Public water system (PWS)."

Underground injection. A subsurface emplacement through a bored, drilled, driven, or dug well where the depth is greater than the largest surface dimension, whenever the principal function of the well is emplacement of any fluid.

United States.[70] The several States, the District of Columbia, the Commonwealths of Puerto Rico and the Northern Mariana Islands, American Samoa, Guam, Midway and Wake Islands, any other territory or possession of the United States, and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States.

Volatile organic compound (VOC). An organic compound that has a high vapor pressure at room temperature.

Vulnerability assessment. The process the commander uses to determine the susceptibility to attack from the full range of threats to the security of personnel, family members, and facilities, which provides a basis for determining antiterrorism measures that can protect personnel and assets from terrorist attacks.

Waters of Japan. Surface water including the territorial seas recognized under customary international law, including:

(1) All waters that are currently used, were used in the past, or may be susceptible to use in commerce.

(2) Waters that are or could be used for recreation or other purposes.

(3) Waters where fish or shellfish are or could be taken and sold.

(4) Waters that are used or could be used for industrial purposes by industries.

(5) Waters including lakes, rivers, streams (including intermittent streams), sloughs, prairie potholes, or natural ponds.

(6) Tributaries of waters identified in this definition.

(7) Exclusions to Waters of Japan are domestic or industrial waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of JEGS Chapter 9. This exclusion applies to only manmade bodies of water that were neither originally Waters of Japan nor resulted from impoundment of Waters of Japan.

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[70] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

## VOLUME III.B: ACRONYMS

| | |
|---|---|
| BFPD | backflow prevention device |
| BHC | benzenehexachloride |
| BMP | best management practice |
| $BOD_5$ | biochemical oxygen demand (5-day measure) |
| °C | degrees Celsius |
| $CBOD_5$ | carbonaceous biochemical oxygen demand (5-day measure) |
| CCR | consumer confidence report |
| CFR | Code of Federal Regulations |
| CFU | colony forming unit |
| COD | chemical oxygen demand |
| CPE | comprehensive performance evaluation |
| CT | concentration x time |
| CWS | community water system |
| D | dichlorophenoxyacetic acid |
| DBCP | 1,2-dibromo-3-chloropropane |
| DDBP | disinfectant/disinfection byproducts |
| DDT | dichlorodiphenyl trichloroethane |
| DDE | dichlorodiphenyl dichloroethylene |
| DLA | Defense Logistics Agency |
| DoD | Department of Defense |
| DoDD | Department of Defense directive |
| DoDI | Department of Defense instruction |
| DWTS | domestic wastewater treatment system |
| EDB | ethylene dibromide |
| EPN | ethyl p-nitrophenyl benzenethiophosphonate |
| °F | degrees Fahrenheit |
| GOJ | Government of Japan |

| | |
|---|---|
| GPD | gallons per day |
| GWUDISW | groundwater under the direct influence of surface water |
| HAA5 | haloacetic acids (five) |
| IWTS | industrial wastewater treatment system |
| ISSA | interservice support agreement |
| JEGS | Japan Environmental Governing Standards |
| L | liter |
| LEC | Lead Environmental Component |
| LIA | local implementing agreement |
| LOQ | limit of quantitation |
| LPD | liters per day |
| LRAA | locational running annual average |
| LRV | log removal value |
| MCL | maximum contaminant level |
| μg | microgram |
| mg | milligram |
| mg-min/L | milligrams x minute per liter |
| MGD | million gallons per day |
| mJ | millijoule |
| mL | milliliter |
| mrem | millirem |
| MRDL | maximum residual disinfectant level |
| NCWS | non-community water system |
| ng | nanogram |
| NPWS | non-public water system |
| NTNCWS | non-transient, non-community water system |
| NTU | nephelometric turbidity unit |
| OEL | operational evaluation level |

| | |
|---|---|
| oocysts/L | oocysts per liter |
| OWS | oil/water separator |
| pCi | picoCurie |
| pg | picogram |
| PCB | polychlorinated biphenyl |
| ppm | parts per million |
| PWS | public water system |
| RPZ | reduced pressure zone |
| SOC | synthetic organic compound |
| SWPPP | stormwater pollution prevention plan |
| TCDD | tetrachlorodibenzo-p-dioxin |
| TDE | tetrachlorodiphenylethane |
| TEQ | toxic equivalence |
| TNCWS | transient, non-community water system |
| TOC | total organic carbon |
| TP | trichlorophenoxypropionic acid |
| TSS | total suspended solids |
| TTHM | total trihalomethanes |
| TTO | total toxic organics |
| UFC | Unified Facilities Criteria |
| UV | ultraviolet |
| VOC | volatile organic compound |

# CHAPTER 8: DRINKING WATER

## 8.1 INTRODUCTION

This chapter contains standards on the safety of water provided for human consumption. It includes requirements for DoD non-public water systems (NPWS) and requirements for DoD public water systems (PWS) that produce water, as well as those that purchase or are provided water from a Japanese PWS.

## 8.2 GENERAL

Installation commanders are responsible for ensuring that water provided for human consumption is safe, regardless of whether the water is produced by the installation or obtained from a Japanese PWS. Applicability of specific standards in this chapter is delineated by the classification of the system(s) providing water on the installation. DoD systems are classified as either NPWS or PWS, with a PWS further classified as either a community water system (CWS), non-transient, non-community water system (NTNCWS), and transient, non-community water system (TNCWS) (refer to the definition of PWS). Samples taken to conform to the standards of this chapter must be validated by independent testing or validated supplier testing.

8.2.1 Non-Public Water Systems (NPWS). A DoD NPWS must be monitored for coliform bacteria (total coliforms and *E. coli*), at a minimum, and disinfectant residuals periodically (e.g., quarterly, or before and during operation of an infrequently or seasonally used NPWS) in accordance with the appropriate DoD medical authority. A DoD NPWS is not required to meet any of the additional requirements of this chapter.

8.2.2 Public Water Systems (PWS). A DoD PWS must provide proper monitoring and treatment for all water provided for human consumption in accordance with the requirements of this chapter. For drinking water that is purchased or otherwise provided from a Japanese treatment plant or other source, Paragraphs 8.2.2.1 through 8.2.2.5 are only applicable within U.S. exclusive use facilities and areas. Additionally, a DoD PWS must meet the following general standards:

8.2.2.1 Design, Operation, and Maintenance

8.2.2.1.1 Implement and comply with the design, operation, and maintenance guidelines in accordance with UFC 3-230-01, Water Storage and Distribution, UFC 3-230-02, Operation and Maintenance: Water Supply Systems, and UFC 3-230-03, Water Treatment.

8.2.2.1.2 Maintain a map or drawing of the complete PWS.

8.2.2.1.3 Perform water distribution system operation and maintenance practices:

8.2.2.1.3.1 Maintain a detectable disinfectant residual throughout the water distribution system, except where determined unnecessary by the appropriate DoD medical authority.

8.2.2.1.3.2 Implement proper procedures for repairing and replacing mains and distribution system appurtenances (e.g., valves, meters, service connections), including disinfection and bacteriological testing.[71]

8.2.2.1.3.3 Conduct an annual water main flushing program to include uni-directional flushing.[72]

8.2.2.1.3.4 Properly operate and maintain storage tanks and reservoirs, including cleaning and inspection.

8.2.2.1.3.5 Maintain distribution system components, including hydrants and valves.

8.2.2.1.3.6 Maintain a continuous positive pressure of at least 138 kilopascals [20 pounds per square inch] in the water distribution system.

8.2.2.1.4 Establish a cross-connection control and backflow prevention program. The program will include, as a minimum, the following:

8.2.2.1.4.1 A cross-connection control plan to detect and prevent cross-connections in drinking water systems that create, or have the potential to create, an imminent and substantial danger to public health via drinking water contamination.[73] The plan will include cross-connection and backflow protection device (BFPD) inventories that are kept current. If any unprotected high-hazard cross-connection is discovered during the course of a cross-connection survey, the installation must report the finding to the appropriate DoD medical authority within 48 hours.

8.2.2.1.4.2 Inspection and testing of all BFPD for proper installation and operation.[74]

8.2.2.1.4.3 Reduced pressure zone (RPZ) BFPD on all fire suppression systems that use foam, antifreeze, or other chemicals.[75]

8.2.2.1.5 Use only lead-free pipe, pipe or plumbing fitting or fixture, solder, and flux in the installation or repair of water systems and plumbing systems for drinking water.

8.2.2.2 <u>Documentation and Recordkeeping</u>. Maintain all corrective actions, monitoring, and analytical records for at least three years, except:

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[71] UFC 3-230-01, Water Storage and Distribution: Chapter 5, Distribution System Piping and Appurtenances; UFC 3-230-02, Operation and Maintenance, Water Supply Systems: Chapter 6-3, Distribution System Maintenance.

[72] UFC 3-230-02, Operation and Maintenance, Water Supply Systems: Chapter 6-3.3, Flushing.

[73] UFC 3-230-01, Water Storage and Distribution: Chapter 5-9.1, Backflow Prevention and Cross Connection Control.

[74] UFC 3-230-02, Operation and Maintenance, Water Supply Systems: Chapter 9, Cross-Connection Control and Backflow Prevention.

[75] UFC 3-600-01, Fire Protection Engineering for Facilities: Chapter 9-6.6, Backflow Prevention and Cross Connection Control.

8.2.2.2.1 Bacteriological records for five years (except source water *Cryptosporidium* and *E. coli*).

8.2.2.2.2 *Cryptosporidium* and *E. coli* source water records for 10 years.

8.2.2.2.3 Chemical records for 10 years.

8.2.2.2.4 Cross-connection and backflow prevention testing and repair records for 10 years.

8.2.2.3 Source Water Protection

8.2.2.3.1 Protect all groundwater and surface water sources of drinking water from contamination by operations on DoD installations by:

8.2.2.3.1.1 Suitable placement and construction of wells.

8.2.2.3.1.2 Suitable placement of the new intake (heading) to all water treatment facilities.

8.2.2.3.1.3 Proper siting and maintaining septic systems and on-site treatment units.

8.2.2.3.1.4 Appropriate land use management.

8.2.2.3.1.5 Appropriate stormwater management.

8.2.2.3.1.6 Appropriate wellhead protection program.

8.2.2.3.2 Conduct sanitary surveys of the water system at least every three years for surface water systems, as well as groundwater under the influence of surface water, and every five years for systems using groundwater, or as warranted.[76] Sanitary surveys consist of an on-site inspection of the water source, treatment, distribution system, finished water storage, pumping facilities and controls, monitoring and reporting data, system management and operation, and compliance with operator requirements. Requirements for sanitary surveys state that off-installation surveys should be coordinated with the appropriate local governmental authorities.

8.2.2.3.3 Manage underground injection on DoD installations to protect underground water supply sources. Installations must not dispose of hazardous waste or wastewater by underground injection (does not preclude the disposal of sanitary wastewater in septic systems and small capacity cesspools that have been sited, constructed, and operated with the approval of appropriate DoD authorities).

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[76] Installations will conduct more frequent sanitary surveys on the direction of the appropriate DoD medical authority or service regulations: TB MED 576, Sanitary Control and Surveillance of Water Supplies at Fixed Installations, Chapter 1-6; DAFI 48-144, Drinking Water Surveillance Program, Chapter 3.4; NAVMED P-5010-5, Manual of Naval Protective Medicine, Chapter 5-35.

8.2.2.3.4 Conduct (and update as necessary) vulnerability assessments that include, but are not limited to, a review of:

8.2.2.3.4.1 Pipes and constructed conveyances; physical barriers; water collection, pretreatment, treatment, storage, and distribution facilities; and electronic, computer, or other automated systems used by the DoD PWS.

8.2.2.3.4.2 Use, storage, or handling of various chemicals.

8.2.2.3.4.3 Operation and maintenance of the water storage, treatment, and distribution systems.

8.2.2.4 Contingency Plan. Develop and update, as necessary, an emergency contingency plan to ensure the provision of water fit for human consumption despite interruptions from natural disasters and service interruptions. At a minimum, the plan must identify:

8.2.2.4.1 Plans, procedures, and equipment that can be implemented or used in the event of an intentional or unintentional disruption.

8.2.2.4.2 Key personnel.

8.2.2.4.3 Procedures to restore service, including supplemental sampling procedures.

8.2.2.4.4 Procedures to isolate damaged lines.

8.2.2.4.5 Alternative water supplies.[77]

8.2.2.4.6 Installation public notification procedures.

8.2.2.5 Source Water Sampling for DoD PWS with Japanese PWS Sources. Each DoD PWS that purchases or is provided water from a Japanese PWS, and is required to perform water sampling in accordance with Paragraphs 8.7, 8.9, and 8.11, must perform sampling at the point of entry to the installation before any additional treatment by the installation.

## 8.3 PERSONNEL QUALIFICATIONS

8.3.1 The appropriate installation point of contact must designate an operator in responsible charge to be the certified operator who makes decisions regarding the daily operational activities of a PWS, water treatment facility, or distribution system, that directly impact the quality or quantity of drinking water.

8.3.2 Operators in responsible charge must:

8.3.2.1 Be appropriately trained according to the level of complexity of the DoD PWS they operate and oversee.

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[77] Installations should develop interservice support agreements (ISSA) and local implementing agreements (LIA) necessary for access to alternate water supplies.

8.3.2.2 Be certified by having successfully completed, and been licensed through, a U.S. State-approved water system operator certification course, a similar Japanese course, or a course that meets industry standards and practices.

8.3.2.3 Maintain current certification for the duration of the appointment.

## 8.4 COLIFORM BACTERIA REQUIREMENTS

8.4.1 Monitoring Program. A DoD PWS must comply with the total coliform-related operational evaluation level (OEL) and *E. coli* maximum contaminant level (MCL). The DoD PWS must develop and maintain a written sample siting plan that is representative of water throughout the distribution system. The plan must identify routine and repeat sampling sites and a sample collection schedule. Total coliform samples must be collected in accordance with the written sample siting plan.

8.4.1.1 The total coliform-related OEL is exceeded whenever more than five percent of samples per month for a system examining 40 or more samples a month, or two or more samples per month when a system analyzes less than 40 samples per month, are confirmed positive for total coliforms.

8.4.1.2 The MCL for *E. coli* is exceeded whenever:

8.4.1.2.1 A routine *E. coli* positive sample is followed by a repeat total coliform positive sample or a repeat *E. coli* positive sample.

8.4.1.2.2 A routine total coliform positive sample is followed by any repeat sample that is positive for *E. coli*.

8.4.1.2.3 Any required repeat samples are not collected following an *E. coli* positive routine sample.

8.4.1.2.4 Any repeat total coliform positive sample is not tested for *E. coli*.

8.4.1.3 Whenever the OEL or *E. coli* MCL is exceeded, complete an assessment to determine if any sanitary defects exist and, if found, take corrective action.

8.4.2 Monitoring Plan and Sampling. A DoD PWS must develop and maintain a written monitoring plan and collect routine samples in accordance with the monitoring frequency provided in Table 8.1. Seasonal DoD PWS that do not maintain positive pressure throughout the distribution system must develop a startup plan to be completed before providing water at the beginning of the season.

8.4.3 Follow-up Sampling and Assessment

8.4.3.1 A DoD PWS with initial samples testing positive for total coliforms must collect repeat samples as soon as possible, preferably within 24 hours of being notified of the positive result. Repeat sample locations are required at the same tap as the original sample plus an upstream and downstream sample, each within five service connections of the original tap.

Monitoring must continue until total coliforms are no longer detected or the system determines the OEL has been exceeded and an assessment is initiated.

8.4.3.2 When any routine or repeat sample tests positive for total coliforms, it must be tested for *E. coli*. *E. coli* testing can be foregone on a total coliform positive sample if *E. coli* is assumed to be present.

8.4.3.3 If a DoD PWS has an indication of coliform contamination (e.g., as a result of an OEL exceedance, *E. coli* MCL violation, performance failure), it must be assessed to determine if any sanitary defects exist. If sanitary defects are found, the system must take corrective action.

8.4.4 Notification. If a DoD PWS has exceeded the total coliform-related OEL or *E. coli* MCL, the PWS must complete the notification in accordance with Paragraph 8.16, as follows:

8.4.4.1 Total Coliform-Related OEL. Notify the appropriate DoD medical authority within 24 hours of the DoD PWS receiving notification of an exceedance of the OEL. There is no requirement to notify the public of exceedance of the OEL if the OEL was not triggered by an *E. coli* MCL exceedance.

8.4.4.2 *E. coli* MCL. Notify the appropriate DoD medical authority as soon as possible, but no later than the end of the same day the command responsible for operating the DoD PWS is notified of the result. Because an acute risk to public health may exist, the installation public must be notified as soon as possible, but not later than 24 hours after the command responsible for operating the DoD PWS is notified of the test result.

## 8.5. INORGANIC CHEMICAL REQUIREMENTS

8.5.1 A DoD PWS must ensure that the water distributed for human consumption does not exceed inorganic chemical MCLs provided in Table 8.2, as applicable based on the system classification.

8.5.1.1 Except for nitrate, nitrite, and total nitrate and nitrite, for systems monitored quarterly or more frequently, a system is out of compliance if the annual running average concentration of an inorganic chemical exceeds the MCL.

8.5.1.2 For systems monitored annually or less frequently, a system is out of compliance if a single sample exceeds the MCL.

8.5.1.3 For nitrate, nitrite, and total nitrate and nitrite, system compliance is determined by averaging the single sample that exceeds the MCL with its confirmation sample; if this average exceeds the MCL, the system is out of compliance.

8.5.2 Systems must be monitored for inorganic chemicals at the frequency provided in Table 8.3.

8.5.2.1 Sampling Location. After any application of treatment, a minimum of one sample must be taken from water systems at every entry point to the distribution system or in the distribution system at a point that is representative.

8.5.2.2 Increased Monitoring. Increased monitoring must be performed quarterly and must begin in the next quarter after receipt of the sample result that triggered increased monitoring. Increased quarterly monitoring requires a minimum of two consecutive quarterly samples for groundwater systems and at least four consecutive quarterly samples for surface water systems. If all results are less than the increased monitoring trigger criteria, then the system may return to baseline monitoring requirements. Additional increased monitoring requirements relating to nitrate and nitrite are specified in Table 8.3.

8.5.3 If a DoD PWS is out of compliance, the installation must complete the notification in accordance with Paragraph 8.16 as soon as possible. If the nitrate, nitrite, or total nitrate and nitrite MCLs are exceeded, it is considered an acute health risk and the installation must complete the notification to:

8.5.3.1 The appropriate DoD medical authority as soon as possible, but in no case later than the end of the same day the command responsible for operating the PWS is notified of the result.

8.5.3.2 The installation public as soon as possible, but not later than 72 hours after the command responsible for operating the DoD PWS is notified of the test result. If the installation is only monitoring annually on the basis of direction from the appropriate DoD medical authority, it must immediately increase monitoring in accordance with Table 8.3 until corrective actions are completed and authorities determine the system is reliable and consistent.

## 8.6. FLUORIDE REQUIREMENTS

8.6.1 A DoD PWS adding fluoride (i.e., practicing fluoridation) for dental health should fluoridate to 0.7 mg/L.

8.6.2 A DoD PWS practicing fluoridation must sample at least daily for operational control of fluoridation. They must also analyze samples collected in the distribution system in conjunction with bacteriological samples. The command responsible for operating the DoD PWS must consider the presence of populations at risk for dental health effects and ensure fluoride is maintained throughout the distribution system when determining which bacteriological sampling sites will be monitored for fluoride.

8.6.3 A DoD PWS must be monitored for fluoride at the entry point to the distribution system as specified in Table 8.3 to determine compliance with the fluoride MCL.

8.6.4 An installation commander responsible for a DoD CWS must ensure that the fluoride content of drinking water does not exceed the MCL of 4.0 mg/L and should ensure the fluoride content does not exceed the secondary MCL of 2.0 mg/L, as stated in Table 8.2.

8.6.4.1 If any sample exceeds the MCL, the installation must complete the notification requirements specified in Paragraph 8.16.

8.6.4.2 If fluoride exceeds the secondary MCL, but not the MCL, the command responsible for operating the DoD CWS must notify the appropriate DoD medical authority within 14 calendar days and the installation public within one year, in accordance with

Paragraph 8.16. Notification of the installation public must be included in the annual consumer confidence report.

## 8.7 LEAD AND COPPER REQUIREMENTS

A DoD CWS or NTNCWS must not exceed action levels (distinguished from the MCL) of 0.015 mg/L of lead or 1.3 mg/L of copper in more than 10 percent of tap water samples collected during any monitoring period. An action level exceedance triggers other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring and treatment, public education, and lead service line replacement.

8.7.1 Affected DoD systems must conduct monitoring in accordance with Table 8.4. DoD installations and facilities must sample or ensure sampling is completed regardless of system ownership. High-risk sampling sites must be targeted by conducting a materials evaluation of the distribution system. Sampling sites must be selected based on a hierarchical approach.

8.7.1.1 For a CWS, priority is given to single-family residences that contain copper pipe with lead solder installed after 1982, contain lead pipes, or are served by lead service lines; then, structures, including multi-family residences with the foregoing characteristics; and, finally, residences and structures with copper pipe with lead solder installed before 1983.

8.7.1.2 NTNCWS sampling sites must consist of structures that contain copper pipe with lead solder installed after 1982, contain lead pipes, or are served by lead service lines. First draw samples must be collected from a cold water kitchen or bathroom tap; nonresidential samples must be taken at an interior tap from which water is typically drawn for consumption.

8.7.2 The installation must provide public notification, including corrective actions that may be taken, concerning the lead content of materials used in distribution or plumbing systems or the corrosivity of water that has caused leaching, which indicates a potential health threat if exposed to leaded water.

8.7.3 Action levels are exceeded based on the 90th percentile level. The 90th percentile level is calculated by multiplying the number of valid samples sorted in ascending order by 0.9 (e.g., 10 samples x 0.9 = 9.0; thus, use the 9th highest lead and copper test results to compare to the action level). If an action level is exceeded, the installation must:

8.7.3.1 Collect additional monitoring of water quality parameters as specified in Table 8.4.

8.7.3.2 Pursue optimal corrosion control treatment.

8.7.3.2.1 If action levels are exceeded after implementation of applicable corrosion control and source water treatment, lead service lines must be replaced if the lead service lines cause the lead action level to be exceeded.

8.7.3.2.2 Discontinue lead service line replacement whenever lead monitoring results do not exceed the action level in tap samples for two consecutive six-month monitoring periods.

8.7.3.2.3 Return to the standard monitoring schedule identified in Table 8.4.

8.7.4 The installation commander must implement an education program for installation personnel (including United States and Japan) within 60 days after the end of the monitoring period in which the action level was exceeded and must complete the notification in accordance with Paragraph 8.16 as soon as possible, but in no case later than 14 calendar days after the violation.

## 8.8 ORGANIC CHEMICAL REQUIREMENTS

8.8.1 A DoD CWS or NTNCWS must ensure that synthetic organic compounds (SOCs) and volatile organic compounds (VOCs) in water distributed to people do not exceed the MCLs delineated in Table 8.5.

8.8.1.1 Systems monitoring quarterly or more frequently are out of compliance if the annual running average concentration of an organic chemical, for each sample point, exceeds the MCL.

8.8.1.2 Systems monitoring annually or less frequently with a detection greater than the MCL are not out of compliance until an annual average is calculated and exceeds the MCL. The annual average is based on the annual or less frequent sample result and the quarterly monitoring sample results, required under the increased monitoring criteria delineated in Table 8.6.

8.8.2 A CWS or NTNCWS must be monitored for SOCs and VOCs according to the schedule stated in Table 8.6.

8.8.2.1 New DoD CWS or NTNCWS beginning operation must initially collect four consecutive quarterly samples to determine compliance with established VOC and SOC MCLs. New systems with no detections during the initial sampling event must continue monitoring at the base monitoring frequencies in Table 8.6.

8.8.2.2 A CWS or NTNCWS must choose sampling locations in accordance with the following:[78]

8.8.2.2.1 Groundwater systems must take a minimum of one sample at every entry point to the distribution system that is representative of each well after treatment. Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.

8.8.2.2.2 Surface water systems (or combined surface/ground) must take a minimum of one sample at every entry point to the distribution system at a point that is representative of each source or at each entry point to the distribution system after treatment. Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.

8.8.2.2.3 If the system draws water from more than one source and the sources are combined before distribution, the system must sample at an entry point to the distribution system

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[78] 40 CFR §141.24: National Primary Drinking Water Regulations, Monitoring and Analytical Requirements, Organic Chemicals, Sampling and Analytical Requirements.

during periods of normal operating conditions (i.e., when water representative of all sources is being used).

8.8.2.3 A CWS or NTNCWS monitoring at the base monitoring frequency or a reduced monitoring frequency that exceeds the trigger for increased monitoring in any one sample must continue or immediately begin quarterly monitoring. Monitoring must continue until the system demonstrates that it is reliably and consistently below the MCLs (i.e., when there is enough confidence that future sampling results will be sufficiently below the MCL to justify reducing the quarterly monitoring frequency). For example, water systems with widely varying analytical results or analytical results that are just below the MCL would not meet this criterion.

8.8.2.3.1 Groundwater systems must have a minimum of two consecutive quarterly samples with no detections or detections below the MCL to demonstrate the system is reliably and consistently below MCLs.

8.8.2.3.2 Surface water systems must have a minimum of four consecutive quarterly samples with no detections or detections below the MCL to demonstrate the system is reliably and consistently below MCLs.

8.8.2.4 A CWS or NTNCWS that detects a VOC or SOC above the MCL must continue or immediately begin quarterly monitoring and continue monitoring for a minimum of four consecutive quarters, until a system demonstrates that it is reliably and consistently below the MCL.

8.8.3 If a CWS or NTNCWS is out of compliance, the notification in accordance with Paragraph 8.16 must be completed as soon as possible, but no later than 14 days after the violation. The installation must continue monitoring, as noted in Table 8.6, and must continue until the installation commander determines the system is back in compliance and all necessary corrective measures have been implemented.

## 8.9. DISINFECTANT/DISINFECTION BYPRODUCTS (DDBP) REQUIREMENTS

8.9.1 DDBP Precursor Requirements. A DoD PWS with surface water or GWUDISW as the source water:

8.9.1.1 Using conventional filtration treatment must monitor each treatment plant water source for total organic carbon (TOC) on a monthly basis. Samples must be taken from the source water before treatment and the treated water (i.e., paired samples) not later than the point of combined filter effluent turbidity monitoring. Source water alkalinity must also be monitored at the same time. Systems with average treated water TOC of less than 2.0 mg/L for two consecutive years, or less than 1.0 mg/L for one year, may reduce TOC and alkalinity to one paired sample per plant per quarter.

8.9.1.2 Not using conventional filtration treatment must monitor only source water TOC before any treatment on a monthly basis. Source water TOC must be monitored quarterly for systems on reduced total trihalomethanes (TTHM) and haloacetic acids (five) (HAA5) monitoring frequencies.

8.9.2 DDBP Requirements for CWS and NTNCWS. A DoD CWS or NTNCWS that adds a disinfectant (i.e., an oxidant, such as chlorine, chlorine dioxide, chloramines, or ozone) to any part of their treatment process, including disinfectant added by a local water supplier, must meet the following requirements.

8.9.2.1 Comply with the following MCLs and maximum residual disinfectant levels (MRDLs):

8.9.2.1.1 TTHM MCL of 0.08 mg/L

8.9.2.1.2 HAA5 MCL of 0.06 mg/L

8.9.2.1.3 Chlorite MCL of 1.0 mg/L

8.9.2.1.4 Bromate MCL of 0.01 mg/L

8.9.2.1.5 Chlorine MRDL of 4.0 mg/L (as $Cl_2$)

8.9.2.1.6 Chloramines MRDL of 4.0 mg/L (as $Cl_2$)

8.9.2.1.7 Chlorine dioxide MRDL of 0.8 mg/L (as $ClO_2$)[79]

8.9.2.2 Noncompliance is determined as:

8.9.2.2.1 For TTHM or HAA5, when any locational running annual average (LRAA), computed quarterly for each sampling location, exceeds the MCL.

8.9.2.2.2 For chlorite, when the average concentration of any three-sample set (i.e., one monthly sample set from within the distribution system) exceeds the MCL.

8.9.2.2.3 For bromate, when a running yearly average of samples, computed quarterly, exceeds the MCL.

8.9.2.2.4 For chlorine or chloramine, when a running yearly average of monthly averages of all samples, computed quarterly, exceeds the MRDL. Operators may increase residual disinfectant levels of chlorine or chloramines in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems caused by circumstances such as distribution line breaks, storm runoff events, source water contamination, or cross-connections.

8.9.2.2.5 For chlorine dioxide, when:

8.9.2.2.5.1 Any daily sample from the entrance to the distribution system exceeds the MRDL and if one or more of the three samples taken the following day from within the distribution system exceeds the MRDL, or the system fails to take any distribution system samples. The MRDL for chlorine dioxide may be exceeded for short periods to address specific microbiological contamination problems.

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[79] 40 CFR §141.65: National Primary Drinking Water Regulations, Maximum Contaminant Levels and Maximum Residual Disinfectant Levels, Maximum Residual Disinfectant Levels.

8.9.2.2.5.2 Any two consecutive daily samples exceed the MRDL even if none of the distribution samples exceed the MRDL.

8.9.2.2.5.3 Monitoring is not performed at the entrance to the distribution system on the day following an exceedance of the chlorine dioxide MRDL.

8.9.2.3 Routinely monitor TTHM, HAA5, chlorine dioxide, chlorite, chloramine, chlorine, and bromate in accordance with Table 8.7.[80] Determine sample locations as follows:

8.9.2.3.1 For TTHM and HAA5, a CWS or NTNCW must collect the number of samples listed in Table 8.7. One of the samples must be taken at a location in the distribution system reflecting the maximum residence time of water in the system. If a maximum residence time sample location is identified on a dead-end line, ensure that the sample location is at or before the last consumer and not at the very end of the dead-end line. One of the samples must be taken at a location closer to the entry point to the distribution system or at a location where disinfectant residuals (e.g., chlorine and chloramines) are regularly detected. If more than two sample locations are required, one of the remaining samples must be collected at a location representative of the average residence time. Any other remaining samples must be taken at representative locations in the distribution system. Dual sample sets must be collected at each sampling location.

8.9.2.3.2 A CWS or NTNCWS using chlorine dioxide for disinfection or oxidation must take daily chlorite and chlorine dioxide samples at the entrance to the distribution system. Systems must also collect monthly chlorite samples within the distribution system, with one as close as possible to the first customer, one in a location representative of average residence time, and one as close as possible to the end of the distribution system (reflects maximum residence time within the distribution system).

8.9.2.3.3 A CWS or NTNCWS using ozone for disinfection or oxidation must take at least one monthly bromate sample at the entrance to the distribution system for each treatment plant in the system using ozone under normal operating conditions.

8.9.2.3.4 A CWS or NTNCWS using chlorine for disinfection or oxidation must sample for chlorine at the same time and location in the distribution systems as total coliforms.

8.9.2.3.5 A CWS or NTNCWS using chloramine for disinfection or oxidation must sample for chloramine (as either total chlorine or combined chlorine) at the same time and location in the distribution systems as total coliforms.

8.9.2.4 Increased monitoring is required as follows:

8.9.2.4.1 For TTHM and HAA5, systems monitoring annually or less frequently must increase monitoring frequency to quarterly at all sample locations if a TTHM sample result is greater than 0.08 mg/L or a HAA5 sample result is greater than 0.06 mg/L at any location. Quarterly sampling must continue for four consecutive quarters to calculate the LRAA for

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[80] 40 CFR §141.132: National Primary Drinking Water Regulations, Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors, Monitoring Requirements.

compliance determination. For systems monitoring annually, if no annual TTHM sample result is greater than 0.08 mg/L or HAA5 sample result is greater than 0.06 mg/L, the sample result for each monitoring location is considered the LRAA for that monitoring location.

8.9.2.4.2 For chlorite, additional monitoring is required when a daily sample exceeds the chlorite MCL. A three-sample set (following the monthly sample set protocol) must be collected the following day. Further distribution system monitoring is not required in that month unless the chlorite concentration at the entrance to the distribution system again exceeds the MCL.

8.9.2.4.3 For chlorine dioxide, if the MRDL is exceeded, three additional samples must be taken the following day as follows:

8.9.2.4.3.1 If chlorine is used to maintain a disinfectant residual in the distribution system and there are one or more disinfection addition points after the entrance to the distribution system (i.e., booster chlorination), the system must collect one sample as close as possible to the first customer, one sample in a location representative of average residence time, and one sample as close as possible to the end of the distribution system (reflects maximum residence time within the distribution system).

8.9.2.4.3.2 If chlorine dioxide or chloramines are used to maintain a disinfectant residual in the distribution system, or if chlorine is used to maintain a disinfectant residual and there are no disinfection addition points after the entrance to the distribution system (i.e., no booster chlorination), systems must take three samples in the distribution system as close as possible to the first customer at intervals of not less than six hours.

8.9.2.5 Reduced monitoring is as follows:

8.9.2.5.1 Systems using ozone may reduce bromate monitoring from monthly to once per quarter if the yearly average raw water bromide concentration is less than or equal to 0.0025 mg/L based on monthly measurements for one year.

8.9.2.5.2 Systems using chlorine dioxide may reduce chlorite monitoring from monthly to quarterly if, after one year, the chlorite concentration in all samples taken in the distribution system is below the MCL and no daily sample exceeds the MCL. Daily samples must still be collected. Monthly sample set monitoring resumes when any one daily sample exceeds the MCL.

8.9.2.5.3 Systems using surface water or GWUDISW source water may reduce TTHM and HAA5 monitoring as follows:

8.9.2.5.3.1 Systems serving a population of 499 or less are not eligible for reduced monitoring.

8.9.2.5.3.2 Systems serving a population of 500 or more must meet all of the following conditions to be eligible for reduced monitoring.

8.9.2.5.3.2.1 LRAA for TTHM is no more than 0.04 mg/L.

8.9.2.5.3.2.2 Annual average for HAA5 is no more than 0.03 mg/L.

8.9.2.5.3.2.3 At least 1 year of routine monitoring has been completed.

8.9.2.5.3.2.4 LRAA source water TOC level is no more than 4.0 mg/L before treatment.

8.9.2.5.3.3 Systems serving a population of 500 to 9,999 that meets the eligibility requirements in Paragraphs 8.9.2.5.3.2.1 through 8.9.2.5.3.2.4 may reduce monitoring frequency to two sample locations per year. Dual sample sets must be collected at each sampling location. Samples must be collected during the month of warmest water temperature. One sample location must be at the location representative of maximum residence time and one location must be at a location closer to the entry point to the distribution system. Systems remain on the reduced schedule as long as the annual sample result at any location is no more than 0.04 mg/L for TTHM and 0.03 mg/L for HAA5, and the source water annual average TOC is not greater than 4.0 mg/L.[81] Systems that do not meet these levels must revert to routine monitoring the following quarter.

8.9.2.5.3.4 Systems serving a population of 10,000 to 49,999 that meets the eligibility requirements in Paragraphs 8.9.2.5.3.2.1 through 8.9.2.5.3.2.4 may reduce monitoring frequency to two sample locations per quarter. Dual sample sets must be collected at each sampling location. Samples must be collected during the month of warmest water temperature. One sample location must be at the location representative of maximum residence time and one location must be at a location closer to the entry point to the distribution system. Systems may remain on the reduced schedule as long as the LRAA is no more than 0.04 mg/L for TTHM and 0.03 mg/L for HAA5, and the source water annual average TOC is not greater than 4.0 mg/L.[81] Systems that do not meet these levels must revert to routine monitoring the following quarter.

8.9.2.5.3.5 Systems serving a population of 50,000 or more that meet the eligibility requirements of Paragraphs 8.9.2.5.3.2.1 through 8.9.2.5.3.2.4 may reduce monitoring of TTHM and HAA5 to four sample locations per quarter. Dual sample sets must be collected at each sampling location. Samples must be collected during the warmest month of water during the sampling period. One sample location must be at the location representative of maximum residence time and one location must be at a location closer to the entry point to the distribution system. Systems may remain on the reduced schedule as long as the LRAA is no more than 0.04 mg/L for TTHM and 0.03 mg/L for HAA5, and the source water annual average TOC is not greater than 4.0 mg/L.[81] Systems that do not meet these levels must revert to routine monitoring the following quarter.

8.9.2.5.4 Systems using groundwater (not under the influence of surface water) source water may reduce TTHM and HAA5 monitoring as follows:

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[81] 40 CFR §141.623: National Primary Drinking Water Regulations, Stage 2 Disinfection Byproducts Requirements, Reduced Monitoring.

8.9.2.5.4.1 Systems must meet all of the following conditions to be eligible for reduced monitoring:

8.9.2.5.4.1.1 LRAA for TTHM is no more than 0.04 mg/L.

8.9.2.5.4.1.2 LRAA for HAA5 is no more than 0.03 mg/L.

8.9.2.5.4.1.3 At least 1 year of routine monitoring has been completed.

8.9.2.5.4.2 Systems serving a population of 10,000 or more that meet the eligibility requirements of Paragraphs 8.9.2.5.4.1.1 through 8.9.2.5.4.1.3 may reduce monitoring of TTHM and HAA5 to two sample locations per year. Dual sample sets must be collected at each sampling location. Samples must be collected during the month of warmest water temperature. One sample location must be at the location representative of maximum residence time and one location must be at a location closer to the entry point to the distribution system. Systems may remain on the reduced schedule as long as the annual sample result at any location is no more than 0.060 mg/L for TTHM or 0.045 mg/L for HAA5. Systems that do not meet these levels must revert to routine monitoring the following quarter.

8.9.2.5.4.3 Systems serving a population of 500 to 9,999 that meet the eligibility requirements of Paragraphs 8.9.2.5.4.1.1 through 8.9.2.5.4.1.3 may reduce monitoring of TTHM and HAA5 to one sampling location per year. A dual sample set must be collected at the location representative of maximum residence time. Samples must be collected during the month of warmest water temperature. Systems may remain on the reduced schedule as long as the annual sample result at the location is no more than 0.06 mg/L for TTHM or 0.045 mg/L for HAA5. Systems that do not meet these levels must revert to routine monitoring the following quarter.

8.9.2.5.4.4 Systems serving a population of 499 or less that meet the eligibility requirements of Paragraphs 8.9.2.5.4.1.1 through 8.9.2.5.4.1.3 may reduce monitoring of TTHM and HAA5 to two sample locations every three years. Dual sample sets must be collected at each sampling location. Samples must be collected during the month of warmest water temperature. One sample location must be at the location representative of maximum residence time and one location must be at a location closer to the entry point to the distribution system. Systems remain on the reduced schedule as long as the annual sample result at any location is no more than 0.06 mg/L for TTHM or 0.045 mg/L for HAA5. Systems that do not meet these levels must revert to routine monitoring the following quarter.

8.9.2.6 If a CWS or NTNCWS is out of compliance as described in Paragraph 8.9.2.2, the installation must perform the notification in accordance with Paragraph 8.16 as soon as possible, but in no case later than 14 calendar days after the violation, and undertake corrective measures.

8.9.3 DDBP Requirement for TNCWS. A TNCWS that uses chlorine dioxide as a disinfectant or oxidant must comply with the chlorine dioxide MRDL of 0.8 mg/L and the associated monitoring requirements for chlorine dioxide.

## 8.10 RADIONUCLIDE REQUIREMENTS

8.10.1 A DoD CWS must comply with the radionuclide MCLs in Table 8.8 and associated monitoring requirements.

8.10.1.1 Routine Monitoring. A CWS using groundwater, surface water, or both groundwater and surface water must sample at every entry point (i.e., sampling points) to the distribution system that is representative of all sources being used under normal operating conditions.

8.10.1.1.1 For gross alpha activity and radium-226 and radium-228, and uranium, systems must be tested once every four years. Testing must be conducted using an annual composite of four consecutive quarterly samples or the average of four samples obtained at quarterly intervals at a representative point in the distribution system.

8.10.1.1.2 Gross alpha only may be analyzed if activity is less than or equal to 5.0 pCi/L. Where radium-228 may be present in drinking water, radium-226 and/or radium-228 analyses should be performed when activity is greater than 2.0 pCi/L.

8.10.1.1.2.1 If the average annual concentration is less than 50 percent of the MCL, analysis of a single sample may be substituted for the quarterly sampling procedure.

8.10.1.1.2.2 A system with two or more sources having different concentrations of radioactivity must monitor source water in addition to water from a free-flowing tap.

8.10.1.1.2.3 If the installation introduces a new water source, these contaminants must be monitored within the first year after introduction.

8.10.1.1.3 A CWS must monitor for beta particle and photon radioactivity every nine years to include tritium and strontium-90. Monitoring consists of four consecutive quarterly samples at each entry point to the distribution system.

8.10.1.1.3.1 If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity is greater than 50 pCi/L for any sample, that sample must be further analyzed to identify the major radioactive constituents present and the appropriate doses must be calculated and summed to determine compliance with the MCL for beta particle and photon radioactivity.

8.10.1.1.3.2 A CWS may analyze for naturally occurring potassium-40 beta particle activity from the same or equivalent sample used for gross beta particle activity analysis. A CWS is allowed to subtract the potassium-40 beta particle activity value from the total gross beta particle activity value to determine if the resultant value greater than 50 pCi/L.

8.10.1.1.3.3 The potassium-40 beta particle activity must be calculated by multiplying elemental potassium concentrations (in mg/L) by a factor of 0.82.

8.10.1.2 Follow-up Requirements

8.10.1.2.1 If the annual average of sample results exceeds the MCL for gross alpha activity, radium-226 and radium-228 (combined), or uranium, the installation must provide the notification in accordance with Paragraph 8.16 within 14 calendar days. Monitoring must continue until corrective actions are completed and the average annual concentration no longer exceeds the respective MCL. Continued monitoring for gross alpha-related contamination must occur quarterly.

8.10.1.2.2 The beta particle and photon radioactivity MCL is exceeded if the average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water produces an annual dose equivalent to the total body or any internal organ greater than 4.0 mrem/year. The concentration of man-made radionuclides causing 4.0 mrem total body or organ dose equivalents must be calculated on the basis of two liters per day (LPD) drinking water intake using the 168-hour data list in the National Bureau of Standards Handbook 69.[82] If the beta particle and photon radioactivity MCL is exceeded, the installation must:

8.10.1.2.2.1 Provide the notification in accordance with Paragraph 8.16 within 14 calendar days.

8.10.1.2.2.2 Increase monitoring frequency to monthly as delineated in Paragraph 8.10.1.2.3.

8.10.1.2.3 A CWS that exceeds the beta particle and photon radioactivity MCL must conduct monthly monitoring beginning the month after the exceedance occurs. The CWS returns to routine monitoring (four consecutive quarters every nine years) when the rolling average of three monthly samples is less than the MCL. Routine monitoring begins in the quarter immediately after the rolling average of three monthly samples is less than the MCL.

## 8.11 SURFACE WATER TREATMENT REQUIREMENTS

A DoD PWS that use surface water sources or GWUDISW must meet the surface water treatment requirements. Only a DoD PWS that uses surface water sources or GWUDISW, and is in the control of the watershed or treatment plant in accordance with Paragraph 8.2, must meet the surface water treatment requirements.

8.11.1 Unfiltered Systems

8.11.1.1 Systems that use unfiltered surface water or GWUDISW must analyze the raw water for total coliforms or fecal coliforms at least weekly and for turbidity at least daily, and must continue as long as the unfiltered system is in operation.

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[82] U.S. Department of Commerce: National Bureau of Standards Handbook 69, Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure, 5 June 1959.

8.11.1.1.1 If the total coliforms or fecal coliforms exceed 100/100 milliliters (mL) and 20/100 mL, respectively, in excess of 10 percent of the samples collected in the previous six months, appropriate filtration must be applied.

8.11.1.1.2 Appropriate filtration must also be applied if turbidity of the source water immediately before the first or only point of disinfectant application exceeds 5.0 nephelometric turbidity units (NTU). If the turbidity exceeds the limit, the installation must provide notification in accordance with Paragraph 8.16 as soon as possible, but no later than 14 calendar days after the violation, and undertake corrective action.

8.11.1.2 Disinfection must achieve at least 99.9 percent (3.0-log) inactivation of *Giardia lamblia* cysts and 99.99 percent (4.0-log) inactivation of viruses by meeting applicable CT values as shown in Tables 8.12 through 8.27, or UV dose requirements as shown in Table 8.28. Note that ultraviolet (UV) disinfection converts hypochlorite to chloride. Therefore, log removal for chlorine disinfection residual following UV disinfection is available only if chlorine is added to re-establish a disinfectant residual.

8.11.1.2.1 Disinfection systems must have redundant components to ensure uninterrupted disinfection during operational periods.

8.11.1.2.2 Disinfectant residual must be monitored immediately after disinfection once every four hours that the system is in operation. Disinfectant residual measurements in the distribution system must be made at the same times as total coliforms are sampled.

8.11.1.2.3 Disinfectant residual of water entering the distribution system cannot be less than 0.2 mg/L for greater than four hours.

8.11.1.2.4 Water in a distribution system with a heterotrophic bacteria concentration less than or equal to 500/mL measured as heterotrophic plate count is considered to have a detectable disinfectant residual for the purpose of determining compliance with the surface water treatment requirements.

8.11.1.2.5 If disinfectant residuals in the distribution system are undetected in more than five percent of monthly samples for two consecutive months, appropriate filtration must be implemented if the undetected disinfectant residuals are due to a deficiency in treatment and not due to a deficiency in the distribution system, such as cross-connection contamination.

8.11.1.2.6 Surface water and GWUDISW systems that make changes to their disinfection practices (e.g., change in disinfectant or application point) in order to meet the DDBP requirements in Paragraph 8.9 must ensure that protection from microbial pathogens is not compromised.

8.11.1.3 To the extent that a DoD PWS has the ability, the system must maintain a watershed control program that minimizes the potential for contamination by *Giardia lamblia* cysts and viruses in the source water. The water system should demonstrate that it can control all human activities that may have an adverse impact on the microbial quality of the source water.

GWUDISW systems may use a wellhead protection program to meet the requirements of a watershed control program. At a minimum, a watershed control program must:

8.11.1.3.1 Characterize the watershed hydrology and land ownership.

8.11.1.3.2 Identify watershed characteristics and activities that may have an adverse effect on source water quality.

8.11.1.3.3 Monitor the occurrence of activities that may have an adverse effect on source water quality.

8.11.1.4 Installations must physically cover all finished water reservoirs, holding tanks, and storage water facilities.

8.11.2 Filtered Systems

8.11.2.1 Filtered water systems must provide a combination of disinfection and filtration that achieves a total of 99.9 percent (3.0-log) removal and inactivation of *Giardia lamblia* cysts, 99.99 percent (4.0-log) removal and inactivation of viruses, and 99 percent (2.0-log) removal of *Cryptosporidium* through filtration.

8.11.2.2 The turbidity of filtered water must be monitored at least once every four hours. The turbidity of filtered water for direct and conventional filtration systems must not exceed 0.3 NTU (1.0 NTU for slow sand and diatomaceous earth filters) in 95 percent of the analyses in a month, with a maximum of 1.0 NTU (5.0 NTU for slow sand and diatomaceous earth filters). If the turbidity exceeds the limit, the installation must provide notification in accordance with Paragraph 8.16 as soon as possible, but no later than 14 calendar days after the violation, and undertake corrective action.

8.11.2.3 Disinfection must provide the remaining log removal of *Giardia lamblia* cysts and viruses not obtained by the filtration technology applied. Proper conventional filtration treatment typically removes 2.5-log *Giardia*/2.0-log viruses/2.0-log *Cryptosporidium*. Proper direct filtration and diatomaceous earth filtration remove 2.0-log *Giardia*/1.0-log viruses/2.0-log *Cryptosporidium*. Slow sand filtration removes typically removes 2.0-log *Giardia*/2.0-log viruses/2.0-log *Cryptosporidium*. Less log removal may be assumed if treatment is not properly applied.

8.11.2.4 Disinfection residual maintenance and monitoring requirements are the same as those for unfiltered systems outlined in Paragraph 8.11.1.2.

8.11.2.5 Surface water and GWUDISW systems that make changes to their disinfection practices (e.g., change in disinfectant or application point) in order to meet the DDBP requirements in Paragraph 8.9 must ensure that protection from microbial pathogens is not compromised.

8.11.2.6 Use of alternate filtration technologies such as membrane processes and cartridge or bag filters for treatment of surface water for microbial contaminants must be approved by the appropriate DoD medical authority.

8.11.2.7 Conventional or direct filtration systems must continuously monitor (every 15 minutes) the individual filter turbidity for each filter used at the system. Systems with two or fewer filters may monitor combined filter effluent turbidity continuously instead of individual filter turbidity monitoring. If a system exceeds 1.0 NTU in two consecutive measurements for three months in a row for the same filter, the installation must conduct an assessment of the filter within 14 calendar days.

8.11.2.7.1 The assessment must include at least the following components: assessment of filter performance, development of a filter profile, identification and prioritization of factors limiting filter performance, assessment of the applicability of corrections, and preparation of a self-assessment report.

8.11.2.7.2 If a system exceeds 2.0 NTU (in two consecutive measurements 15 minutes apart) for two months in a row, a comprehensive performance evaluation (CPE) must be conducted within 90 days. The CPE will review and analyze a treatment plant's performance-based capabilities and associated administrative, operation, and maintenance practices. The CPE is conducted to identify factors that may be adversely impacting a plant's capability to achieve compliance and emphasizes approaches that can be implemented without significant capital improvements.

8.11.2.7.3 The CPE must consist, at a minimum, of the following components: assessment of plant performance, evaluation of major unit processes, identification and prioritization of performance limiting factors, assessment of the applicability of comprehensive technical assistance, and preparation of a CPE report.

8.11.2.8 Installations must cover all finished water reservoirs, holding tanks, and storage water facilities.

8.11.3 Enhanced Treatment for *Cryptosporidium* for Systems that Use Surface Water or Ground Water Under the Direct Influence of Surface Water (GWUDISW)

8.11.3.1 Unfiltered Systems

8.11.3.1.1 Initial Round of Source Water Monitoring. A system serving at least 10,000 people must sample their source water for *Cryptosporidium*, *E. coli*, and turbidity at least monthly for 24 months. Systems serving less than 10,000 people must sample their source water for *Cryptosporidium* at least twice per month for 12 months or at least monthly for 24 months.

8.11.3.1.1.1 Systems that operate less than six months per year and monitor for *Cryptosporidium* must collect at least six *Cryptosporidium* samples per year during each of two years of monitoring. Samples must be evenly spaced throughout the plant's operation period. Systems must sample their source water only during the time that the plant operates.

8.11.3.1.1.2 A system that begins using a new source of surface water or GWUDISW after the system is required to begin the initial round of source water monitoring must monitor the new source. The new system must also comply with determining the mean *Cryptosporidium* level, *Cryptosporidium* inactivation treatment requirements, and the second round of source water monitoring that must start not later than six years following the initial determination of the mean *Cryptosporidium* level.

8.11.3.1.1.3 Unfiltered systems are not required to conduct initial source water monitoring if the system provides a total of at least 3.0-log *Cryptosporidium* inactivation.

8.11.3.1.2 Determine Mean *Cryptosporidium* Level. Following the completion of the initial round of source water monitoring, calculate the arithmetic mean of all the *Cryptosporidium* sample concentrations reported.

8.11.2.1.2.1 The unfiltered system must report the arithmetic mean for approval to the appropriate DoD medical authority no later than six months after the month the system is required to complete the initial round of source water monitoring.

8.11.2.1.2.2 The arithmetic mean *Cryptosporidium* level must incorporate a summary of the source water monitoring data used for the calculation.

8.11.3.1.3 *Cryptosporidium* Inactivation Requirements. Systems with a mean *Cryptosporidium* level of 0.01 oocysts per liter (oocysts/L) or less must provide at least 2.0-log *Cryptosporidium* inactivation. Systems with a mean *Cryptosporidium* level of greater than 0.01 oocysts/L must provide at least 3.0-log *Cryptosporidium* inactivation.

8.11.3.1.4 Inactivation Treatment Technology Requirements. Unfiltered systems must use chlorine dioxide, ozone, or UV to meet the *Cryptosporidium* inactivation requirements. Unfiltered systems must meet the *Cryptosporidium* inactivation requirements using a minimum of two disinfectants. Each of two disinfectants must separately achieve the total inactivation required for *Cryptosporidium*, *Giardia*, or viruses.

8.11.3.1.5 Second Round of Source Water Monitoring. Initiate the second round of source water monitoring nine years after the initial round. A system must meet the requirements for monitoring parameters, frequency, and duration as described in Paragraph 8.11.3.1.1 unless the system provides a total of at least 3.0-log *Cryptosporidium* inactivation, equivalent to meeting the treatment requirements for unfiltered systems with a mean *Cryptosporidium* concentration greater than 0.01 oocysts/L.

8.11.3.1.5.1 The unfiltered system must report the arithmetic mean for approval to the appropriate DoD medical authority no later than six months after the month the system is required to complete the second round of source water monitoring. The arithmetic mean *Cryptosporidium* level must incorporate a summary of the source water monitoring data used for the calculation.

8.11.3.1.5.2 If the mean *Cryptosporidium* level for unfiltered systems changes following the second round of source water monitoring, and if the systems must provide a different level of *Cryptosporidium* treatment as a result of this change, the system must develop a schedule to meet treatment requirements.

8.11.3.2 Filtered Systems

8.11.3.2.1 Initial Round of Source Water Monitoring. A system serving at least 10,000 people must sample its source water for *Cryptosporidium*, *E. coli*, and turbidity at least monthly for 24 months. A system serving less than 10,000 people must sample its source water for *E. coli* at least once every two weeks for 12 months but may avoid *E. coli* monitoring if it is required to sample for *Cryptosporidium*. Systems serving fewer than 10,000 people must sample their source for *Cryptosporidium* at least twice per month for 12 months or at least monthly for 24 months if they use lake or reservoir sources and the annual mean *E. coli* concentration is greater than 10 *E. coli*/100 mL, or use flow stream sources and the annual mean *E. coli* concentration is greater than 50 *E. coli*/100 mL. Systems serving fewer than 10,000 people using GWUDISW sources must comply with requirements for *Cryptosporidium* monitoring based on the *E. coli* level that applies to the nearest surface body. If no surface water body is nearby, the system must comply based on the requirements that apply to systems using lake or reservoir sources.

8.11.3.2.1.1 Systems that operate less than six months per year and monitor for *Cryptosporidium* must collect at least six *Cryptosporidium* samples per year during each of two years of monitoring. Samples must be evenly spaced throughout the plant's operation period. Systems must sample their source water only during the time the plant operates.

8.11.3.2.1.2 A system that begins using a new source of surface water or GWUDISW, after the system is required to begin the initial round of source water monitoring, must monitor the new source. The new system must also comply with determining bin classification, *Cryptosporidium* inactivation treatment requirements, and the second round of source water monitoring which must start not later than six years following the initial bin determination.

8.11.3.2.1.3 Filtered systems are not required to conduct initial source water monitoring if the system provides a total of at least 5.5-log *Cryptosporidium* inactivation.

8.11.3.2.2 Determination of *Cryptosporidium* Bin Classification. Following the completion of the initial round of source water monitoring, systems must calculate an initial *Cryptosporidium* bin concentration for each plant for which monitoring was required. If the monthly *Cryptosporidium* sampling frequency varies, systems must first compute a monthly average for each month of monitoring. Systems must then use these monthly average concentrations, rather than individual sample concentrations. Use Table 8.9 to determine initial bin classification.

8.11.3.2.2.1 For systems that collected a total of at least 48 samples, the bin concentration is equal to the arithmetic mean of all sample concentrations.

8.11.3.2.2.2 For systems that collected a total of at least 24 samples, but no more than 47 samples, the bin concentration is equal to the highest arithmetic mean of all sample concentrations in any 12 consecutive months during which the *Cryptosporidium* samples were collected.

8.11.3.2.2.3 For systems serving less than 10,000 people that monitor for *Cryptosporidium* for only one year (i.e., collect 24 samples in 12 months), the bin concentration is equal to the arithmetic mean of all sample concentrations.

8.11.3.2.2.4 For systems that operate only part of the year and that monitor fewer than 12 months per year, the bin concentration is equal to the highest arithmetic mean of all sample concentrations during any year of *Cryptosporidium* monitoring.

8.11.3.2.3 Inactivation Treatment Technology Requirements. Systems must provide the level of additional treatment for *Cryptosporidium* inactivation specified in Table 8.10.

8.11.3.2.4 Second Round of Source Water Monitoring. Initiate a second round of source water monitoring nine years after the initial round. A system must meet the requirements for monitoring parameters, frequency, and duration as described in Paragraph 8.11.3.2.1 unless the system provides a total of at least 5.5-log of treatment for *Cryptosporidium*, which is equivalent to meeting the treatment requirements of Bin 4.

8.11.3.2.4.1 Filtered systems must recalculate their *Cryptosporidium* bin concentration following completion of the second round of source water monitoring.

8.11.3.2.4.2 If the classification for a filtered system changes following the second round of source water monitoring, the system must give the level of treatment required for *Cryptosporidium*.

8.11.3.2.4.3 Filtered systems may use one or more of the treatment and management options listed in Table 8.11.

## 8.12 GROUNDWATER TREATMENT REQUIREMENTS

8.12.1 A DoD PWS that uses only groundwater supplies not under the influence of surface water must provide adequate treatment. Systems that fail to meet the requirements for adequate treatment for longer than 24 hours must provide the notification in accordance with Paragraph 8.16 as soon as possible, but in no case later than 14 calendar days after the violation, and undertake corrective action.

8.12.2 Groundwater systems must provide treatment that reliably achieves at least a 4.0-log treatment of viruses (using disinfection, or a combination filtration and disinfection) before or at the first customer for the groundwater source. Groundwater systems are not allowed to discontinue 4.0-log treatment of viruses.

8.12.2.1 Disinfection Treatment

8.12.2.1.1 Groundwater systems using chlorine for disinfection must achieve 4.0-log inactivation of viruses by meeting applicable CT values as shown in Table 8.19.

8.12.2.1.2 Groundwater systems using chlorine dioxide for disinfection must achieve 4.0-log inactivation of viruses by meeting applicable CT values as shown in Table 8.21.

8.12.2.1.3 Groundwater systems using ozone for disinfection must achieve 4.0-log inactivation of viruses by meeting applicable CT values as shown in Table 8.23. Groundwater systems that use ozone must also add a chemical disinfectant (chlorine, chloramines, chlorine dioxide) to maintain a disinfectant residual in accordance with Paragraph 8.2.2.1.3.1.

8.12.2.1.4 Groundwater systems are not allowed to use UV for disinfection as the only treatment provided. Groundwater systems may use UV in combination with another disinfectant or in combination with filtration to achieve 4.0-log inactivation of viruses. Groundwater systems that use UV must also add a chemical disinfectant (chlorine, chloramines, chlorine dioxide) to maintain a disinfectant residual in accordance with Paragraph 8.2.2.1.3.1.

8.12.2.1.5 Groundwater systems providing disinfection treatment must meet the following monitoring requirements:

8.12.2.1.5.1 Groundwater systems serving a population of more than 3,300 must continuously monitor the residual disinfectant at the entry point to the distribution system and must record the lowest residual disinfectant concentration each day that the system is in operation. The lowest daily residual disinfectant concentration must be used to determine if 4.0-log inactivation of viruses is achieved. If the system fails to achieve a 4.0-log inactivation of viruses for more than one day, the system is in violation of the treatment requirements and must provide public notification in accordance with Paragraph 8.16 as soon as possible, but in no case later than 14 calendar days after the violation, and undertake corrective action.

8.12.2.1.5.2 Groundwater systems serving a population of 3,300 or less must monitor and record the residual disinfectant at the entry point to the distribution system each day that the system is in operation. The recorded residual disinfectant concentration must be used to determine if 4.0-log inactivation of viruses is achieved. If the system fails to achieve a 4.0-log inactivation of viruses for more than one day, the system is in violation of the treatment requirements and must provide public notification in accordance with Paragraph 8.16 as soon as possible, but no later than 14 calendar days after the violation, and undertake corrective action.

8.12.2.2 <u>Filtration and Disinfection Treatment</u>

8.12.2.2.1 Groundwater systems using filtration and disinfection treatment must achieve a total 4.0-log treatment of viruses either through disinfection treatment alone (in accordance with the disinfection treatment requirements in Paragraph 8.12.2.1) or through a combination of filtration and disinfection treatment in accordance with the following requirements.

8.12.2.2.1.1 Groundwater systems using conventional filtration, direct filtration, diatomaceous earth filtration, or slow sand filtration must meet the turbidity requirements for filtered systems in Paragraph 8.11.2.2.

8.12.2.2.1.2 Groundwater systems using conventional or slow sand filtration that meet the turbidity requirements and provide proper filtration treatment achieve 2.0-log virus removal and must achieve 2.0-log virus inactivation through disinfection for a total 4.0-log treatment of viruses.

8.12.2.2.1.3 Groundwater systems using direct filtration or diatomaceous earth filtration that meet the turbidity requirements and provide proper filtration treatment achieve 1.0-log virus removal and must achieve 3.0-log virus inactivation through disinfection for a total 4.0-log treatment of viruses. Proper filtration treatment is generally considered to be operation and maintenance in accordance with best industry standards and practices (e.g., consistent use of a chemical coagulant). Less log removal may be assumed if treatment is not properly applied.

8.12.2.2.1.4 Groundwater systems must comply with the disinfection treatment and monitoring requirements as delineated under disinfection treatment in Paragraph 8.12.2.1.5.

8.12.2.2.2 Groundwater systems using alternative filtration technology, such as membrane filtration, must demonstrate to the appropriate DoD medical authority that the alternative filtration technology, in combination with disinfection treatment, consistently achieves 4.0-log treatment of viruses.

## 8.13 FILTER BACKWASH REQUIREMENTS

To prevent microbes and other contaminants from passing through and into finished drinking water, a DoD PWS must ensure that recycled streams (i.e., recycled filter backwash water, sludge thickener supernatant, and liquids from dewatering processes) are treated by direct and conventional filtration processes. This requirement only applies to a DoD PWS that:

8.13.1 Uses surface water or GWUDISW and are in control of the treatment plant in accordance with Paragraph 8.2.

8.13.2 Uses direct or conventional filtration processes.

8.13.3 Recycles spent filter backwash water, sludge thickener supernatant, or liquids from dewatering processes.

## 8.14 ALTERNATIVE WATER SUPPLIES

Installations will, if necessary to protect public health, only use an alternative water supplies, including point-of-entry and point-of-use treatment devices, bottled water, and bulk water supplies that are approved by the installation commander upon recommendation by the appropriate DoD medical and veterinary authority.

8.14.1 The use of point-of-use treatment devices to comply with microbiological contaminant requirements (e.g., coliform bacteria) and VOC MCLs is prohibited.

8.14.2 Point-of-entry and point-of-use treatment devices used to comply with drinking water quality requirements of this chapter must be owned, operated, and maintained by the water system.

8.14.3 Monitoring for applicable contaminants covered by this chapter is required.

8.14.4 Bottled water is water that is sealed in bottles, packages, or other containers by commercial (non-military) interests for human consumption. When purchased as an alternative drinking source, bottled water must originate from a U.S. Army Veterinary Services approved source.

## 8.15 CONSUMER CONFIDENCE REPORTS

A DoD CWS must deliver to the population served by the CWS a consumer confidence report (i.e., water quality report) annually by July 1. The report will provide water quality data collected during the prior calendar year. Delivery can be accomplished through one or more of the following methods: posting to an installation website, publication in an installation newspaper, posting in public places such as community centers in housing areas, and hand or postal delivery. At a minimum, consumer confidence reports must include:

8.15.1 Phone number and e-mail for a water system contact person.

8.15.2 Source(s) of water.

8.15.3 Definitions (e.g., definition of MCL).

8.15.4 Information about contaminants detected.

8.15.5 Information about compliance with drinking water standards in this chapter.

8.15.6 Information about compliance with *Cryptosporidium* requirements in this chapter.

8.15.7 Additional information, as appropriate, regarding system operations, drinking water quality, and public information.

## 8.16 NOTIFICATION REQUIREMENTS

8.16.1 When a DoD PWS is out of compliance as set forth in this chapter, the LEC, Service Component Commander, and appropriate DoD medical authority must be notified as soon as possible, but in no case more than 48 hours after discovery of the violation.[83] The notice must provide:

8.16.1.1 A clear and readily understandable explanation of the violation.

8.16.1.2 Any potential adverse health effects; the population at risk.

8.16.1.3 The steps being taken to correct the violation.

8.16.1.4 The necessity for seeking an alternative water supply, if any.

8.16.1.5 Any preventive measures the consumer should take until the violation is corrected.

8.16.2 The appropriate local governmental authorities, after consultation with the LEC and Service Component Commander, must be notified in cases where Japanese populations are at risk.

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[83] Installation populations will be notified in accordance with the timelines specified in Paragraphs 8.4 through 8.12.

**Table 8.1: Total Coliform Monitoring Frequency**

| POPULATION SERVED | NUMBER OF SAMPLES(1) | POPULATION SERVED | NUMBER OF SAMPLES(1) |
|---|---|---|---|
| 25 to 1,000(2) | 1 | 59,001 to 70,000 | 70 |
| 1,001 to 2,500 | 2 | 70,001 to 83,000 | 80 |
| 2,501 to 3,300 | 3 | 83,001 to 96,000 | 90 |
| 3,301 to 4,100 | 4 | 96,001 to 130,000 | 100 |
| 4,101 to 4,900(3) | 5 | 130,001 to 220,000 | 120 |
| 4,901 to 5,800 | 6 | 220,001 to 320,000 | 150 |
| 5,801 to 6,700 | 7 | 320,001 to 450,000 | 180 |
| 6,701 to 7,600 | 8 | 450,001 to 600,000 | 210 |
| 7,601 to 8,500 | 9 | 600,001 to 780,000 | 240 |
| 8,501 to 12,900 | 10 | 780,001 to 970,000 | 270 |
| 12,901 to 17,200 | 15 | 970,001 to 1,230,000 | 300 |
| 17,201 to 21,500 | 20 | 1,230,001 to 1,520,000 | 330 |
| 21,501 to 25,000 | 25 | 1,520,001 to 1,850,000 | 360 |
| 25,001 to 33,000 | 30 | 1,850,001 to 2,270,000 | 390 |
| 33,001 to 41,000 | 40 | 2,270,001 to 3,020,000 | 420 |
| 41,001 to 50,000 | 50 | 3,020,001 to 3,960,000 | 450 |
| 50,001 to 59,000 | 60 | 3,960,001 or more | 480 |

Notes:

1. Minimum number of routine samples per month.
2. A non-community water system (NCWS) using groundwater and serving a population of 1,000 or less may monitor once in each calendar quarter during which the system provides water, provided a sanitary survey conducted within the last five years shows the system is supplied solely by a protected groundwater source and free of sanitary defects.
3. Systems that use groundwater, serve a population of less than 4,900, and collect samples from different sites may collect all samples on a single day. All other systems must collect samples at regular intervals throughout the month.

## Table 8.2: Inorganic Chemical MCLs

| CONTAMINANT | MCL (mg/L unless otherwise noted) |
|---|---|
| Arsenic(1) | 0.010 |
| Antimony(1) | 0.006 |
| Asbestos(1) | 7.0 x $10^6$ fibers/liter (longer than 10 µm) |
| Barium(1) | 2.0 |
| Beryllium(1) | 0.004 |
| Cadmium(1) | 0.005 |
| Chromium(1) | 0.02(6) |
| Cyanide(1) | 0.2 (as free cyanide) |
| Fluoride(2) | 4.0 |
| Fluoride (Secondary MCL)(3) | 2.0 |
| Mercury(1) | 0.002 |
| Nickel(4) | |
| Nitrate(5) | 10 (as N) |
| Nitrite(5) | 1.0 (as N) |
| Total Nitrite and Nitrate(5) | 10 (as N) |
| Selenium(1) | 0.05 |
| Sodium(4) | |
| Thallium(1) | 0.002 |

mg/L = milligrams per liter

Notes:

1. MCLs apply to CWS and NTNCWS.
2. MCL applies only to CWS.
3. Fluoride secondary MCL applies to CWS for notification purposes only.
4. No MCL established or in effect. Monitoring is required so that concentration levels can be made available on request. Sodium and nickel levels must be reported to the DoD medical authority on receipt of analysis.
5. MCLs apply to CWS, NTNCWS, and TNCWS.
6. Source: Ministerial Order on Drinking Water Quality Standard, Ministry of Health, Labor and Welfare Order No. 101 of 2003, updated 25 March 2020.

### Table 8.3: Inorganic Chemical Monitoring Requirements

| CONTAMINANT | GROUNDWATER BASELINE REQUIREMENT | SURFACE WATER BASELINE REQUIREMENT | TRIGGER THAT INCREASES MONITORING | REDUCED MONITORING |
|---|---|---|---|---|
| Arsenic | 1 sample every 3 years | Annual | > MCL | No |
| Antimony | 1 sample every 3 years | Annual | > MCL | No |
| Barium | 1 sample every 3 years | Annual | > MCL | No |
| Beryllium | 1 sample every 3 years | Annual | > MCL | No |
| Cadmium | 1 sample every 3 years | Annual | > MCL | No |
| Chromium | 1 sample every 3 years | Annual | > MCL | No |
| Cyanide | 1 sample every 3 years | Annual | > MCL | No |
| Fluoride | 1 sample every 3 years | Annual | > MCL | No |
| Mercury | 1 sample every 3 years | Annual | > MCL | No |
| Nickel | 1 sample every 3 years | Annual | | No |
| Selenium | 1 sample every 3 years | Annual | > MCL | No |
| Thallium | 1 sample every 3 years | Annual | > MCL | No |
| Sodium | 1 sample every 3 years | Annual | | No |
| Asbestos(1) | 1 sample every 9 years | 1 sample every 9 years | > MCL | Yes |
| Total Nitrate/Nitrite | Annual | Quarterly | ≥ 50% Nitrite MCL | No |
| Nitrate | Annual(2) | Quarterly(2) | ≥ 50% MCL(3) | Yes(4) |
| Nitrite | Annual(2) | Quarterly(2) | ≥ 50% MCL(3) | Yes(5) |
| Corrosivity(6) | Once | Once | | |

### Table 8.3: Inorganic Chemical Monitoring Requirements, Continued

| CONTAMINANT | GROUNDWATER BASELINE REQUIREMENT | SURFACE WATER BASELINE REQUIREMENT | TRIGGER THAT INCREASES MONITORING | REDUCED MONITORING |
|---|---|---|---|---|

Notes:

1. Necessity for analysis is predicated upon a sanitary survey conducted by the PWS.
2. Any sampling point with an analytical value greater than or equal to 0.5 mg/L as N (50 percent of the nitrite MCL) must begin sampling for nitrate and nitrite separately. Since nitrite readily converts to nitrate, a system can conclude that if the total nitrate/nitrite value of a sample is less than 50 percent of the nitrite MCL, then the value of nitrite in the sample would also be below 50 percent of its MCL.
3. Increased monitoring frequency must be quarterly for at least one year following any one sample for nitrate or nitrite in which the concentration is greater than or equal to 50 percent of the MCL. Groundwater systems may return to baseline monitoring requirements if all sample results are less than the nitrate or nitrite MCLs.
4. The appropriate DoD medical authority may reduce repeat sampling frequency for surface water systems to annually if after one year results are less than 50 percent of the MCL.
5. The appropriate DoD medical authority may reduce repeat sampling frequency to one annual sample if results are less than 50 percent of the MCL.
6. A PWS must be analyzed to determine the corrosivity entering the distribution system. Two samples (one mid-winter and one mid-summer) must be collected at the entry point of the distribution system for systems using surface water and groundwater under the direct influence (GWUDISW). One sample must be collected for systems using only groundwater. Corrosivity characteristics of the water must include measurements of pH, calcium, hardness, alkalinity, temperature, total dissolved solids, and calculation of Langelier Saturation Index.

### Table 8.4: Monitoring Requirements for Lead and Copper Water Quality Parameters

| POPULATION SERVED | NO. OF SITES FOR STANDARD MONITORING(1) | NO. OF SITES FOR REDUCED MONITORING(2) | NO. OF SITES FOR WATER QUALITY PARAMETERS(3) |
|---|---|---|---|
| > 100,000 | 100 | 50 | 25 |
| 10,001 – 100,000 | 60 | 30 | 10 |
| 3,301 – 10,000 | 40 | 20 | 3 |
| 501 – 3,300 | 20 | 10 | 2 |
| 101 – 500 | 10 | 5 | 1 |
| < 100 | 5 | 5 | 1 |

Notes:

1. Every six months for lead and copper.
2. Annually for lead and copper if action levels are met during each of two consecutive six-month monitoring periods. Any small- or medium-sized system (serving a population of less than 50,000) that meets the lead and copper action levels during three consecutive years may reduce the monitoring for lead and copper from annually to once every three years. Annual or triennial sampling must be conducted during the four warmest months of the year.
3. This monitoring must be conducted by all large systems (serving a population of greater than 50,000). Small- and medium-sized systems must monitor water quality parameters when action levels are exceeded. Samples must be representative of water quality throughout the distribution system and include a sample from the entry to the distribution system. Samples must be taken in duplicate for pH, alkalinity, calcium, conductivity or total dissolved solids, and water temperatures to allow a corrosivity determination (via a Langelier Saturation Index or other saturation index); additional parameters are orthophosphate when a phosphate inhibitor is used and silica when a silicate inhibitor is used.

## Table 8.5: Organic Chemical MCLs

| ORGANIC CHEMICALS | MCL (µg/L) | DETECTION LIMIT (µg/L) |
|---|---|---|
| SYNTHETIC ORGANIC CHEMICALS (SOCs) | | |
| Alachlor | 2.0 | 0.2 |
| Atrazine | 3.0 | 0.1 |
| Benzo[a]pyrene | 0.2 | 0.02 |
| Carbofuran | 40 | 0.9 |
| Chlordane | 2.0 | 0.2 |
| Dalapon | 200 | 1.0 |
| 2,4-D | 70 | 0.1 |
| 1,2-Dibromo-3-chloropropane (DBCP) | 0.2 | 0.02 |
| Di-(2-ethylhexyl) adipate | 400 | 0.6 |
| Di-(2-ethylhexyl) phthalate | 6.0 | 0.6 |
| Dinoseb | 7.0 | 0.2 |
| Diquat | 20 | 0.4 |
| Endrin | 2.0 | 0.01 |
| Endothall | 100 | 9.0 |
| Ethylene dibromide (EDB) | 0.05 | 0.01 |
| Glyphosate | 700 | 6.0 |
| Heptachlor | 0.4 | 0.04 |
| Heptachlorepoxide | 0.2 | 0.02 |
| Hexachlorobenzene | 1.0 | 0.1 |
| Hexachlorocyclopentadiene | 50 | 0.1 |
| Lindane | 0.2 | 0.02 |
| Methoxychlor | 40 | 0.1 |
| Oxamyl (Vydate) | 200 | 2.0 |
| PCBs (as decachlorobiphenyls) | 0.5 | 0.1 |
| Pentachlorophenol | 1.0 | 0.04 |
| Picloram | 500 | 0.1 |
| Simazine | 4.0 | 0.07 |
| 2,3,7,8-TCDD (Dioxin) | 30 pg/L | 5 pg/L |
| Toxaphene | 3.0 | 1.0 |
| 2,4,5-TP (Silvex) | 50 | 0.2 |

## Table 8.5: Organic Chemical MCLs, Continued

| ORGANIC CHEMICALS | MCL (µg/L) | DETECTION LIMIT (µg/L) |
|---|---|---|
| VOLATILE ORGANIC CHEMICALS (VOCs) | | |
| Benzene | 5.0 | 0.5 |
| Carbon tetrachloride | 5.0 | 0.5 |
| o-Dichlorobenzene | 600 | 0.5 |
| cis-1,2-Dichloroethylene | 70 | 0.5 |
| trans-1,2-Dichloroethylene | 100 | 0.5 |
| 1,1-Dichloroethylene | 7.0 | 0.5 |
| 1,1,1-Trichloroethane | 200 | 0.5 |
| 1,2-Dichloroethane | 5.0 | 0.5 |
| Dichloromethane | 5.0 | 0.5 |
| 1,1,2-Trichloroethane | 5.0 | 0.5 |
| 1,2,4-Trichlorobenzene | 70 | 0.5 |
| 1,2-Dichloropropane | 5.0 | 0.5 |
| Ethylbenzene | 700 | 0.5 |
| Monochlorobenzene | 100 | 0.5 |
| para-Dichlorobenzene | 75 | 0.5 |
| Styrene | 100 | 0.5 |
| Tetrachloroethylene | 5.0 | 0.5 |
| Trichloroethylene | 5.0 | 0.5 |
| Toluene | 1,000 | 0.5 |
| Vinyl chloride | 2.0 | 0.5 |
| Xylene (total) | 10,000 | 0.5 |
| OTHER ORGANICS | | |
| Acrylamide | treatment technique: 0.05% dosed at 1.0 ppm(1) | |
| Epichlorohydrin | treatment technique: 0.01% dosed at 20 ppm(1) | |

µg/L = micrograms per liter
pg/L = picograms per liter
PCB = polychlorinated biphenyl

<u>Note</u>:

1. Only applies when adding these polymer flocculants to the treatment process. No sampling is required; the system certifies that dosing is within specified limits.

### Table 8.6: Organic Chemical Monitoring Requirements

| CONTAMINANT | BASELINE MONITORING FREQUENCY | | TRIGGER FOR INCREASED MONITORING | REDUCED MONITORING |
|---|---|---|---|---|
| | GROUNDWATER | SURFACE WATER | | |
| VOCs | 1 sample every 3 years | Annual | > 0.5 µg/L | Yes(1) |
| SOCs | 4 consecutive quarterly samples every 3 years | 4 consecutive quarterly samples every 3 years | > Detection limit(2) | Yes(1,3) |

µg/L = micrograms per liter

Notes:

1. Monitoring frequency may be reduced if warranted based on a sanitary survey of the PWS.
2. Detection limits provided in Table 8.5 or as determined by the best available testing methods.
3. For systems monitoring at the base monitoring frequency with one round of no detections (e.g., four consecutive quarters with no detections) may further reduce monitoring frequency to the following: systems serving a population greater than 3,300 may reduce to two consecutive quarterly samples within one year during a period of three years; systems serving a population less than 3,300 may reduce to one sample every three years.

**Table 8.7: DDBP Monitoring Requirements**

| SOURCE WATER TYPE | POPULATION SERVED BY SYSTEM | ANALYTE AND ROUTINE MONITORING FREQUENCY | NUMBER OF SAMPLING LOCATIONS |
|---|---|---|---|
| Surface water or GWUDISW | ≥ 50,000 | TTHM & HAA5 – Quarterly | 8 |
| | 10,000 – 49,999 | TTHM & HAA5 – Quarterly | 4 |
| | 500 – 9,999 | TTHM & HAA5 – Quarterly | 2 |
| | ≤ 499 | TTHM & HAA5 – Yearly(1) | 2 |
| Groundwater | ≥ 10,000 | TTHM & HAA5 – Quarterly | 4 |
| | 500 – 9,999 | TTHM & HAA5 – Yearly | 2 |
| | ≤ 499 | TTHM & HAA5 – Yearly | 2 |

| WATER SYSTEM CRITERIA | ANALYTE AND ROUTINE MONITORING FREQUENCY |
|---|---|
| Water systems using chlorine dioxide | Chlorite – Daily and Monthly |
| | Chlorine Dioxide – Daily |
| Water systems using ozone | Bromate – Monthly |
| Water systems using chlorine | Chlorine – Same time and location as monthly bacteriological samples in accordance with Paragraph 8.4 |
| Water systems using chloramines | Chloramines – Same time and location as monthly bacteriological samples in accordance with Paragraph 8.4 |
| Water systems using surface water or GWUDISW | TOC – Monthly |

Note:

1. A surface water or GWUDISW water system serving a population of 499 or less must sample two locations per year to meet routine monitoring requirements. Samples must be collected during the month of warmest water temperature. Reduced monitoring is not allowed.

**Table 8.8: Radionuclide MCLs**

| CONTAMINANT | MCL |
|---|---|
| Gross Alpha(1) | 15 pCi/L |
| Combined Radium-226 and -228 | 5.0 pCi/L |
| Beta Particle and Photon Radioactivity(2,3) | 4.0 mrem/year(4) |
| Uranium | 30 μg/L |

μg/L = micrograms per liter
mrem/year = millirems per year
pCi/L = picoCuries per liter

Notes:

1. Gross alpha activity includes radium-226, but excludes radon and uranium.
2. Beta particle and photon activity is also referred to as gross beta activity from manmade radionuclides.
3. Includes tritium and strontium-90.
4. If the results of testing for all beta and photon emitters is less than or equal to 50 pCi/L, the system is in compliance. If the results are greater than 50 pCi/L, the samples must be further analyzed for individual nuclides. The results of the more specialized analysis are compared to the concentration allowed for that particular nuclide as shown in EPA Report 815-R-02-001, Radionuclides in Drinking Water: A Small Entity Compliance Guide.

## Table 8.9: Bin Classification for Filtered Systems

| BIN CLASSIFICATION | *CRYPTOSPORIDIUM* BIN CONCENTRATION |
|---|---|
| Bin 1 | < 0.075 oocysts/L |
| Bin 2 | 0.075 oocysts/L ≤ *Cryptosporidium* < 1.0 oocysts/L |
| Bin 3 | 1.0 oocysts/L ≤ *Cryptosporidium* < 3.0 oocysts/L |
| Bin 4 | *Cryptosporidium* ≥ 3.0 oocysts/L |

## Table 8.10: Additional Treatment for *Cryptosporidium* Inactivation

| FILTRATION SYSTEMS | | | | |
|---|---|---|---|---|
| BIN CLASSIFICATION OF SYSTEM | CONVENTIONAL FILTRATION TREATMENT (INCLUDING SOFTENING) | DIRECT FILTRATION | SLOW SAND OR DIATOMACEOUS EARTH FILTRATION | ALTERNATIVE FILTRATION TECHNOLOGIES |
| Bin 1 | No additional treatment | No additional treatment | No additional treatment | No additional treatment |
| Bin 2 | 1.0-log treatment | 1.5-log treatment | 1.0-log treatment | 4.0-log removal and inactivation |
| Bin 3(1) | 2.0-log treatment | 2.5-log treatment | 2.0-log treatment | 5.0-log removal and inactivation |
| Bin 4(1) | 2.5-log treatment | 3.0-log treatment | 2.5-log treatment | 5.5-log removal and inactivation |

Note:

1. Systems classified in Bins 3 and 4 must achieve at least 1.0-log of additional *Cryptosporidium* treatment using either one or a combination of the following: bag filters, bank filtration, cartridge filters, chlorine dioxide, membranes, ozone, or UV.

## Table 8.11: Microbial Toolbox

| OPTIONS | *CRYPTOSPORIDIUM* TREATMENT CREDIT AND IMPLEMENTATION CRITERIA |
|---|---|
| SOURCE PROTECTION AND MANAGEMENT | |
| Watershed control program(1) | 0.5-log credit for program comprising required elements, annual program status report, and regular watershed survey. |
| PRE-FILTRATION | |
| Pre-sedimentation basin with coagulation | 0.5-log credit during any month that pre-sedimentation basins achieve a monthly mean reduction of 0.5-log or greater in turbidity or alternative State-approved performance criteria.(2) |
| Two-stage lime softening | 0.5-log credit for two-stage softening where chemical addition and hardness precipitation occur in both stages. All plant flow must pass through both stages.(3) |
| Bank filtration | 0.5-log credit for 25-foot setback; 1.0-log credit for 50-foot setback; aquifer must be unconsolidated sand containing at least 10% fines; average turbidity in wells must be less than 1 NTU.(4) |
| TREATMENT PERFORMANCE | |
| Combined filter performance | 0.5-log credit for combined filter effluent turbidity less than or equal to 0.15 NTU in at least 95% of measurements each month. |
| Individual filter performance | 0.5-log credit (in addition to 0.5-log combined filter performance credit) if individual filter effluent turbidity is less than or equal to 0.15 NTU in at least 95% of samples each month in each filter and is never greater than 0.3 NTU in two consecutive measurements in any filter. |
| ADDITIONAL FILTRATION | |
| Bag or cartridge filters (individual filters) | Up to 2.0-log credit based on the removal efficiency demonstrated during challenge testing(5) with a 1.0-log factor of safety. |
| Bag or cartridge filters (in series) | Up to 2.5-log credit based on the removal efficiency demonstrated during challenge testing(5) with a 0.5-log factor of safety. |
| Membrane filtration | Log credit equivalent to removal efficiency demonstrated in challenge testing, direct integrity testing, and continuous indirect integrity monitoring. The required testing applies to other pathogens if membrane removal credits are claimed. |
| Second stage filtration | 0.5-log credit for second separate granular media filtration stage if treatment train includes coagulation before first filter. |
| Slow sand filters | 2.5-log credit as secondary filtration step; 3.0-log credit as a primary filtration process.(6) |

# Table 8.11: Microbial Toolbox, Continued

| OPTIONS | *CRYPTOSPORIDIUM* TREATMENT CREDIT AND IMPLEMENTATION CRITERIA |
|---|---|
| INACTIVATION | |
| Chlorine dioxide | Log credit based on measured CT in relation to Table 8.26. |
| Ozone | Log credit based on measured CT in relation to Table 8.27. |
| UV | Log credit based on validated UV dose in relation to Table 8.28.(7) |

Notes:

1. Unfiltered systems are not eligible for credit.
2. To be eligible, basins must be operated continuously with coagulant addition and all plant flow must pass through basins.
3. Single-stage softening is credited as equivalent to conventional filtration treatment.
4. Systems using wells followed by filtration when conducting source water monitoring must sample the well to determine bin classification and are not eligible for additional credit.
5. Bag and cartridge filter systems must complete challenge testing in order to receive *Cryptosporidium* treatment credit. The challenge testing must meet the following criteria:
   i. Test must be performed full-scale, identical to the construction, configuration (i.e., either individual filters or in series) and housing of the original system.
   ii. Test must be conducted using *Cryptosporidium* or a surrogate that is removed no more efficiently than *Cryptosporidium*. A method capable of discreetly quantifying the specific microorganism or surrogate must be used to determine concentration. Turbidity may not be used.
   iii. Maximum feed water concentration is based on the detection limit of the microorganism or surrogate and it can be computed using this equation:

   $$\text{Maximum Feed Concentration} = (1.0 \times 10^4) \times (\text{Filter Detection Limit})$$

   iv. Test must be conducted at the maximum design flow rate for the filter as specified by manufacturer.
   v. Removal efficiency of a filter is determined by applying this formula:

   $$LRV = LOG_{10}(C_f) - LOG_{10}(C_p)$$

   Where: LRV = Log removal value demonstrated during challenge test
   $C_f$ = Feed concentration measured during challenge test (same units as $C_p$)
   $C_p$ = Filtrate concentration measured during the challenge test (same units as $C_f$)

   If *Cryptosporidium* or surrogate is not detected in the filtrate, then the term $C_p$ must be set equal to the detection limit.
   vi. Each filter tested must be challenged with *Cryptosporidium* or the surrogate during three periods over the filtration cycle: (1) within two hours of startup of a new filter; (2) when the pressure drop is between 45 and 55 percent of the terminal pressure drop; and (3) at the end of the cycle after pressure drop has reached 100 percent of the terminal pressure drop. The LRV for the filter ($LRV_{filter}$) must be assigned the value of the minimum LRV observed during the three challenge periods for that filter.
   vii. If fewer than 20 filters are tested, the overall removal efficiency for the filter product line must be set equal to the lowest $LRV_{filter}$ among the filters tested. If 20 or more filters are tested, the overall removal efficiency for the filter product line must be set equal to the 10th percentile of the set of $LRV_{filter}$ values for the various filters tested.
   viii. If a previously tested filter is modified in a manner that could change the removal efficiency of the filter product line, challenge testing to demonstrate the removal efficiency of the modified filter must be conducted and submitted to the appropriate DoD medical authority.
6. No prior chlorination for either option.
7. Reactor validation testing required to establish UV dose and associated operating conditions.

## APPENDIX 8A: DRINKING WATER DISINFECTION TABLES

### Table 8.12: Estimated Baffling Factors

| BAFFLING CONDITION | BAFFLING FACTOR | BAFFLING DESCRIPTION |
|---|---|---|
| Partial Bypass | 0.0 | Tank with common inlet and outlet |
| Unbaffled (mixed flow) | 0.1 | None, agitated basin, very low length to width ratio, high inlet and outlet flow velocities |
| Poor | 0.3 | Single or multiple unbaffled inlets and outlets, no intra-basin baffles |
| Average | 0.5 | Baffled inlet or outlet with some intra-basin baffles |
| Superior | 0.7 | Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders |
| Perfect (plug flow) | 1.0 | Very high length to width ratio (pipeline flow), perforated inlet, outlet, and intra-basin baffles |

## Table 8.13: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Free Chlorine at 0.5°C [32.9°F] or Lower(1)

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 6 LOG INACTIVATIONS | | | | | | pH = 6.5 LOG INACTIVATIONS | | | | | | pH = 7.0 LOG INACTIVATIONS | | | | | | pH = 7.5 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 0.5 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 23 | 46 | 69 | 40 | 114 | 137 | 27 | 54 | 82 | 109 | 136 | 163 | 33 | 65 | 98 | 130 | 163 | 195 | 40 | 79 | 119 | 158 | 198 | 237 |
| 0.6 | 24 | 47 | 71 | 40 | 118 | 141 | 28 | 56 | 84 | 112 | 140 | 168 | 33 | 67 | 100 | 133 | 167 | 200 | 40 | 80 | 120 | 159 | 199 | 239 |
| 0.8 | 24 | 48 | 73 | 41 | 121 | 145 | 29 | 57 | 86 | 115 | 143 | 172 | 34 | 68 | 103 | 137 | 171 | 205 | 41 | 82 | 123 | 164 | 205 | 246 |
| 1.0 | 25 | 49 | 74 | 42 | 123 | 148 | 29 | 59 | 88 | 117 | 147 | 176 | 35 | 70 | 105 | 140 | 175 | 210 | 42 | 84 | 127 | 169 | 211 | 253 |
| 1.2 | 25 | 51 | 76 | 43 | 127 | 152 | 30 | 60 | 90 | 120 | 150 | 180 | 36 | 72 | 108 | 143 | 179 | 215 | 43 | 86 | 130 | 173 | 216 | 259 |
| 1.4 | 26 | 52 | 78 | 44 | 129 | 155 | 31 | 61 | 92 | 123 | 153 | 184 | 37 | 74 | 111 | 147 | 184 | 221 | 44 | 89 | 133 | 177 | 222 | 266 |
| 1.6 | 26 | 52 | 79 | 46 | 131 | 157 | 32 | 63 | 95 | 126 | 158 | 189 | 38 | 75 | 113 | 151 | 188 | 226 | 46 | 91 | 137 | 182 | 228 | 273 |
| 1.8 | 27 | 54 | 81 | 47 | 135 | 162 | 32 | 64 | 97 | 129 | 161 | 193 | 39 | 77 | 116 | 154 | 193 | 231 | 47 | 93 | 140 | 186 | 233 | 279 |
| 2.0 | 28 | 55 | 83 | 48 | 138 | 165 | 33 | 66 | 99 | 131 | 164 | 197 | 39 | 79 | 118 | 157 | 197 | 236 | 48 | 95 | 143 | 191 | 238 | 286 |
| 2.2 | 28 | 56 | 85 | 50 | 141 | 169 | 34 | 67 | 101 | 134 | 168 | 201 | 40 | 81 | 121 | 161 | 202 | 242 | 50 | 99 | 149 | 198 | 248 | 297 |
| 2.4 | 29 | 57 | 86 | 50 | 143 | 172 | 34 | 68 | 103 | 137 | 171 | 205 | 41 | 82 | 124 | 165 | 206 | 247 | 50 | 99 | 149 | 199 | 248 | 298 |
| 2.6 | 29 | 58 | 88 | 51 | 146 | 175 | 35 | 70 | 105 | 139 | 174 | 209 | 42 | 84 | 126 | 168 | 210 | 252 | 51 | 101 | 152 | 203 | 253 | 304 |
| 2.8 | 30 | 59 | 89 | 52 | 148 | 178 | 36 | 71 | 107 | 142 | 178 | 213 | 43 | 86 | 129 | 171 | 214 | 257 | 52 | 103 | 155 | 207 | 258 | 310 |
| 3.0 | 30 | 60 | 91 | 53 | 151 | 181 | 36 | 72 | 109 | 145 | 181 | 217 | 44 | 87 | 131 | 174 | 218 | 261 | 53 | 105 | 158 | 211 | 263 | 316 |

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 8 LOG INACTIVATIONS | | | | | | pH = 8.5 LOG INACTIVATIONS | | | | | | pH = 9.0 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 46 | 92 | 139 | 185 | 231 | 277 | 55 | 110 | 165 | 219 | 274 | 329 | 65 | 130 | 195 | 260 | 325 | 390 |
| 0.6 | 48 | 95 | 143 | 191 | 238 | 286 | 57 | 114 | 171 | 228 | 285 | 342 | 68 | 136 | 204 | 271 | 339 | 407 |
| 0.8 | 49 | 98 | 148 | 197 | 246 | 295 | 59 | 118 | 177 | 236 | 295 | 354 | 70 | 141 | 211 | 281 | 352 | 422 |
| 1.0 | 51 | 101 | 152 | 203 | 253 | 304 | 61 | 122 | 183 | 243 | 304 | 365 | 73 | 146 | 219 | 291 | 364 | 437 |
| 1.2 | 52 | 104 | 157 | 209 | 261 | 313 | 63 | 125 | 188 | 251 | 313 | 376 | 75 | 150 | 226 | 301 | 376 | 451 |
| 1.4 | 54 | 107 | 161 | 214 | 268 | 321 | 65 | 129 | 194 | 258 | 323 | 387 | 77 | 155 | 232 | 309 | 387 | 464 |
| 1.6 | 55 | 110 | 165 | 219 | 274 | 329 | 66 | 132 | 199 | 265 | 331 | 397 | 80 | 159 | 239 | 318 | 398 | 477 |
| 1.8 | 56 | 113 | 169 | 225 | 282 | 338 | 68 | 136 | 204 | 271 | 339 | 407 | 82 | 163 | 245 | 326 | 408 | 489 |
| 2.0 | 58 | 115 | 173 | 231 | 288 | 346 | 70 | 139 | 209 | 278 | 348 | 417 | 83 | 167 | 250 | 333 | 417 | 500 |
| 2.2 | 59 | 118 | 177 | 235 | 294 | 353 | 71 | 142 | 213 | 284 | 355 | 426 | 85 | 170 | 256 | 341 | 426 | 511 |
| 2.4 | 60 | 120 | 181 | 241 | 301 | 361 | 73 | 145 | 218 | 290 | 363 | 435 | 87 | 174 | 261 | 348 | 435 | 522 |
| 2.6 | 61 | 123 | 184 | 245 | 307 | 368 | 74 | 148 | 222 | 296 | 370 | 444 | 89 | 178 | 267 | 355 | 444 | 533 |
| 2.8 | 63 | 125 | 188 | 250 | 313 | 375 | 75 | 151 | 226 | 301 | 377 | 452 | 91 | 181 | 272 | 362 | 453 | 543 |
| 3.0 | 64 | 127 | 191 | 255 | 318 | 382 | 77 | 153 | 230 | 307 | 383 | 460 | 92 | 184 | 276 | 368 | 460 | 552 |

°C = degree Celsius, °F = degree Fahrenheit

Note:

1. $CT_{99.9}$ = CT for 3.0-log inactivation.

### Table 8.14: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Free Chlorine at 5.0°C [41°F]$^{(1)}$

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 6 LOG INACTIVATIONS | | | | | | pH = 6.5 LOG INACTIVATIONS | | | | | | pH = 7.0 LOG INACTIVATIONS | | | | | | pH = 7.5 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 0.5 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 16 | 32 | 49 | 65 | 81 | 97 | 20 | 39 | 59 | 78 | 98 | 117 | 23 | 46 | 70 | 93 | 116 | 139 | 28 | 55 | 83 | 111 | 138 | 166 |
| 0.6 | 17 | 33 | 50 | 67 | 83 | 100 | 20 | 40 | 60 | 80 | 100 | 120 | 24 | 48 | 72 | 95 | 119 | 143 | 29 | 57 | 86 | 114 | 143 | 171 |
| 0.8 | 17 | 34 | 52 | 69 | 86 | 103 | 20 | 41 | 61 | 81 | 102 | 122 | 24 | 49 | 73 | 97 | 122 | 146 | 29 | 58 | 88 | 117 | 146 | 175 |
| 1.0 | 18 | 35 | 53 | 70 | 88 | 105 | 21 | 42 | 63 | 83 | 104 | 125 | 25 | 50 | 75 | 99 | 124 | 149 | 30 | 60 | 90 | 119 | 149 | 179 |
| 1.2 | 18 | 36 | 54 | 71 | 89 | 107 | 21 | 42 | 64 | 85 | 106 | 127 | 25 | 51 | 76 | 101 | 127 | 152 | 31 | 61 | 92 | 122 | 153 | 183 |
| 1.4 | 18 | 36 | 55 | 73 | 91 | 109 | 22 | 43 | 65 | 87 | 108 | 130 | 26 | 52 | 78 | 103 | 129 | 155 | 31 | 62 | 94 | 125 | 156 | 187 |
| 1.6 | 19 | 37 | 56 | 74 | 93 | 111 | 22 | 44 | 66 | 88 | 110 | 132 | 26 | 53 | 79 | 105 | 132 | 158 | 32 | 64 | 96 | 128 | 160 | 192 |
| 1.8 | 19 | 38 | 57 | 76 | 95 | 114 | 23 | 45 | 68 | 90 | 113 | 135 | 27 | 54 | 81 | 108 | 135 | 162 | 33 | 65 | 98 | 131 | 163 | 196 |
| 2.0 | 19 | 39 | 58 | 77 | 97 | 116 | 23 | 46 | 69 | 92 | 115 | 138 | 28 | 55 | 83 | 110 | 138 | 165 | 33 | 67 | 100 | 133 | 167 | 200 |
| 2.2 | 20 | 39 | 59 | 79 | 98 | 118 | 23 | 47 | 70 | 93 | 117 | 140 | 28 | 56 | 85 | 113 | 141 | 169 | 34 | 68 | 102 | 136 | 170 | 204 |
| 2.4 | 20 | 40 | 60 | 80 | 100 | 120 | 24 | 48 | 72 | 95 | 119 | 143 | 29 | 57 | 86 | 115 | 143 | 172 | 35 | 70 | 105 | 139 | 174 | 209 |
| 2.6 | 20 | 41 | 61 | 81 | 102 | 122 | 24 | 49 | 73 | 97 | 122 | 146 | 29 | 58 | 88 | 117 | 146 | 175 | 36 | 71 | 107 | 142 | 178 | 213 |
| 2.8 | 21 | 41 | 62 | 83 | 103 | 124 | 25 | 49 | 74 | 99 | 123 | 148 | 30 | 59 | 89 | 119 | 148 | 178 | 36 | 72 | 109 | 145 | 181 | 217 |
| 3.0 | 21 | 42 | 63 | 84 | 105 | 126 | 25 | 50 | 76 | 101 | 126 | 151 | 30 | 61 | 91 | 121 | 152 | 182 | 37 | 74 | 111 | 147 | 184 | 221 |

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 8 LOG INACTIVATIONS | | | | | | pH = 8.5 LOG INACTIVATIONS | | | | | | pH = 9.0 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 33 | 66 | 99 | 132 | 165 | 198 | 39 | 79 | 118 | 157 | 197 | 236 | 47 | 93 | 140 | 186 | 233 | 279 |
| 0.6 | 34 | 68 | 102 | 136 | 170 | 204 | 41 | 81 | 122 | 163 | 203 | 244 | 49 | 97 | 146 | 194 | 243 | 291 |
| 0.8 | 35 | 70 | 105 | 140 | 175 | 210 | 42 | 84 | 126 | 168 | 210 | 252 | 50 | 100 | 151 | 201 | 251 | 301 |
| 1.0 | 36 | 72 | 108 | 144 | 180 | 216 | 43 | 87 | 130 | 173 | 217 | 260 | 52 | 104 | 156 | 208 | 260 | 312 |
| 1.2 | 37 | 74 | 111 | 147 | 184 | 221 | 45 | 89 | 134 | 178 | 223 | 267 | 53 | 107 | 160 | 213 | 267 | 320 |
| 1.4 | 38 | 76 | 114 | 151 | 189 | 227 | 46 | 91 | 137 | 183 | 228 | 274 | 55 | 110 | 165 | 219 | 274 | 329 |
| 1.6 | 39 | 77 | 116 | 155 | 193 | 232 | 47 | 94 | 141 | 187 | 234 | 281 | 56 | 112 | 169 | 225 | 281 | 337 |
| 1.8 | 40 | 79 | 119 | 159 | 198 | 238 | 48 | 96 | 144 | 191 | 239 | 287 | 58 | 115 | 173 | 230 | 288 | 345 |
| 2.0 | 41 | 81 | 122 | 162 | 203 | 243 | 49 | 98 | 147 | 196 | 245 | 294 | 59 | 118 | 177 | 235 | 294 | 353 |
| 2.2 | 41 | 83 | 124 | 165 | 207 | 248 | 50 | 100 | 150 | 200 | 250 | 300 | 60 | 120 | 181 | 241 | 301 | 361 |
| 2.4 | 42 | 84 | 127 | 169 | 211 | 253 | 51 | 102 | 153 | 204 | 255 | 306 | 61 | 123 | 184 | 245 | 307 | 368 |
| 2.6 | 43 | 86 | 129 | 172 | 215 | 258 | 52 | 104 | 156 | 208 | 260 | 312 | 63 | 125 | 188 | 250 | 313 | 375 |
| 2.8 | 44 | 88 | 132 | 175 | 219 | 263 | 53 | 106 | 159 | 212 | 265 | 318 | 64 | 127 | 191 | 255 | 318 | 382 |
| 3.0 | 45 | 89 | 134 | 179 | 223 | 268 | 54 | 108 | 162 | 216 | 270 | 324 | 65 | 130 | 195 | 259 | 324 | 389 |

°C = degree Celsius, °F = degree Fahrenheit

Note:

1. $CT_{99.9}$ = CT for 3.0-log inactivation.

## Table 8-15. CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Free Chlorine at 10°C [50°F][(1)]

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 6 LOG INACTIVATIONS | | | | | | pH = 6.5 LOG INACTIVATIONS | | | | | | pH = 7.0 LOG INACTIVATIONS | | | | | | pH = 7.5 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 0.5 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 12 | 24 | 37 | 49 | 61 | 73 | 15 | 29 | 44 | 59 | 73 | 88 | 17 | 35 | 52 | 69 | 87 | 104 | 21 | 42 | 63 | 83 | 104 | 125 |
| 0.6 | 13 | 25 | 38 | 50 | 63 | 75 | 15 | 30 | 45 | 60 | 75 | 90 | 18 | 36 | 54 | 71 | 89 | 107 | 21 | 43 | 64 | 85 | 107 | 128 |
| 0.8 | 13 | 26 | 39 | 52 | 65 | 78 | 15 | 31 | 46 | 61 | 77 | 92 | 18 | 37 | 55 | 73 | 92 | 110 | 22 | 44 | 66 | 87 | 109 | 131 |
| 1.0 | 13 | 26 | 40 | 53 | 66 | 79 | 16 | 31 | 47 | 63 | 78 | 94 | 19 | 37 | 56 | 75 | 93 | 112 | 22 | 45 | 67 | 89 | 112 | 134 |
| 1.2 | 13 | 27 | 40 | 53 | 67 | 80 | 16 | 32 | 48 | 63 | 79 | 95 | 19 | 38 | 57 | 76 | 95 | 114 | 23 | 46 | 69 | 91 | 114 | 137 |
| 1.4 | 14 | 27 | 41 | 55 | 68 | 82 | 16 | 33 | 49 | 65 | 82 | 98 | 19 | 39 | 58 | 77 | 97 | 116 | 23 | 47 | 70 | 93 | 117 | 140 |
| 1.6 | 14 | 28 | 42 | 55 | 69 | 83 | 17 | 33 | 50 | 66 | 83 | 99 | 20 | 40 | 60 | 79 | 99 | 119 | 24 | 48 | 72 | 96 | 120 | 144 |
| 1.8 | 14 | 29 | 43 | 57 | 72 | 86 | 17 | 34 | 51 | 67 | 84 | 101 | 20 | 41 | 61 | 81 | 102 | 122 | 25 | 49 | 74 | 98 | 123 | 147 |
| 2.0 | 15 | 29 | 44 | 58 | 73 | 87 | 17 | 35 | 52 | 69 | 87 | 104 | 21 | 41 | 62 | 83 | 103 | 124 | 25 | 50 | 75 | 100 | 125 | 150 |
| 2.2 | 15 | 30 | 45 | 59 | 74 | 89 | 18 | 35 | 53 | 70 | 88 | 105 | 21 | 42 | 64 | 85 | 106 | 127 | 26 | 51 | 77 | 102 | 128 | 153 |
| 2.4 | 15 | 30 | 45 | 60 | 75 | 90 | 18 | 36 | 54 | 71 | 89 | 107 | 22 | 43 | 65 | 86 | 108 | 129 | 26 | 52 | 79 | 105 | 131 | 157 |
| 2.6 | 15 | 31 | 46 | 61 | 77 | 92 | 18 | 37 | 55 | 73 | 92 | 110 | 22 | 44 | 66 | 87 | 109 | 131 | 27 | 53 | 80 | 107 | 133 | 160 |
| 2.8 | 16 | 31 | 47 | 62 | 78 | 93 | 19 | 37 | 56 | 74 | 93 | 111 | 22 | 45 | 67 | 89 | 112 | 134 | 27 | 54 | 82 | 109 | 136 | 163 |
| 3.0 | 16 | 32 | 48 | 63 | 79 | 95 | 19 | 38 | 57 | 75 | 94 | 113 | 23 | 46 | 69 | 91 | 114 | 137 | 28 | 55 | 83 | 111 | 138 | 166 |

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 8 LOG INACTIVATIONS | | | | | | pH = 8.5 LOG INACTIVATIONS | | | | | | pH = 9.0 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 25 | 50 | 75 | 99 | 124 | 149 | 30 | 59 | 89 | 118 | 148 | 177 | 35 | 70 | 105 | 139 | 174 | 209 |
| 0.6 | 26 | 51 | 77 | 102 | 128 | 153 | 31 | 61 | 92 | 122 | 153 | 183 | 36 | 73 | 109 | 145 | 182 | 218 |
| 0.8 | 26 | 53 | 79 | 105 | 132 | 158 | 32 | 63 | 95 | 126 | 158 | 189 | 38 | 75 | 113 | 151 | 188 | 226 |
| 1.0 | 27 | 54 | 81 | 108 | 135 | 162 | 33 | 65 | 98 | 130 | 163 | 195 | 39 | 78 | 117 | 156 | 195 | 234 |
| 1.2 | 28 | 55 | 83 | 111 | 138 | 166 | 33 | 67 | 100 | 133 | 167 | 200 | 40 | 80 | 120 | 160 | 200 | 240 |
| 1.4 | 28 | 57 | 85 | 113 | 142 | 170 | 34 | 69 | 103 | 137 | 172 | 206 | 41 | 82 | 124 | 165 | 206 | 247 |
| 1.6 | 29 | 58 | 87 | 116 | 145 | 174 | 35 | 70 | 106 | 141 | 176 | 211 | 42 | 84 | 127 | 169 | 211 | 253 |
| 1.8 | 30 | 60 | 90 | 119 | 149 | 179 | 36 | 72 | 108 | 143 | 179 | 215 | 43 | 86 | 130 | 173 | 216 | 259 |
| 2.0 | 30 | 61 | 91 | 121 | 152 | 182 | 37 | 74 | 111 | 147 | 184 | 221 | 44 | 88 | 133 | 177 | 221 | 265 |
| 2.2 | 31 | 62 | 93 | 124 | 155 | 186 | 38 | 75 | 113 | 150 | 188 | 225 | 45 | 90 | 136 | 181 | 226 | 271 |
| 2.4 | 32 | 63 | 95 | 127 | 158 | 190 | 38 | 77 | 115 | 153 | 192 | 230 | 46 | 92 | 138 | 184 | 230 | 276 |
| 2.6 | 32 | 65 | 97 | 129 | 162 | 194 | 39 | 78 | 117 | 156 | 195 | 234 | 47 | 94 | 141 | 187 | 234 | 281 |
| 2.8 | 33 | 66 | 99 | 131 | 164 | 197 | 40 | 80 | 120 | 159 | 199 | 239 | 48 | 96 | 144 | 191 | 239 | 287 |
| 3.0 | 34 | 67 | 101 | 134 | 168 | 201 | 41 | 81 | 122 | 162 | 203 | 243 | 49 | 97 | 146 | 195 | 243 | 292 |

°C = degree Celsius, °F = degree Fahrenheit

Note:

1. $CT_{99.9}$ = CT for 3.0-log inactivation.

## Table 8.16: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Free Chlorine at 15°C [59°F][(1)]

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 6 LOG INACTIVATIONS | | | | | | pH = 6.5 LOG INACTIVATIONS | | | | | | pH = 7.0 LOG INACTIVATIONS | | | | | | pH = 7.5 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 0.5 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 8 | 16 | 25 | 33 | 41 | 49 | 10 | 20 | 30 | 39 | 49 | 59 | 12 | 23 | 35 | 47 | 58 | 70 | 14 | 28 | 42 | 55 | 69 | 83 |
| 0.6 | 8 | 17 | 25 | 33 | 42 | 50 | 10 | 20 | 30 | 40 | 50 | 60 | 12 | 24 | 36 | 48 | 60 | 72 | 14 | 29 | 43 | 57 | 72 | 86 |
| 0.8 | 9 | 17 | 26 | 35 | 43 | 52 | 10 | 20 | 31 | 41 | 51 | 61 | 12 | 24 | 37 | 49 | 61 | 73 | 15 | 29 | 44 | 59 | 73 | 88 |
| 1.0 | 9 | 18 | 27 | 35 | 44 | 53 | 11 | 21 | 32 | 42 | 53 | 63 | 13 | 25 | 38 | 50 | 63 | 75 | 15 | 30 | 45 | 60 | 75 | 90 |
| 1.2 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 21 | 32 | 43 | 53 | 64 | 13 | 25 | 38 | 51 | 63 | 76 | 15 | 31 | 46 | 61 | 77 | 92 |
| 1.4 | 9 | 18 | 28 | 37 | 46 | 55 | 11 | 22 | 33 | 43 | 54 | 65 | 13 | 26 | 39 | 52 | 65 | 78 | 16 | 31 | 47 | 63 | 78 | 94 |
| 1.6 | 9 | 19 | 28 | 37 | 47 | 56 | 11 | 22 | 33 | 44 | 55 | 66 | 13 | 26 | 40 | 53 | 66 | 79 | 16 | 32 | 48 | 64 | 80 | 96 |
| 1.8 | 10 | 19 | 29 | 38 | 48 | 57 | 11 | 23 | 34 | 45 | 57 | 68 | 14 | 27 | 41 | 54 | 68 | 81 | 16 | 33 | 49 | 65 | 82 | 98 |
| 2.0 | 10 | 19 | 29 | 39 | 48 | 58 | 12 | 23 | 35 | 46 | 58 | 69 | 14 | 28 | 42 | 55 | 69 | 83 | 17 | 33 | 50 | 67 | 83 | 100 |
| 2.2 | 10 | 20 | 30 | 39 | 49 | 59 | 12 | 23 | 35 | 47 | 58 | 70 | 14 | 28 | 43 | 57 | 71 | 85 | 17 | 34 | 51 | 68 | 85 | 102 |
| 2.4 | 10 | 20 | 30 | 40 | 50 | 60 | 12 | 24 | 36 | 48 | 60 | 72 | 14 | 29 | 43 | 57 | 72 | 86 | 18 | 35 | 53 | 70 | 88 | 105 |
| 2.6 | 10 | 20 | 31 | 41 | 51 | 61 | 12 | 24 | 37 | 49 | 61 | 73 | 15 | 29 | 44 | 59 | 73 | 88 | 18 | 36 | 54 | 71 | 89 | 107 |
| 2.8 | 10 | 21 | 31 | 41 | 52 | 62 | 12 | 25 | 37 | 49 | 62 | 74 | 15 | 30 | 45 | 59 | 74 | 89 | 18 | 36 | 55 | 73 | 91 | 109 |
| 3.0 | 11 | 21 | 32 | 42 | 53 | 63 | 13 | 25 | 38 | 51 | 63 | 76 | 15 | 30 | 46 | 61 | 76 | 91 | 19 | 37 | 56 | 74 | 93 | 111 |

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 8 LOG INACTIVATIONS | | | | | | pH = 8.5 LOG INACTIVATIONS | | | | | | pH = 9.0 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 17 | 33 | 50 | 66 | 83 | 99 | 20 | 39 | 59 | 79 | 98 | 118 | 23 | 47 | 70 | 93 | 117 | 140 |
| 0.6 | 17 | 34 | 51 | 68 | 85 | 102 | 20 | 41 | 61 | 81 | 102 | 122 | 24 | 49 | 73 | 97 | 122 | 146 |
| 0.8 | 18 | 35 | 53 | 70 | 88 | 105 | 21 | 42 | 63 | 84 | 105 | 126 | 25 | 50 | 76 | 101 | 126 | 151 |
| 1.0 | 18 | 36 | 54 | 72 | 90 | 108 | 22 | 43 | 65 | 87 | 108 | 130 | 26 | 52 | 78 | 104 | 130 | 156 |
| 1.2 | 19 | 37 | 56 | 74 | 93 | 111 | 22 | 45 | 67 | 89 | 112 | 134 | 27 | 53 | 80 | 107 | 133 | 160 |
| 1.4 | 19 | 38 | 57 | 76 | 95 | 114 | 23 | 46 | 69 | 91 | 114 | 137 | 28 | 55 | 83 | 110 | 138 | 165 |
| 1.6 | 19 | 39 | 58 | 77 | 97 | 116 | 24 | 47 | 71 | 94 | 118 | 141 | 28 | 56 | 85 | 113 | 141 | 169 |
| 1.8 | 20 | 40 | 60 | 79 | 99 | 119 | 24 | 48 | 72 | 96 | 120 | 144 | 29 | 58 | 87 | 115 | 144 | 173 |
| 2.0 | 20 | 41 | 61 | 81 | 102 | 122 | 25 | 49 | 74 | 98 | 123 | 147 | 30 | 59 | 89 | 118 | 148 | 177 |
| 2.2 | 21 | 41 | 62 | 83 | 103 | 124 | 25 | 50 | 75 | 100 | 125 | 150 | 30 | 60 | 91 | 121 | 151 | 181 |
| 2.4 | 21 | 42 | 64 | 85 | 106 | 127 | 26 | 51 | 77 | 102 | 128 | 153 | 31 | 61 | 92 | 123 | 153 | 184 |
| 2.6 | 22 | 43 | 65 | 86 | 108 | 129 | 26 | 52 | 78 | 104 | 130 | 156 | 31 | 63 | 94 | 125 | 157 | 188 |
| 2.8 | 22 | 44 | 66 | 88 | 110 | 132 | 27 | 53 | 80 | 106 | 133 | 159 | 32 | 64 | 96 | 127 | 159 | 191 |
| 3.0 | 22 | 45 | 67 | 89 | 112 | 134 | 27 | 54 | 81 | 108 | 135 | 162 | 33 | 65 | 98 | 130 | 163 | 195 |

°C = degree Celsius, °F = degree Fahrenheit

Note:

1. $CT_{99.9}$ = CT for 3.0-log inactivation.

## Table 8.17: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Free Chlorine at 20°C [68°F](1)

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 6 LOG INACTIVATIONS | | | | | | pH = 6.5 LOG INACTIVATIONS | | | | | | pH = 7.0 LOG INACTIVATIONS | | | | | | pH = 7.5 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 0.5 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 6 | 12 | 18 | 24 | 30 | 36 | 7 | 15 | 22 | 29 | 37 | 44 | 9 | 17 | 26 | 35 | 43 | 52 | 10 | 21 | 31 | 41 | 52 | 62 |
| 0.6 | 6 | 13 | 19 | 25 | 32 | 38 | 8 | 15 | 23 | 30 | 38 | 45 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 21 | 32 | 43 | 53 | 64 |
| 0.8 | 7 | 13 | 20 | 26 | 33 | 39 | 8 | 15 | 23 | 31 | 38 | 46 | 9 | 18 | 28 | 37 | 46 | 55 | 11 | 22 | 33 | 44 | 55 | 66 |
| 1.0 | 7 | 13 | 20 | 26 | 33 | 39 | 8 | 16 | 24 | 31 | 39 | 47 | 9 | 19 | 28 | 37 | 47 | 56 | 11 | 22 | 34 | 45 | 56 | 67 |
| 1.2 | 7 | 13 | 20 | 27 | 33 | 40 | 8 | 16 | 24 | 32 | 40 | 48 | 10 | 19 | 29 | 38 | 48 | 57 | 12 | 23 | 35 | 46 | 58 | 69 |
| 1.4 | 7 | 14 | 21 | 27 | 34 | 41 | 8 | 16 | 25 | 33 | 41 | 49 | 10 | 19 | 29 | 39 | 48 | 58 | 12 | 23 | 35 | 47 | 58 | 70 |
| 1.6 | 7 | 14 | 21 | 28 | 35 | 42 | 8 | 17 | 25 | 33 | 42 | 50 | 10 | 20 | 30 | 39 | 49 | 59 | 12 | 24 | 36 | 48 | 60 | 72 |
| 1.8 | 7 | 14 | 22 | 29 | 36 | 43 | 9 | 17 | 26 | 34 | 43 | 51 | 10 | 20 | 31 | 41 | 51 | 61 | 12 | 25 | 37 | 49 | 62 | 74 |
| 2.0 | 7 | 15 | 22 | 29 | 37 | 44 | 9 | 17 | 26 | 35 | 43 | 52 | 10 | 21 | 31 | 41 | 52 | 62 | 13 | 25 | 38 | 50 | 63 | 75 |
| 2.2 | 7 | 15 | 22 | 29 | 37 | 44 | 9 | 18 | 27 | 35 | 44 | 53 | 11 | 21 | 32 | 42 | 53 | 63 | 13 | 26 | 39 | 51 | 64 | 77 |
| 2.4 | 8 | 15 | 23 | 30 | 38 | 45 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 22 | 33 | 43 | 54 | 65 | 13 | 26 | 39 | 52 | 65 | 78 |
| 2.6 | 8 | 15 | 23 | 31 | 38 | 46 | 9 | 18 | 28 | 37 | 46 | 55 | 11 | 22 | 33 | 44 | 55 | 66 | 13 | 27 | 40 | 53 | 67 | 80 |
| 2.8 | 8 | 16 | 24 | 31 | 39 | 47 | 9 | 19 | 28 | 37 | 47 | 56 | 11 | 22 | 34 | 45 | 56 | 67 | 14 | 27 | 41 | 54 | 68 | 81 |
| 3.0 | 8 | 16 | 24 | 31 | 39 | 47 | 10 | 19 | 29 | 38 | 48 | 57 | 11 | 23 | 34 | 45 | 57 | 68 | 14 | 28 | 42 | 55 | 69 | 83 |

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 8 LOG INACTIVATIONS | | | | | | pH = 8.5 LOG INACTIVATIONS | | | | | | pH = 9.0 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 12 | 25 | 37 | 49 | 62 | 74 | 15 | 30 | 45 | 59 | 74 | 89 | 18 | 35 | 53 | 70 | 88 | 105 |
| 0.6 | 13 | 26 | 39 | 51 | 64 | 77 | 15 | 31 | 46 | 61 | 77 | 92 | 18 | 36 | 55 | 73 | 91 | 109 |
| 0.8 | 13 | 26 | 40 | 53 | 66 | 79 | 16 | 32 | 48 | 63 | 79 | 95 | 19 | 38 | 57 | 75 | 94 | 113 |
| 1.0 | 14 | 27 | 41 | 54 | 68 | 81 | 16 | 33 | 49 | 65 | 82 | 98 | 20 | 39 | 59 | 78 | 98 | 117 |
| 1.2 | 14 | 28 | 42 | 55 | 69 | 83 | 17 | 33 | 50 | 67 | 83 | 100 | 20 | 40 | 60 | 80 | 100 | 120 |
| 1.4 | 14 | 28 | 43 | 57 | 71 | 85 | 17 | 34 | 52 | 69 | 86 | 103 | 21 | 41 | 62 | 82 | 103 | 123 |
| 1.6 | 15 | 29 | 44 | 58 | 73 | 87 | 18 | 35 | 53 | 70 | 88 | 105 | 21 | 42 | 63 | 84 | 105 | 126 |
| 1.8 | 15 | 30 | 45 | 59 | 74 | 89 | 18 | 36 | 54 | 72 | 90 | 108 | 22 | 43 | 65 | 86 | 108 | 129 |
| 2.0 | 15 | 30 | 46 | 61 | 76 | 91 | 18 | 37 | 55 | 73 | 92 | 110 | 22 | 44 | 66 | 88 | 110 | 132 |
| 2.2 | 16 | 31 | 47 | 62 | 78 | 93 | 19 | 38 | 57 | 75 | 94 | 113 | 23 | 45 | 68 | 90 | 113 | 135 |
| 2.4 | 16 | 32 | 48 | 63 | 79 | 95 | 19 | 38 | 58 | 77 | 96 | 115 | 23 | 46 | 69 | 92 | 115 | 138 |
| 2.6 | 16 | 32 | 49 | 65 | 81 | 97 | 20 | 39 | 59 | 78 | 98 | 117 | 24 | 47 | 71 | 94 | 118 | 141 |
| 2.8 | 17 | 33 | 50 | 66 | 83 | 99 | 20 | 40 | 60 | 79 | 99 | 119 | 24 | 48 | 72 | 95 | 119 | 143 |
| 3.0 | 17 | 34 | 51 | 67 | 84 | 101 | 20 | 41 | 61 | 81 | 102 | 122 | 24 | 49 | 73 | 97 | 122 | 146 |

°C = degree Celsius, °F = degree Fahrenheit

Note:

1. $CT_{99.9}$ = CT for 3.0-log inactivation.

## Table 8.18: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Free Chlorine at 25°C [77°F][1]

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 6 LOG INACTIVATIONS | | | | | | pH = 6.5 LOG INACTIVATIONS | | | | | | pH = 7.0 LOG INACTIVATIONS | | | | | | pH = 7.5 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 0.5 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 4 | 8 | 12 | 16 | 20 | 24 | 5 | 10 | 15 | 19 | 24 | 29 | 6 | 12 | 18 | 23 | 29 | 35 | 7 | 14 | 21 | 28 | 35 | 42 |
| 0.6 | 4 | 8 | 13 | 17 | 21 | 25 | 5 | 10 | 15 | 20 | 25 | 30 | 6 | 12 | 18 | 24 | 30 | 36 | 7 | 14 | 22 | 29 | 36 | 43 |
| 0.8 | 4 | 9 | 13 | 17 | 22 | 26 | 5 | 10 | 16 | 21 | 26 | 31 | 6 | 12 | 19 | 25 | 31 | 37 | 7 | 15 | 22 | 29 | 37 | 44 |
| 1.0 | 4 | 9 | 13 | 17 | 22 | 26 | 5 | 10 | 16 | 21 | 26 | 31 | 6 | 12 | 19 | 25 | 31 | 37 | 8 | 15 | 23 | 30 | 38 | 45 |
| 1.2 | 5 | 9 | 14 | 18 | 23 | 27 | 5 | 11 | 16 | 21 | 27 | 32 | 6 | 13 | 19 | 25 | 32 | 38 | 8 | 15 | 23 | 31 | 38 | 46 |
| 1.4 | 5 | 9 | 14 | 18 | 23 | 27 | 6 | 11 | 17 | 22 | 28 | 33 | 7 | 13 | 20 | 26 | 33 | 39 | 8 | 16 | 24 | 31 | 39 | 47 |
| 1.6 | 5 | 9 | 14 | 19 | 23 | 28 | 6 | 11 | 17 | 22 | 28 | 33 | 7 | 13 | 20 | 27 | 33 | 40 | 8 | 16 | 24 | 32 | 40 | 48 |
| 1.8 | 5 | 10 | 15 | 19 | 24 | 29 | 6 | 11 | 17 | 23 | 28 | 34 | 7 | 14 | 21 | 27 | 34 | 41 | 8 | 16 | 25 | 33 | 41 | 49 |
| 2.0 | 5 | 10 | 15 | 19 | 24 | 29 | 6 | 12 | 18 | 23 | 29 | 35 | 7 | 14 | 21 | 27 | 34 | 41 | 8 | 17 | 25 | 33 | 42 | 50 |
| 2.2 | 5 | 10 | 15 | 20 | 25 | 30 | 6 | 12 | 18 | 23 | 29 | 35 | 7 | 14 | 21 | 28 | 35 | 42 | 9 | 17 | 26 | 34 | 43 | 51 |
| 2.4 | 5 | 10 | 15 | 20 | 25 | 30 | 6 | 12 | 18 | 24 | 30 | 36 | 7 | 14 | 22 | 29 | 36 | 43 | 9 | 17 | 26 | 35 | 43 | 52 |
| 2.6 | 5 | 10 | 16 | 21 | 26 | 31 | 6 | 12 | 19 | 25 | 31 | 37 | 7 | 15 | 22 | 29 | 37 | 44 | 9 | 18 | 27 | 35 | 44 | 53 |
| 2.8 | 5 | 10 | 16 | 21 | 26 | 31 | 6 | 12 | 19 | 25 | 31 | 37 | 8 | 15 | 23 | 30 | 38 | 45 | 9 | 18 | 27 | 36 | 45 | 54 |
| 3.0 | 5 | 11 | 16 | 21 | 27 | 32 | 6 | 13 | 19 | 25 | 32 | 38 | 8 | 15 | 23 | 31 | 38 | 46 | 9 | 18 | 28 | 37 | 46 | 55 |

| CHLORINE CONCENTRATION (mg/L) | pH ≤ 8 LOG INACTIVATIONS | | | | | | pH = 8.5 LOG INACTIVATIONS | | | | | | pH = 9.0 LOG INACTIVATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| ≤ 0.4 | 8 | 17 | 25 | 33 | 42 | 50 | 10 | 20 | 30 | 39 | 49 | 59 | 12 | 23 | 35 | 47 | 58 | 70 |
| 0.6 | 9 | 17 | 26 | 34 | 43 | 51 | 10 | 20 | 31 | 41 | 51 | 61 | 12 | 24 | 37 | 49 | 61 | 73 |
| 0.8 | 9 | 18 | 27 | 35 | 44 | 53 | 11 | 21 | 32 | 42 | 53 | 63 | 13 | 25 | 38 | 50 | 63 | 75 |
| 1.0 | 9 | 18 | 27 | 36 | 45 | 54 | 11 | 22 | 33 | 43 | 54 | 65 | 13 | 26 | 39 | 52 | 65 | 78 |
| 1.2 | 9 | 18 | 28 | 37 | 46 | 55 | 11 | 22 | 34 | 45 | 56 | 67 | 13 | 27 | 40 | 53 | 67 | 80 |
| 1.4 | 10 | 19 | 29 | 38 | 48 | 57 | 12 | 23 | 35 | 46 | 58 | 69 | 14 | 27 | 41 | 55 | 68 | 82 |
| 1.6 | 10 | 19 | 29 | 39 | 48 | 58 | 12 | 23 | 35 | 47 | 58 | 70 | 14 | 28 | 42 | 56 | 70 | 84 |
| 1.8 | 10 | 20 | 30 | 40 | 50 | 60 | 12 | 24 | 36 | 48 | 60 | 72 | 14 | 29 | 43 | 57 | 72 | 86 |
| 2.0 | 10 | 20 | 31 | 41 | 51 | 61 | 12 | 25 | 37 | 49 | 62 | 74 | 15 | 29 | 44 | 59 | 73 | 88 |
| 2.2 | 10 | 21 | 31 | 41 | 52 | 62 | 13 | 25 | 38 | 50 | 63 | 75 | 15 | 30 | 45 | 60 | 75 | 90 |
| 2.4 | 11 | 21 | 32 | 42 | 53 | 63 | 13 | 26 | 39 | 51 | 64 | 77 | 15 | 31 | 46 | 61 | 77 | 92 |
| 2.6 | 11 | 22 | 33 | 43 | 54 | 65 | 13 | 26 | 39 | 52 | 65 | 78 | 16 | 31 | 47 | 63 | 78 | 94 |
| 2.8 | 11 | 22 | 33 | 44 | 55 | 66 | 13 | 27 | 40 | 53 | 67 | 80 | 16 | 32 | 48 | 64 | 80 | 96 |
| 3.0 | 11 | 22 | 34 | 45 | 56 | 67 | 14 | 27 | 41 | 54 | 68 | 81 | 16 | 32 | 49 | 65 | 81 | 97 |

°C = degree Celsius, °F = degree Fahrenheit

<u>Note</u>:

1. $CT_{99.9}$ = CT for 3.0-log inactivation.

### Table 8.19: CT Values (mg-min/L) for Inactivation of Viruses by Free Chlorine

| TEMPERATURE (°C) | 2.0-LOG INACTIVATION | | 3.0-LOG INACTIVATION | | 4.0-LOG INACTIVATION | |
|---|---|---|---|---|---|---|
| | pH 6-9 | pH 10 | pH 6-9 | pH 10 | pH 6-9 | pH 10 |
| 0.5 | 6 | 45 | 9 | 66 | 12 | 90 |
| 5 | 4 | 30 | 6 | 44 | 8 | 60 |
| 10 | 3 | 22 | 4 | 33 | 6 | 45 |
| 15 | 2 | 15 | 3 | 22 | 4 | 30 |
| 20 | 1 | 11 | 2 | 16 | 3 | 22 |
| 25 | 1 | 7 | 1 | 11 | 2 | 15 |

### Table 8.20: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Chlorine Dioxide

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 0.5-log | 10 | 4.3 | 4.0 | 3.2 | 2.5 | 2.0 |
| 1.0-log | 21 | 8.7 | 7.7 | 6.3 | 5.0 | 3.7 |
| 1.5-log | 32 | 13 | 12 | 10 | 7.5 | 5.5 |
| 2.0-log | 42 | 17 | 15 | 13 | 10 | 7.3 |
| 2.5-log | 52 | 22 | 19 | 16 | 13 | 9.0 |
| 3.0-log | 63 | 26 | 23 | 19 | 15 | 11 |

### Table 8.21: CT Values (mg-min/L) for Inactivation of Viruses by Chlorine Dioxide, pH 6-9

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 2.0-log | 8.4 | 5.6 | 4.2 | 2.8 | 2.1 | 1.4 |
| 3.0-log | 25.6 | 17.1 | 12.8 | 8.6 | 6.4 | 4.3 |
| 4.0-log | 50.1 | 33.4 | 25.1 | 16.7 | 12.5 | 8.4 |

### Table 8.22: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Ozone

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 0.5-log | 0.48 | 0.32 | 0.23 | 0.16 | 0.12 | 0.08 |
| 1.0-log | 0.97 | 0.63 | 0.48 | 0.32 | 0.24 | 0.16 |
| 1.5-log | 1.5 | 0.95 | 0.72 | 0.48 | 0.36 | 0.24 |
| 2.0-log | 1.9 | 1.3 | 0.95 | 0.63 | 0.48 | 0.32 |
| 2.5-log | 2.4 | 1.6 | 1.2 | 0.79 | 0.60 | 0.40 |
| 3.0-log | 2.9 | 1.9 | 1.43 | 0.95 | 0.72 | 0.48 |

### Table 8.23: CT Values (mg-min/L) for Inactivation of Viruses by Free Ozone

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 1.0-log | 0.9 | 0.6 | 0.5 | 0.3 | 0.25 | 0.15 |
| 2.0-log | 1.4 | 0.9 | 0.8 | 0.5 | 0.4 | 0.25 |
| 3.0-log | 1.8 | 1.2 | 1.0 | 0.6 | 0.5 | 0.3 |

### Table 8.24: CT Values (mg-min/L) for Inactivation of *Giardia lamblia* Cysts by Chloramine, pH 6-9

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 0.5-log | 635 | 365 | 310 | 250 | 185 | 125 |
| 1.0-log | 1,270 | 735 | 615 | 500 | 370 | 250 |
| 1.5-log | 1,900 | 1,100 | 930 | 750 | 550 | 375 |
| 2.0-log | 2,535 | 1,470 | 1,230 | 1,000 | 735 | 500 |
| 2.5-log | 3,170 | 1,830 | 1,540 | 1,250 | 915 | 625 |
| 3.0-log | 3,800 | 2,200 | 1,850 | 1,500 | 1,100 | 750 |

## Table 8.25: CT Values (mg-min/L) for Inactivation of Viruses by Chloramine

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 2.0-log | 1,243 | 857 | 643 | 428 | 321 | 214 |
| 3.0-log | 2,063 | 1,423 | 1,067 | 712 | 534 | 356 |
| 4.0-log | 2,883 | 1,988 | 1,491 | 994 | 746 | 497 |

## Table 8.26: CT Values (mg-min/L) for *Cryptosporidium* Inactivation by Chlorine Dioxide(1)

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 0.5-log | 305 | 214 | 138 | 89 | 58 | 38 |
| 1.0-log | 610 | 429 | 277 | 179 | 116 | 75 |
| 1.5-log | 915 | 643 | 415 | 268 | 174 | 113 |
| 2.0-log | 1,220 | 858 | 553 | 357 | 232 | 150 |
| 2.5-log | 1,525 | 1,072 | 691 | 447 | 289 | 188 |
| 3.0-log | 1,830 | 1,286 | 830 | 536 | 347 | 226 |

Note:
1. Systems may use this equation to determine log credit between the indicated values:
Log credit = $(0.001506 \times [1.09116]^{Temp}) \times CT$

## Table 8.27: CT Values (mg-min/L) for *Cryptosporidium* Inactivation by Ozone(1)

| INACTIVATION | TEMPERATURE | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 1°C [33.8°F] | 5°C [41°F] | 10°C [50°F] | 15°C [59°F] | 20°C [68°F] | 25°C [77°F] |
| 0.5-log | 12 | 7.9 | 4.9 | 3.1 | 2.0 | 1.2 |
| 1.0-log | 23 | 16 | 9.9 | 6.2 | 3.9 | 2.5 |
| 1.5-log | 35 | 24 | 15 | 9.3 | 5.9 | 3.7 |
| 2.0-log | 46 | 32 | 20 | 12 | 7.8 | 4.9 |
| 2.5-log | 58 | 40 | 25 | 16 | 9.8 | 6.2 |
| 3.0-log | 69 | 47 | 30 | 19 | 12 | 7.4 |

Note:
1. Systems may use this equation to determine log credit between the indicated values:
Log credit = $(0.001506 \times [1.09116]^{Temp}) \times CT$

### Table 8.28: UV Dose Requirements for *Cryptosporidium*, *Giardia lamblia* Cysts, and Virus Inactivation Credit

| INACTIVATION | UV DOSE (mJ/cm$^2$) | | |
|---|---|---|---|
| | *Cryptosporidium* | *Giardia lamblia* cysts(1) | Virus(1) |
| 0.5-log | 1.6 | 1.5 | 39 |
| 1.0-log | 2.5 | 2.1 | 58 |
| 1.5-log | 3.9 | 3.0 | 79 |
| 2.0-log | 5.8 | 5.2 | 100 |
| 2.5-log | 8.5 | 7.7 | 121 |
| 3.0-log | 12 | 7.0 | 143 |
| 3.5-log | 15 | 11 | 163 |
| 4.0-log | 22 | 15 | 186 |

Note:
1. 40 CFR §141.720: National Primary Drinking Water Regulations, Enhanced Treatment for *Cryptosporidium*, Inactivation Toolbox Components.

# CHAPTER 9: WASTEWATER AND STORMWATER

## 9.1 INTRODUCTION

This chapter contains standards on the control of discharges of wastewater and stormwater into the Waters of Japan and to protect the aquatic environment and groundwater resources. It includes, but is not limited to domestic and industrial wastewater discharges, and stormwater runoff associated with industrial and construction activities.

## 9.2 GENERAL

Installation commanders are responsible for ensuring that wastewater discharges and stormwater management activities comply with the standards of this chapter, as applicable.

9.2.1 <u>Personnel Qualifications</u>

9.2.1.1 <u>Wastewater</u>. Installations must ensure that personnel responsible for operating or overseeing domestic wastewater treatment systems (DWTS) and industrial wastewater treatment systems (IWTS) or equipment are appropriately trained, on a recurring basis, to perform their duties according to the complexity of the systems they operate or oversee.

9.2.1.2 <u>Stormwater</u>. Personnel who work in areas where industrial materials or activities are exposed to stormwater, or who are responsible for implementing activities necessary to meet the conditions of the Stormwater Pollution Prevention Plan (SWPPP) (e.g., inspectors and maintenance personnel) must be trained in appropriate best management practices (BMPs) applicable to their work.

9.2.2 <u>Unified Facilities Criteria (UFC) Guidelines</u>. Installations must implement and follow the design, operation, and maintenance guidelines in accordance with UFC 3-240-01, Wastewater Collection and Treatment, and UFC 3-230-13, Industrial Water Treatment Operation and Maintenance when operating wastewater treatment systems or conducting wastewater treatment.

9.2.3 <u>Complaint System</u>. Establish a system that involves the LEC, as appropriate, to investigate water pollution complaints from individuals or appropriate governmental water pollution control authorities.

9.2.4 <u>Recordkeeping Requirements</u>. Retain the following records for three years:

9.2.4.1 Effluent concentration, or other measurement specified for each regulated parameter.

9.2.4.2 Daily volume of effluent discharge from each point source.

9.2.4.3 Test procedures for the analysis of pollutants.

9.2.4.4 Date, exact place, and time of sampling and measurements.

9.2.4.5 Name of the person who performed the sampling or measurements.

9.2.4.6 Date of analysis.

9.2.4.7 Records documenting personnel training and certification.

9.2.4.8 Records of complaints.

9.2.5 Notification Requirements. When an installation is out of compliance with an effluent limitation as set forth in this chapter, the installation commander will notify the LEC and the Service Component Commander as soon as possible, but in no case more than 48 hours after discovery of the violation. The notice must provide:

9.2.5.1 A clear and readily understandable explanation of the violation.

9.2.5.2 Any potential adverse environmental effects related to the violation.

9.2.5.3 The steps being taken to correct the violation.

## 9.3 WATERS OF JAPAN DIRECT INTERACTION

9.3.1 Pesticides. Installations that may discharge pesticides directly to the Waters of Japan must follow the measures in JEGS Paragraph 14.6.7.

9.3.2 Cooling Water Intake Structures. Installations that have facilities designed to withdraw more than 7.57 million LPD [2.0 MGD] of water from the Waters of Japan, and that use at least 25 percent of the water they withdraw exclusively for cooling purposes, must minimize impingement and entrainment of aquatic species.

## 9.4 EFFLUENT LIMITATIONS FOR WASTEWATER DISCHARGES

9.4.1 Treated Domestic Wastewater

9.4.1.1 Effluent Discharge Limits. Installations that discharge treated domestic wastewater from a DWTS to the Waters of Japan must comply with the effluent discharge limits in Table 9.5.

9.4.1.2 Monitoring. Installations must collect samples at the point of discharge to the Waters of Japan.

9.4.1.2.1 Conventional Pollutants. Monitoring requirements apply to all regulated facilities. The monitoring frequency (including both sampling and analysis) is shown in Table 9.1.

9.4.1.2.2 Other Pollutants. Monitoring requirements apply to regulated facilities that discharge greater than or equal to 50 cubic meters per day on average [13,208 gallons per day].[84] Monitoring frequency is one or more times per year.[85]

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[84] GOJ Ordinance for Enforcement of Water Pollution Control Act, Article 1-4.

[85] GOJ Ordinance for Enforcement of Water Pollution Control Act, Article 9.

9.4.1.3 Limited Effluent Standards. For DWTS sampling once per month for $BOD_5$ and TSS, the single monthly sample must comply with the 30-day average limit. For DWTS sampling weekly, the weekly sample must comply with the level for the 7-day average, and the 30-day average is calculated by determining the average of all samples taken within the same calendar month.

9.4.2 Industrial Wastewater

9.4.2.1 Effluent Discharge Limits. Installations that discharge industrial wastewater to the Waters of Japan, including discharges from an IWTS, must comply with the effluent discharge limits of Tables 9.5 and 9.6. Installations are required to sample for only pH among the conventional pollutants, unless sampling for the other conventional pollutants is indicated based on the industrial wastewater source.

9.4.2.2 Monitoring. Monitoring requirements apply to all regulated facilities. Installations will collect samples at the point of discharge to the Waters of Japan. Monitoring frequency is one or more times per year.[86] For a one-time discharge of industrial wastewater, the installation must complete sampling prior to discharge.

9.4.3 Categorical Industrial Wastewater. Installations that have activities that fall into any of the industrial categories listed below must comply with the following effluent limitations.

9.4.3.1 Electroplating. The following discharge standards apply to electroplating operations in which metal is electroplated on any basis material and to related metal finishing operations as set forth in the various subparts. These standards apply whether such metal finishing operations are conducted in conjunction with electroplating, independently, or as part of some other operation. Electroplating subparts are identified as:

9.4.3.1.1 Electroplating of Common Metals. Discharges of pollutants in process waters resulting from the process in which a material is electroplated with copper, nickel, chromium, zinc, tin, lead, cadmium, iron, aluminum, or any combination thereof.

9.4.3.1.2 Electroplating of Precious Metals. Discharges of pollutants in process waters resulting from the process in which a material is plated with gold, silver, iridium, palladium, platinum, rhodium, ruthenium, or any combination thereof.

9.4.3.1.3 Anodizing. Discharges of pollutants in process waters resulting from the anodizing of ferrous and nonferrous materials.

9.4.3.1.4 Metal Coatings. Discharges of pollutants in process waters resulting from the chromating, phosphating, or immersion plating on ferrous and nonferrous materials.

9.4.3.1.5 Chemical Etching and Milling. Discharges of pollutants in process waters resulting from the chemical milling or etching of ferrous and nonferrous materials.

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[86] GOJ Ordinance for Enforcement of Water Pollution Control Act, Article 9.

9.4.3.16 Electroless Plating. Discharges of pollutants in process waters resulting from the electroless plating of a metallic layer on a metallic or nonmetallic substrate.

9.4.3.1.7 Printed Circuit Board Manufacturing. Discharges of pollutants in process waters resulting from the manufacture of printed circuit boards, including all manufacturing operations required or used to convert an insulating substrate to a finished printed circuit board.

9.4.3.1.8 Discharge Standards for Electroplating Facilities

9.4.3.1.8.1 The discharge standards in Table 9.2 apply to facilities in the electroplating in Paragraphs 9.4.3.1.1 through 9.4.3.1.7 that directly or indirectly discharge less than 38,000 LPD [10,000 gallons per day (GPD)].

9.4.3.1.8.2 The discharge standards in Table 9.3 apply to facilities that perform activities that fall into any of the electroplating category subparts in Paragraphs 9.4.3.1.1 through 9.4.3.1.7 that directly, or indirectly, discharge 38,000 LPD [10,000 GPD] or more.

9.4.3.2 Monitoring. Conduct monitoring of categorical industrial wastewater discharges (including both sampling and analysis) quarterly for all parameters that are specified in Paragraph 9.4.3 dealing with industrial dischargers.

9.4.3.2.1 Samples must be collected at the point of discharge before any mixing with the receiving water.

9.4.3.2.2 Sampling for TTO may not be required if the installation commander determines that no discharge of concentrated toxic organics into the wastewater has occurred and the facility has implemented a TTO management plan. Components of TTO are identified in Table 9.4.

9.4.3.2.3 Installations must comply with the effluent discharge limits and monitoring frequencies outlined Paragraph 9.4.2 for all categorical industrial wastewater discharges to the Waters of Japan.

9.4.4 Non-Categorical Industrial Wastewater to Domestic Wastewater Treatment Plants. The following effluent limits apply to all discharges of pollutants to a DWTS and associated collection systems from industrial wastewater for which categorical standards have not been established.

9.4.4.1 Solid or Viscous Pollutants. The discharge of solid or viscous pollutants that would result in an obstruction to the domestic wastewater treatment plant flow is prohibited.

9.4.4.2 Ignitability and Explosivity

9.4.4.2.1 The discharge of wastewater with a closed cup flashpoint of less than 60°C [140°F] is prohibited.

9.4.4.2.2 The discharge of waste with any of the following characteristics is prohibited:

9.4.4.2.2.1 A liquid solution that contains more than 24 percent alcohol by volume and has a flash point less than 60°C [140°F].

9.4.4.2.2.2 A non-liquid that, under standard temperature and pressure, can cause a fire through friction.

9.4.4.2.2.3 An ignitable compressed gas.

9.4.4.2.2.4 An oxidizer, such as peroxide.

9.4.4.3 Reactivity and Fume Toxicity. The discharge of any of the following waste is prohibited:

9.4.4.3.1 Waste that is normally unstable and readily undergo violent changes without detonating.

9.4.4.3.2 Waste that reacts violently with water.

9.4.4.3.3 Waste that forms explosive mixtures with water or form toxic gases or fumes when mixed with water.

9.4.4.3.4 Cyanide or sulfide waste that can generate potentially harmful toxic fumes, gases, or vapors.

9.4.4.3.5 Waste capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

9.4.4.3.6 Waste that contains explosives regulated as hazardous materials in accordance with JEGS Chapter 10.

9.4.4.3.7 Waste that produces any toxic fumes, vapors, or gases with the potential to cause safety problems or harm to workers.

9.4.4.4 Corrosivity. It is prohibited to discharge pollutants with the potential to be structurally corrosive to the DWTS. In addition, no discharge of wastewater below a pH of 5.0 is allowed, unless the DWTS is specifically designed to handle that type of wastewater.

9.4.4.5 Oil and Grease. The discharge of the following oils that can pass through, or cause interference to, the DWTS is prohibited: petroleum oil, non-biodegradable cutting oil, and products of mineral oil origin.

9.4.4.6 Spills and Batch Discharges (Slugs). Activities or installations that have a significant potential for spills or batch discharges must develop a Slug Prevention Plan containing these minimum requirements:

9.4.4.6.1 Description of discharge practices, including non-routine batch discharges.

9.4.4.6.2 Description of stored chemicals.

9.4.4.6.3 Plan for immediately notifying the DWTS of slug discharges and discharges that would violate prohibitions under this chapter, including procedures for subsequent written notification within five days.

9.4.4.6.4 Necessary practices to prevent accidental spills. This would include proper inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site runoff, and worker training.

9.4.4.6.5 Procedures for building containment structures or equipment.

9.4.4.6.6 Necessary measures to control toxic organic pollutants and solvents.

9.4.4.6.7 Procedures and equipment for emergency response, and any subsequent plans necessary to limit damage suffered by the treatment plant or the environment.

9.4.4.7 Trucked and Hauled Waste. The discharge of trucked and hauled waste into the DWTS, except at locations specified by the DWTS operator, is prohibited.

9.4.4.8 Heat. Heat in amounts that inhibit biological activity in the DWTS resulting in interference is prohibited, but in no case in such quantities that the temperature of the process water at the DWTS exceeds 40°C [104°F].

## 9.5 LOCAL WASTEWATER HANDLING AND TREATMENT

9.5.1 Septic Systems. Septic systems must be sited, constructed, and operated with the approval of appropriate DoD authorities. Installations must not discharge to a septic system any wastewater containing industrial pollutants in levels that will inhibit biological activity. Such discharges are prohibited. Known discharges of industrial pollutants to existing septic systems must be eliminated, and appropriate actions must be taken to eliminate contamination.

9.5.2 Cesspools

9.5.2.1 Large capacity cesspools (i.e., cesspools with a capacity to serve 20 or more people per day) are prohibited.

9.5.2.2 Small capacity cesspools must be managed consistent with the septic systems requirements of Paragraph 9.5.1.

9.5.3 Underground Injection Wells. Installations must not dispose of wastewater by underground injection. This does not preclude the disposal of domestic wastewater in septic systems and small capacity cesspools that have been sited, constructed, and operated with the approval of appropriate DoD medical authorities.

## 9.6 BY-PRODUCT DISPOSAL

9.6.1 Sludge Disposal. All sludge produced during the treatment of wastewater must be disposed of in accordance with the guidance for hazardous waste in JEGS Chapter 16 or solid waste in JEGS Chapter 15, as appropriate.

9.6.2 Off-Site Disposal of Industrial Wastewater. Installations that dispose of industrial wastewater at an off-site Japanese treatment/disposal facility must ensure the following requirements are met:

9.6.2.1 Japanese facilities that treat or dispose of DoD-generated industrial wastewater must be evaluated and approved by the appropriate governmental authority (or its duly designated representative) as being in compliance with their regulatory requirements. This evaluation and approval may consist of having a valid license or governmental (or its duly designated representative) equivalent for the industrial wastewater that will be handled.[87] If there is no licensing authority within the jurisdiction in which the facility operates, installations must:

9.6.2.1.1 Ensure the Japanese facility treated the industrial wastewater to the Japanese effluent discharge limits of this chapter, i.e., Tables 9.5 and 9.6.

9.6.2.1.2 Maintain sampling records verifying the Japanese facility treated the industrial wastewater to the Japanese effluent discharge limits of this chapter.

9.6.2.1.3 Report failures of a Japanese facility to comply with the effluent discharge limits of this chapter in accordance with Paragraph 9.2.5.

9.6.2.2 Generators of industrial wastewater are prohibited from contracting with a licensed transporter that requires the transporter to then subcontract with a licensed disposal facility.[88] The installation must either contract with a single contractor who is licensed to both transport and dispose of the wastewater, or contract separately with a licensed transporter and a licensed disposal facility.

## 9.7 STORMWATER MANAGEMENT

Develop and implement a Stormwater Pollution Prevention Plan (SWPPP) for activities to include applicable requirements in Paragraphs 9.7.1 through 9.7.4. Update the SWPPP every five years, at a minimum. The plan must be certified by a U.S. licensed professional engineer who is familiar with stormwater management requirements. The plan must consider industry standards and practices for stormwater management and environmental protection, be prepared in accordance with good engineering practice, and be adequate for the facility. Technical changes (i.e., non-administrative changes) to the plan require recertification.

9.7.1 Exposure to Precipitation. Minimize exposure of manufacturing, processing, and material storage areas (including loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations) to rain, snow, snowmelt, and runoff by either locating these industrial materials and activities inside or protecting them with storm-resistant coverings. To accomplish this:

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[87] GOJ Act on Waste Management and Public Cleansing, Articles 7, 14.

[88] GOJ Act on Waste Management and Public Cleansing, Article 14.

9.7.1.1 Use grading, berming, or curbing to prevent stormwater from adjacent sites from entering these areas and contain runoff of contaminated flows from these areas, unless infeasible.

9.7.1.2 Locate materials, equipment, and activities so that potential leaks and spills are contained or able to be contained or diverted before discharge.

9.7.1.3 Clean up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the discharge of pollutants;

9.7.1.4 Store leaky vehicles and equipment indoors, unless impractical. If stored outdoors, repair leaks, remove fluids, or use drip pans and absorbents.

9.7.1.5 Use spill and overflow protection equipment.

9.7.1.6 Perform all vehicle and equipment cleaning operations indoors, under cover, or in bermed areas that prevent runoff and run-on and that capture any overspray.

9.7.1.7 Drain fluids from equipment and vehicles that will be decommissioned, are unserviceable, or will remain unused for extended periods of time.

9.7.2 Good Housekeeping Practices. Implement good housekeeping practices to keep clean all exposed areas that are potential sources of pollutants. Such measures include, but are not limited to:

9.7.2.1 Sweep or vacuum at regular intervals.

9.7.2.2 Store materials in appropriate containers.

9.7.2.3 Keep all dumpsters under cover or fit with a lid that must remain closed when not in use.

9.7.2.4 Minimize the potential for waste, garbage, and floatable debris to be discharged to receiving waters by keeping exposed areas free of such materials or by intercepting them before they are discharged.

9.7.3 Illicit Stormwater System Discharge Detection and Elimination. Implement programs to detect and eliminate illicit discharges to stormwater drainage systems that discharge to the Waters of Japan. Such programs must include these elements:

9.7.3.1 Creation of a stormwater system map showing the location of all stormwater inlets, stormwater outfalls, and locations of all Waters of Japan that receive discharges from those outfalls. These maps should include, as applicable:

9.7.3.1.1 Direction of stormwater flow and slopes (before and after grading).

9.7.3.1.2 Areas and timing of soil disturbance, areas that will not be disturbed, and natural features to be preserved.

9.7.3.1.3 Locations of BMPs identified in the SWPPP.

9.7.3.1.4 Locations and timing of stabilization measures, and locations of storage areas.

9.7.3.1.5 Areas where stabilization has been accomplished.

9.7.3.2 Installation-wide prohibition of non-stormwater discharges into the stormwater system, to the extent practicable.

9.7.3.3 A plan to detect and address non-stormwater discharges, including prohibited dumping, into the stormwater system.

9.7.3.4 Properly sized underground containment systems designed to contain industrial wastewater discharges, to include containment systems properly sized for the concentration of firefighting foam used for fire suppression, and prevent industrial wastewater from entering the stormwater system.[89,90]

9.7.3.5 A plan to ensure underground containment systems are maintained at all times free of extraneous industrial wastewater, to provide full capacity of the tanks as designed to retain the industrial wastewater intended for collection and prevent industrial wastewater from entering the stormwater system.[89,90]

9.7.3.6 Education of installation personnel, facilities, and tenant commands about the hazards associated with prohibited discharges and improper disposal of wastewater.

9.7.4 Construction and Development Activities. Installations or activities that engage in construction and development activities, including constructing buildings and roadways and clearing land, must implement the following measures to control effluent in stormwater discharges:

9.7.4.1 Control stormwater volume and velocity to minimize soil erosion in order to minimize pollutant discharges.

9.7.4.2 Control stormwater discharges, including both peak flowrates and total stormwater volume, to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points.

9.7.4.3 Provide and maintain natural buffers around the Waters of Japan. Direct stormwater to vegetated areas and maximize stormwater infiltration through use of low-impact development practices (identified by UFC 3-210-10, Low Impact Development) to reduce pollutant discharges, unless infeasible.

9.7.4.4 Minimize soil compaction. Minimizing soil compaction is not required where the intended function of a specific area of the site dictates that it be compacted.

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[89] UFC 3-600-01, Fire Protection Engineering for Facilities: Chapter 9-9.3, Aqueous Film-Forning (AFFF) Systems.

[90] UFC 4-211-01, Aircraft Maintenance Hangars: Chapter 3-5.7, Industrial Oil/Water Waste.

9.7.4.5 Preserve topsoil, unless impractical. Preserving topsoil is not required where the intended function of a specific area of the site dictates that the topsoil be disturbed or removed.

9.7.4.6 Initialize soil stabilization whenever any clearing, grading, excavating, or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. In arid, semi-arid, and drought-stricken areas where initiating vegetative stabilization measures immediately is infeasible, alternative stabilization measures must be employed as appropriate.

9.7.4.7 Minimize the exposure of building materials, building products, construction waste, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on the site to precipitation and to stormwater. Minimization of exposure is not required in cases where the exposure to precipitation and to stormwater will not result in a discharge of pollutants, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use).

### Table 9.1: DWTS Discharge Monitoring Requirements(1)

| PLANT CAPACITY | | MONITORING FREQUENCY |
|---|---|---|
| MGD | LPD | |
| 0.001 – 0.99 | 3,785 –3,747,557 | Monthly |
| 1.0 – 4.99 | 3,785,412 – 18,892,206 | Weekly |
| > 5.0 | 18,927,060 | Daily |

MGD = million gallons per day
LPD = liters per day
Note:
1. Monitoring requirement is for conventional pollutants. Sources: Water Pollution Prevention Act, Act No. 138 of 1970, revised 17 June 2022; Ordinance for Enforcement of Water Pollution Control Act, Ordinance of the Prime Minister's Office No. 2 of 1971, revised 18 December 2020; Ministerial Ordinance for Effluent Standards, Ordinance of the Prime Minister's Office No. 35 of 1971, revised 25 January 2024.

### Table 9.2: Standards for Electroplating Facilities Discharging Less Than 38,000 LPD [10,000 GPD]

| POLLUTANT | MAXIMUM DAILY DISCHARGE LIMIT(1) (mg/L) | 4-DAY AVERAGE (mg/L) |
|---|---|---|
| Boron(2,3) | 30(5) | |
| Cadmium | 0.03(5) | 0.7 |
| Cyanide, amenable | 1.0(5) | 2.7 |
| Fluorine(3) | 40(5) | |
| Lead | 0.1(5) | 0.4 |
| Total Toxic Organics (TTO)(4) | 4.57 | |
| Zinc | < 4.0(5) | |

mg/L = milligrams per liter
Notes:
1. If standards with different limits are specified, the maximum limit will apply to the effluent discharged from the installation. These rules, however, will not apply to boron.
2. Discharge into public waters other than the ocean.
3. Standards for boron and fluorine are transitional and in effect until 30 June 2025.
4. Components of TTO are identified in Table 9.4.
5. Sources: Water Pollution Prevention Act, Act No. 138 of 1970, revised 17 June 2022; Ministerial Ordinance for Effluent Standards, Ordinance of the Prime Minister's Office No. 35 of 1971, revised 25 January 2024.

## Table 9.3: Wastewater Standards for Electroplating Facilities Discharging 38,000 LPD [10,000 GPD] or More

| POLLUTANT | MAXIMUM DAILY DISCHARGE LIMIT(1) (mg/L) | 4-DAY AVERAGE (mg/L) |
|---|---|---|
| Boron(2,3) | 30(11) | |
| Cadmium | 0.03(11) | 0.7 |
| Chromium | 7.0 | 4.0 |
| Chromium (hexavalent)(4) | 0.5(11) | |
| Copper(5) | 4.5 (3.0)(11) | 2.7 |
| Cyanide, total | 1.0(11) | 1.0 |
| Fluorine(3,6) | 40 (15)(11) | |
| Lead | 0.1(11) | 0.4 |
| Metals (total)(7) | 10.5 | 6.8 |
| Nickel | 4.1 | 2.6 |
| Total Toxic Organics (TTO)(8) | 2.13 | |
| Silver(9) | 1.2 | 0.7 |
| Zinc(10) | 4.0(11) | 2.6 |

mg/L = milligrams per liter

Notes:

1. If standards with different limits are specified, the maximum limit will apply to the effluent discharged from the installation. These rules, however, will not apply to boron.
2. Discharge into public waters other than the ocean.
3. Standards for boron and fluorine are transitional and in effect until 30 June 2025.
4. Standard for chromium (hexavalent) is transitional and in effect until 31 March 2027.
5. When discharging ≥ 50,000 LPD, the daily maximum limit for copper is 3.0 mg/L.
6. When discharging ≥ 50,000 LPD, the daily maximum limit for fluorine and its compounds is 15 mg/L.
7. The sum of the concentration or mass of copper, nickel, chromium, and zinc.
8. Components of TTO are identified in Table 9.4.
9. Standard for silver only applies to facilities that electroplate precious metals.
10. Limit for zinc is transitional and in effect until 10 December 2024.
11. Sources: Water Pollution Prevention Act, Act No. 138 of 1970, revised 17 June 2022; Ministerial Ordinance for Effluent Standards, Ordinance of the Prime Minister's Office No. 35 of 1971, revised 25 January 2024.

## Table 9.4: Components of Total Toxic Organics (TTO)

| VOLATILE ORGANICS | |
|---|---|
| Acrolein (Propenyl) | Bromodichloromethane |
| Acrylonitrile | 1,1,2,2-Tetrachloroethane |
| Methyl chloride (Chloromethane) | 1,2-Dichloropropane |
| Methyl bromide (Bromomethane) | 1,3-Dichloropropylene (1,3-Dichloropropene) |
| Vinyl chloride (Chloroethylene) | Trichloroethene |
| Chloroethane | Dibromochloromethane |
| Methylene chloride (Dichloromethane) | 1,1,2-Trichloroethane |
| 1,1-Dichloroethene | Benzene |
| 1,1-Dichloroethane | 2-Chloroethyl vinyl ether (mixed) |
| 1,2-Dichloroethane | Bromoform (Tribromomethane) |
| 1,2-trans-Dichloroethene | Tetrachloroethene |
| Chloroform (Trichloromethane) | Toluene |
| 1,1,1-Trichloroethane | Chlorobenzene |
| Carbon tetrachloride (Tetrachloromethane) | Ethylbenzene |
| BASE/NEUTRAL EXTRACTABLE ORGANICS | |
| N-nitrosodimethylamine | Diethyl phthalate |
| Bis-(2-chloroethyl) ether | 1,2-Diphenylhydrazine |
| 1,3-Dichlorobenzene | N-nitrosodiphenylamine |
| 1,4-Dichlorobenzene | 4-Bromophenyl phenyl ether |
| 1,2-Dichlorobenzene | Hexachlorobenzene |
| Bis-(2-chloroisopropyl) ether | Phenanthrene |
| Hexachloroethane | Anthracene |
| N-nitrosodi-n-propylamine | Di-n-butyl phthalate |
| Nitrobenzene | Fluoranthene |
| Isophorone | Pyrene |
| Bis-(2-chloroethoxy) methane | Benzidine |
| 1,2,4-Trichlorobenzene | Butyl benzyl phthalate |
| Naphthalene | 1,2-Benzoanthracene (Benzo[a]anthracene) |
| Hexachlorobutadiene | Chrysene |
| Hexachlorocyclopentadiene | 3,3-Dichlorobenzidine |
| 2-Chloronaphthalene | Bis-(2-ethylhexyl) phthalate |
| Acenaphthylene | Di-n-octyl phthalate |

## Table 9.4: Components of Total Toxic Organics (TTO), Continued

| BASE/NEUTRAL EXTRACTABLE ORGANICS, continued | |
|---|---|
| Dimethyl phthalate | 3,4-Benzofluoranthene (Benzo[b]fluoranthene) |
| 2,6-Dinitrotoluene | 11,12-Benzofluoranthene (Benzo[k]fluoranthene) |
| Acenaphthene | Benzo(a)pyrene (3,4-Benzopyrene) |
| 2,4-Dinitrotoluene | Indeno (1,2,3-cd) pyrene (2,3-o-Phenylene pyrene) |
| Fluorene | 1,2,5,6-Dibenzanthracene (Dibenezo[a,h]anthracene) |
| 4-Chlorophenyl phenyl ether | 1,12-Benzoperylene (Benzo[g,h,i]perylene) |
| ACID EXTRACTABLE ORGANICS | |
| 2-Chlorophenol | 2,4,6-Trichlorphenol |
| Phenol | 2,4-Dinitrophenol |
| 2-Nitrophenol | 4-Nitrophenol |
| 2,4-Dimethylphenol | p-Chloro-m-cresol |
| 2,4-Dichlorophenol | Pentachlorophenol |
| 4,6-Dinitro-o-cresol | |
| PESTICIDES/PCBs | |
| alpha-Endosulfan | Endrin |
| beta-Endosulfan | Endrin aldehyde |
| Endosulfan sulfate | Heptachlor |
| alpha-BHC | Heptachlor epoxide (BHC-hexachlorocyclohexane) |
| beta-BHC | Toxaphene |
| delta-BHC | PCB-1242 (Arochlor 1242) |
| gamma-BHC | PCB-1254 (Arochlor 1254) |
| 4,4-DDT | PCB-1221 (Arochlor 1221) |
| 4,4-DDE (p,p-TDE) | PCB-1232 (Arochlor 1232) |
| Aldrin | PCB-1248 (Arochlor 1248) |
| Chlordane (technical mixture and metabolites) | PCB-1260 (Arochlor 1260) |
| Dieldrin | PCB-1016 (Arochlor 1016) |
| PCB = polychlorinated biphenyl | |

## APPENDIX 9A: JAPANESE WASTEWATER STANDARDS

### Table 9.5: Effluent Discharge Limits for Conventional and Other Pollutants

| CONTAMINANT | MAXIMUM (mg/L) | DAILY AVERAGE(1) (mg/L) |
|---|---|---|
| CONVENTIONAL POLLUTANTS | | |
| $BOD_5$(2,3) | 160 | 120 |
| TSS(2) | 200 | 150 |
| pH | $5.8 \leq pH \leq 8.6$ (public water area)(4) / $5.0 \leq pH \leq 9.0$ (sea area) | |
| Coliforms (*E. coli*)(5) | | 800 CFU/mL |
| Animal and vegetable oils(6) | 30 | |
| Mineral oils(6) | 5.0 | |
| OTHER POLLUTANTS(7) | | |
| COD(8,9) | 160 | 120 |
| Chromium | 2.0 | |
| Copper | 3.0 | |
| Iron (soluble) | 10 | |
| Manganese (soluble) | 10 | |
| Nitrogen (total) | 120 | 60 |
| Phenols | 5.0 | |
| Phosphorus | 16 | 8.0 |
| Zinc | 2.0 | |

Sources: Water Pollution Prevention Act, Act No. 138 of 1970, revised 17 June 2022; Ministerial Ordinance for Effluent Standards, Ordinance of the Prime Minister's Office No. 35 of 1971, revised 25 January 2024.

mg/L = milligrams per liter

CFU = colony forming unit

Notes:

1. Average condition of contaminant during a one-day period.
2. The 30-day average must not exceed 30 mg/L and the 7-day average must not exceed 45 mg/L. If a facility uses a trickling filter or waste stabilization pond as the principal process and provides significant biological treatment of the wastewater, but cannot consistently achieve these limits, the 30-day average must not exceed 45 mg/L and the 7-day average must not exceed 65 mg/L.
3. Carbonaceous biochemical oxygen demand (5-day measure) may be substituted for $BOD_5$. The $CBOD_5$ test procedure suppresses the nitrification component in the $BOD_5$ test procedure, thereby reducing the value or effects and lowering the oxygen demand. When $CBOD_5$ is substituted for $BOD_5$, the 30-day average must not exceed 25 mg/L and the 7-day average must not exceed 40 mg/L.
4. Public water area includes rivers, lakes, ports and harbors, and coastal seas, including connected public waterways and irrigation waterways.
5. *Escherichia coli*.
6. n-Hexane extract.
7. These effluent discharge limits apply to all regulated facilities, with the following exception. They do not apply if the discharge volumetric flow rate from a DWTS is less than 50 cubic meters per day on average [13,208 gallons per day].
8. For discharges into sea areas, lakes, or marshes.
9. COD sampling is not required when $BOD_5$ sampling is done.

### Table 9.6: Effluent Discharge Limits for Harmful Substances(1)

| CONTAMINANT(2) | MAXIMUM ALLOWABLE (mg/L) |
|---|---|
| INORGANICS | |
| Ammonia, ammonium compounds, nitrate and nitrite(3) | 100 |
| Arsenic | 0.1 |
| Boron | 10 (public water area)(4) / 230 (sea area) |
| Cadmium | 0.03 |
| Chromium (hexavalent) | 0.2 |
| Cyanide (total) | 1.0 |
| Fluorine | 8.0 (public water area)(4) / 15 (sea area) |
| Lead | 0.1 |
| Mercury | 0.005 |
| Mercury (alkyl compounds) | < LOQ |
| Selenium | 0.1 |
| VOLATILE ORGANICS | |
| Benzene | 0.1 |
| Carbon tetrachloride | 0.02 |
| 1,2-Dichloroethane | 0.04 |
| 1,1-Dichloroethylene | 1.0 |
| cis-1,2-Dichloroethylene | 0.4 |
| Dichloromethane | 0.2 |
| 1,3-Dichloropropene | 0.02 |
| Tetrachloroethylene | 0.1 |
| 1,1,1-Trichloroethane | 3.0 |
| 1,1,2-Trichloroethane | 0.06 |
| Trichloroethylene | 0.1 |
| PESTICIDES | |
| Organic phosphorus(5) | 1.0 |
| Simazine | 0.03 |
| Thiobencarb | 0.2 |
| Thiuram | 0.06 |
| OTHER ORGANICS | |
| 1,4-Dioxane | 0.5 |
| Dioxins | 10 pg-TEQ/L |
| PCBs | 0.003 |

## Table 9.6: Effluent Discharge Limits for Harmful Substances,(1) Continued

| CONTAMINANT[2] | MAXIMUM ALLOWABLE (mg/L) |
|---|---|

Sources: Water Pollution Prevention Act, Act No. 138 of 1970, revised 17 June 2022; Ministerial Ordinance for Effluent Standards, Ordinance of the Prime Minister's Office No. 35 of 1971, revised 25 January 2024; Act on Special Measures Against Dioxins, Cabinet Order No. 105 of 1999, revised 17 June 2022; Enforcement Regulation for the Act on Special Measures Against Dioxins, Cabinet Order No. 67 of 1999, revised 25 March 2021.

< LOQ = below the limit of quantitation
mg/L = milligrams per liter
TEQ = toxic equivalence

Notes:

1. The effluent discharge limits of this table apply to all regulated facilities.
2. If documentation is available that explicitly states that one or more of the above substances are never introduced into the system, then those substances may be excluded from monitoring requirements.
3. [0.4 x $NH_3$-N] + $NO_3$-N + $NO_2$-N.
4. Public water area includes rivers, lakes, ports and harbors, and coastal seas, including connected public waterways and irrigation waterways.
5. Includes parathion, methyl parathion, methyl demeton, and EPN only.

# VOLUME IV: HAZARDOUS MATERIALS, STORAGE TANKS, SPILLS, AND PESTICIDES

## VOLUME IV.A: DEFINITIONS

Unless otherwise noted, these terms and their definitions are for the purposes of this volume.

Aboveground storage container. A type of POL storage container that includes those exempt from UST standards that are normally placed on or above the surface of the ground. POL storage containers located above the floor and contained in vaults or basements, bunkered containers, and partially buried containers are considered aboveground storage containers. For the purposes of JEGS Chapter 12, this includes any mobile or fixed structures or tanks.

Airport hydrant fuel distribution system. Also called an airport hydrant system, a type of specialty UST system that operates under high pressure with large diameter piping that typically terminates into one or more hydrants (fill stands). The airport hydrant system begins where fuel enters one or more tanks from an external source such as a pipeline, barge, rail car, or other motor fuel carrier.

Armed Forces Pest Management Board (AFPMB). An organization that recommends policy, provides guidance, and coordinates the exchange of information on all matters related to pest management throughout the DoD.

Automatic line release detectors. A release detection method for piping that alerts the operator to the presence of a leak by either restricting or shutting off POL or hazardous substance flow-through piping or by triggering an audible or visual alarm.

Automatic tank gauging. Equipment that tests for the loss of POL or hazardous substance and conducts inventory control.

Below ground storage container. A type of POL storage container that is completely buried, including deferred USTs, that are exempt from all standards in JEGS Chapter 12 either because they do not meet the definition of an UST or they are specifically excluded from UST requirements. For the purposes of POL management in JEGS Chapter 11, only below ground storage containers that are exempt from the UST requirements of JEGS Chapter 12 are counted toward the aggregate thresholds defined under "POL facility."

Bulk gasoline plant. Any gasoline storage and distribution facility that receives gasoline by pipeline, ship or barge, or cargo tank and subsequently loads the gasoline into gasoline cargo tanks for transport to gasoline dispensing facilities, and has a gasoline throughput of less than 75,708 liters [20,000 gallons] per day.

Certified pesticide applicators. Any certified individual who applies pesticides or, in the case of DoD employees, supervises the use of pesticides during apprenticeship training. Certification must be by DoD, a State of the United States, or Japan in accordance with DoDM 4150.07 (Volume 2), DoD Pest Management Program Elements and Implementation: Pesticide

Applicator Training and Certification Program, which accepts host nation certification in appropriate circumstances.

Class A operator. The individual who has primary responsibility to operate and maintain the UST system. Typically manages resources and personnel, such as establishing work assignments, to achieve and maintain compliance with applicable requirements. This would normally be the owner of the system, the supervisor of operations at a bulk terminal, or a comparable manager at the site.

Class B operator. An individual who has day-to-day responsibility for implementing applicable requirements. Typically implements in-field aspects of operation, maintenance, and associated recordkeeping for the UST system.

Class C operator. An individual responsible for initially addressing emergencies presented by a spill or release from an UST system. Typically controls or monitors the dispensing or sale of hazardous substances or POL and generally includes workers who are handling fuel as their primary job.

Class I specified chemical substance.[91] A chemical substance that: (1) is not likely to undergo a chemical transformation through natural processes and is bioaccumulative; and (2) poses a risk of impairing human health if ingested continuously, or poses a risk of interfering with the inhabitation and/or growth of predator animals at higher trophic levels and are most likely to bioaccumulate through the food chain.

Containment sump. A liquid-tight container that protects the environment by containing leaks and spills of hazardous substances or POL from piping, dispensers, pumps, and related components in the containment area. Containment sumps may be single walled or secondarily contained and located at the top of the tank (tank top or submersible turbine sump), underneath the dispenser (under-dispenser containment sump), or at other points in the piping run (transition or intermediate sump).

Contaminated soil. Soil that contains any substance that exceeds naturally-occurring levels and poses a human health or environmental risk.

Decontamination waste. Waste materials generated during the decontamination of equipment and personnel used during spill response including, but not limited to, purging water, rinsing water, plastic containers, rags, and gloves and other personal protective equipment.

Dispenser. Equipment located aboveground that dispenses hazardous substances or POL from an UST system.

Dispenser system. Includes both the dispenser and any equipment necessary to connect the dispenser to an UST system. Equipment includes check valves, shear valves, unburied risers or

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[91] GOJ Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc., Article 2.

flexible connectors, and other traditional components that are underneath the dispenser and connect the dispenser to the underground piping.

Enduring location.[92] A location is enduring when DoD intends to maintain access and use of that location for the foreseeable future. The following types of sites are considered enduring for U.S. Government purposes: main operating base, forward operating site, and cooperative security location. All three types of locations may be composed of more than one distinct site. Enduring locations are published in the OSD-approved Enduring Location Master List.

Excluded underground storage tank (UST) systems. UST systems that are not subject to the requirements of JEGS Chapter 12.

Existing underground storage tank (UST) system. An UST system where installation began on or before April 11, 2016.

Facility incident commander (FIC). Also known as installation on-scene coordinator and incident commander. The official, designated by the installation commander, who coordinates and directs DoD control and cleanup efforts at the scene of a POL or hazardous substance spill due to DoD activities on or near the installation.

Facility response team (FRT). Also known as installation response team and incident management team. A team performing emergency functions as defined and directed by the FIC.

Field-constructed tank (FCT). A tank constructed in the field such as a tank constructed of concrete that is poured in the field, or a steel or fiberglass tank primarily fabricated in the field.

Free product. For spills to water, any contamination that exists as a separate material that does not mix with or dissolve in water.

Gasoline dispensing facility (GDF). Any stationary facility that dispenses gasoline into the fuel tank of a motor vehicle, motor vehicle engine, non-road vehicle, or non-road engine.

General secondary containment. Containment and diversionary structures intended to prevent a most likely discharge into the Waters of Japan. This can be either active or passive and needs to consider the typical failure mode and most likely discharge quantity.

Groundwater monitoring. Testing or monitoring for POL or hazardous substances on the groundwater.

Hazardous material information resource system (HMIRS). The computer-based information system developed to accumulate, maintain, and disseminate important information on hazardous materials.

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[92] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

Hazardous material. Any material that exhibits any of the characteristics of a physical hazard, a health hazard, a simple asphyxiant, combustible dust, or pyrophoric gas, or is GOJ regulated. Refer to JEGS Table 10.1.

Hazardous material shipment. Any movement of hazardous materials either from an installation to a final destination off the installation, or from a point of origin off the installation to a final destination on the installation, in which certification of the shipment is involved.

Hazardous material warning label. A label, tag, or marking on a container that provides information about the material and its hazards, usually provided by the manufacturer.

Hazardous substance. Any substance having the potential to do serious harm to human health or the environment if spilled or released in reportable quantity. A list of these substances and the corresponding reportable quantities is provided in JEGS Table 16.3. Hazardous substances do not include:

(1) Petroleum, including crude POL or any fraction thereof, that is not otherwise specifically listed or designated in JEGS Table 16.3 as a hazardous substance.

(2) Natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

Hazardous substance underground storage tank (UST) system. An UST system that contains a hazardous substance (not including hazardous waste as defined in JEGS Chapter 16) or any mixture of such hazardous substances and POL, and which is not a POL UST system.

Hazardous waste. A waste that may be solid, semi-solid, liquid, or contained gas, and either exhibits a characteristic of a hazardous waste as detailed in JEGS Paragraph 16A.1 or is listed as a hazardous waste in JEGS Tables 16.2 through 16.8. Does not include domestic sewage sludge, household waste, and medical waste.

Hazardous waste storage area (HWSA). Any location on a DoD installation where hazardous waste is collected before shipment for treatment or disposal. A hazardous waste storage area may store more than the equivalent of a 208-liter [55-gallon] drum of hazardous waste, or a 1.0-liter [1.0-quart] container of an acute hazardous waste, from each waste stream.

Industry standards and practices. Applicable or recognized standards and practices relevant to the design, construction, installation, O&M, inspection, and repair of facilities and equipment. Industry standards and practices can include those established by the following organizations: American Petroleum Institute (API), American Society for Testing and Materials (ASTM), Association for Materials Protection and Performance (AMPP), Petroleum Equipment Institute (PEI), and Steel Tank Institute (STI).

<u>Installation</u>.[93] An enduring location consisting of a base, camp, post, station, yard, center, or other DoD activity under the operational control of the Secretary of a Military Department or the Secretary of Defense.

<u>Integrated pest management (IPM)</u>. A planned program, incorporating continuous monitoring, education, recordkeeping, and communication, to prevent pests and disease vectors from causing unacceptable damage to operations, people, property, materiel, or the environment. IPM uses targeted, sustainable (effective, economical, environmentally sound) methods, including education, habitat modification, biological control, genetic control, cultural control, mechanical control, physical control, regulatory control and, where necessary, the judicious use of least-hazardous pesticides.

<u>International agreement</u>.[93] A multilateral or bilateral agreement, such as a base rights or access agreement, a status-of-forces agreement, or any other instrument defined as a binding international agreement in accordance with DoDD 5530.3, International Agreements.

<u>Interstitial monitoring</u>. Monitoring between the UST system and a secondary barrier immediately around or beneath it.

<u>Inventory control</u>. Tracking of POL or hazardous substances to compare what is in a tank versus what should be in the tank to reconcile the inputs and outputs of POL or hazardous substances with the volume remaining in the tank.

<u>Limit of quantitation (LOQ)</u>. The smallest concentration that produces a quantitative result with known and recorded precision and bias.

<u>Loading and unloading racks</u>. A fixed structure (e.g., platform, gangway) necessary for loading or unloading a tank truck or tank car. Includes a loading or unloading arm.

<u>Mobile refueler</u>. POL storage container onboard a vehicle or towed by a vehicle, that is designed or used solely to store and transport fuel for transfer into or from an aircraft, motor vehicle, locomotive, vessel, ground service equipment, or other oil storage container.

<u>Monthly throughput</u>. For GDFs, the total volume of gasoline loaded into, or dispensed from, all the gasoline storage tanks located at a single GDF.

<u>New dispenser system</u>. A dispenser system where installation began after April 11, 2016.

<u>New underground storage tank (UST) system</u>. An UST system where installation began after April 11, 2016.

<u>Oil</u>. Oil of any kind or in any form, including, but not limited to, petroleum, fuel POL, lube oils, animal fats, vegetable oil, sludge, POL refuse, and POL mixed with waste other than dredged spoil.

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[93] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

Oil-filled operational equipment. Equipment that includes an oil storage container (or multiple containers) in which the oil is present solely to support the function of the apparatus or the device. Oil-filled operational equipment is not considered a POL storage container, and does not include oil-filled manufacturing equipment (flow-through process). Examples of oil-filled operational equipment include, but are not limited to, hydraulic systems, lubricating systems (e.g., those for pumps, compressors and other rotating equipment, including pumpjack lubrication systems), gear boxes, machining coolant systems, heat transfer systems, transformers, circuit breakers, electrical switches, and other systems containing oil solely to enable the operation of the device.

Overfill prevention equipment. Devices that either shut off product flow, restrict product flow, or alert the delivery operator with an alarm when the tank is close to being full.

Pest management consultant. A DoD pest management professional who provides technical and management guidance on using IPM to prevent and control pests and disease vectors. The Director, AFPMB, approves pest management consultants designated by the DoD Service Component as certifying officials of pesticide applicators.

Pesticide. Any substance or mixture of substances, including biological control agents that may prevent, destroy, repel, or mitigate pests or that is used as a plant regulator, defoliant, desiccant, disinfectant, or biocide.

Pesticide waste. Materials subject to pesticide disposal restrictions, including:

(1) Any pesticide that has been identified by the pest management consultant as cancelled under U.S. or appropriate GOJ authority and which cannot be safely used.

(2) Any pesticide that does not meet specifications, is contaminated, has been improperly mixed, or otherwise unusable, whether concentrated or diluted.

(3) Any material used to clean up a pesticide spill.

(4) Any containers, equipment, or material contaminated with pesticides.

Pests. Arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds, and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

Pipeline facility. Includes new and existing pipes, pipeline rights of way, auxiliary equipment (e.g., valves and manifolds), and buildings or other facilities used in the transportation of POL.

Petroleum, oil, and lubricants (POL). Refined POL, including, but not limited to, petroleum, fuel, lubricant oils, synthetic oils, mineral oils, animal fats, vegetable oil, sludge, and POL mixed with waste other than dredged spoil.

<u>Petroleum, oil, and lubricants (POL) facility</u>. An installation with:

(1) An aggregate aboveground storage container capacity (excluding below ground storage containers) of 5,000 liters [1,320 gallons] or greater, counting only containers with a capacity of 208 liters [55 gallons] or greater; or

(2) An aggregate below ground storage container capacity of 159,091 liters [42,000 gallons] or greater; or

(3) A pipeline facility.

<u>Petroleum, oil, and lubricants (POL) storage container</u>. Containers with capacities greater than or equal to 208 liters [55 gallons]. They include mobile and fixed containers as well as those located above and below ground. In the context of USTs in JEGS Chapter 12, USTs required to meet all of the requirements of JEGS Chapter 12 are excluded from the definition of POL storage containers. Motive power containers (vehicle fuel tanks), containers of heating oil used solely at a single-family residence, pesticide application equipment and related mix containers, and milk/milk-product containers are also excluded.

<u>Registered pesticide</u>. A pesticide registered and approved for sale or use within the United States or Japan.

<u>Release detection method</u>. A method, or combinations of methods, for determining whether a release of a hazardous substance or POL has occurred from an UST system into the environment or a leak has occurred into the interstitial space between an UST system and its secondary barrier or secondary containment. Methods of release detection include automatic line release detectors, automatic tank gauging, groundwater monitoring, interstitial monitoring, and inventory control.

<u>Repair</u>. In the context of USTs in JEGS Chapter 12, to restore to proper operating condition a tank, pipe, spill prevention equipment, overfill prevention equipment, corrosion protection equipment, release detection equipment, or other UST system component that has caused a release of product from the UST system or has failed to function properly.

<u>Replace</u>. In the context of USTs in JEGS Chapter 12, to replace a tank means to remove and install another tank. To replace piping means to remove 50 percent or more of piping and install other piping, excluding connectors, connected to a single tank. For tanks with multiple piping runs, this definition applies independently to each piping run.

<u>Reportable quantity (RQ)</u>. A quantity of a substance that has the potential to do serious harm to human health or the environment if spilled or released.

<u>Safe suction piping</u>. Piping that is designed, constructed, and can be readily determined to meet these standards: below-grade piping that operates at less than atmospheric pressure, is sloped so that the contents of the pipe will drain back into the storage tank if the suction is released, has only one check valve included in each suction line, and the check valve is located directly below and as close as practical to the suction pump.

Safety Data Sheet (SDS). A form prepared by manufacturers or importers of chemical products to communicate to users the chemical and physical properties and hazardous effects of a particular product. Formerly known as Material Safety Data Sheet (MSDS).

Secondary containment or secondarily contained.

(1) In the context of POL standards in JEGS Chapter 11 and spill standards in JEGS Chapter 13, a system that provides temporary containment of discharged POL in the event of a failure of the primary containment. This is intended to prevent the migration of POL until appropriate actions can be taken. Secondary containment can include impervious dikes, berms, or retaining walls; curbing or drip pans; sumps and collection systems; culverting and gutters; weirs, booms, or other barriers; spill diversion ponds; retention ponds; or sorbent materials. There are two types of secondary containment, general and sized.

(2) In the context of UST standards in JEGS Chapter 12, a form of release prevention for tanks or piping. A secondary containment system has an inner and outer barrier with an interstitial space that can be monitored for leaks and includes containment sumps when used for interstitial monitoring of piping. Secondary containment must be able to contain hazardous substances or POL leaked from the primary containment until they are detected and removed, and prevent releases of the hazardous substances or POL into the environment at any time during the operational life of an UST system.

Service component. A command consisting of the Service Component Commander and all those Service forces, such as individuals, units, detachments, organizations, and installations under that command, including the support forces that have been assigned to a combatant command or further assigned to a subordinate unified command or joint task force.

Significant spill. A spill for which one of the following conditions apply:

(1) The spill involves a hazardous waste or hazardous substance included in JEGS Table 16.3, at a quantity in excess of the reportable quantity listed in that table;

(2) The spill involves a POL or liquid or semi-liquid hazardous material, hazardous waste, or hazardous substance in excess of 416 liters [110 gallons];

(3) The spill involves other solid hazardous materials in excess of 225 kilograms [500 pounds];

(4) The spill involves combinations of POL and liquid, semi-liquid, and solid hazardous materials, hazardous waste, or hazardous substances in excess of 340 kilograms [750 pounds]; or

(5) The spill is not contained within any required berm or secondary containment, and cannot be removed. If a spill is contained inside an impervious berm, on a nonporous surface, or inside a building and is not volatilized and is cleaned up, the spill is a contained release and is not considered a significant spill.

Sized secondary containment. An impervious (permeability less than or equal to $10^{-7}$ centimeters per second) secondary means of containment capable of holding the entire contents of the POL storage container plus sufficient freeboard.

Specialty underground storage tank (UST) systems. Also referred to as "previously deferred UST systems." Airport hydrant fuel distribution systems and UST systems with FCT that were previously deferred from UST requirements.

Spill. The inadvertent or illicit release of a solid, liquid, or gaseous substance regarded as hazardous to human health or the environment, irrespective of the amount or place of release.

Spill prevention equipment. Containment around the fill pipe that catches small drips or spills that occur when the delivery hose is disconnected from the fill pipe. The containment is typically called a spill bucket, catchment basin, or spill containment manhole. It must be large enough to contain what may spill when the delivery hose is uncoupled from the fill pipe.

Standards. Substantive elements of U.S. laws applicable and federal regulations to DoD installations, facilities, and actions in the United States that have extraterritorial application or are determined necessary to protect human health and the environment on installations outside the United States.

Storage vessel. Any tank, reservoir, or container used for the storage of petroleum, but does not include:

(1) Pressure vessels that are designed to operate in excess of 103 kPa [15 psia] gauge without emissions to the atmosphere, except under emergency conditions.

(2) Subsurface caverns or porous rock reservoirs.

(3) Process tanks.

Tank or line tightness testing. A test that identifies breaches in a tank or line that could result in a release. While different methods exist, all tightness tests must detect leaks from any portion of the tank or line that routinely contains product while accounting for the effects of thermal expansion or contraction of the product, vapor pockets, tank deformation, evaporation or condensation, and the location of the water table.

Transfer areas. Also known as loading and unloading areas. Any location, other than a fixed loading and unloading rack, where POL is authorized to be loaded or unloaded to or from a POL storage container.

Underground storage tank (UST) system. A tank and connected underground piping that is used to contain POL products or hazardous substances and the volume of which, including the volume of connected pipes, is 10 percent or more beneath the surface of the ground, but does not include:

(1) Tanks containing heating oil used for consumption on the premises where it is stored. These tanks are considered below ground storage tanks; refer to JEGS Chapter 11 for requirements.

(2) Septic tanks.

(3) Stormwater or wastewater collection systems.

(4) Flow-through process tanks.

(5) Surface impoundments, pits, ponds, or lagoons.

(6) Storage tanks located in an accessible underground area (e.g., basement, vault) if the storage tank is situated on or above the surface of the floor. These tanks meet the definition of an aboveground storage tank; refer to JEGS Chapter 11 for requirements.

(7) Any pipes connected to a tank that is not considered an UST system.

United States.[94] The several States, the District of Columbia, the Commonwealths of Puerto Rico and the Northern Mariana Islands, American Samoa, Guam, Midway and Wake Islands, any other territory or possession of the United States, and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States.

Vapor balance system. A combination of pipes and hoses that creates a closed system between the vapor spaces of an unloading gasoline cargo tank and a receiving storage tank such that vapors displaced from the storage tank are transferred to the gasoline cargo tank being unloaded.

Vapor monitoring. Testing or monitoring for vapors within the soil gas of the excavation zone.

Wastewater treatment tank. A tank that is designed to receive and treat an influent wastewater through physical, chemical, or biological methods.

Waters of Japan. Surface water including the territorial seas recognized under customary international law, including:

(1) All waters that are currently used, were used in the past, or may be susceptible to use in commerce.

(2) Waters that are or could be used for recreation or other purposes.

(3) Waters where fish or shellfish are or could be taken and sold.

(4) Waters that are used or could be used for industrial purposes by industries.

(5) Waters including lakes, rivers, streams (including intermittent streams), sloughs, prairie potholes, or natural ponds.

(6) Tributaries of waters identified in this definition.

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[94] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

(7) Exclusions to the Waters of Japan are domestic or industrial waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of JEGS Chapter 9. This exclusion applies to only manmade bodies of water that were neither originally Waters of Japan nor resulted from impoundment of the Waters of Japan.

Water resource. A source of water that is useful or potentially useful for humans, including agricultural, industrial, household, recreational, and environmental activities.

Worst-case discharge (WCD). The largest foreseeable discharge from the facility, under adverse weather conditions, as determined using the WCD planning volume standards in JEGS Appendix 13A as a guide.

## VOLUME IV.B: ACRONYMS

| | |
|---|---|
| AFJMAN | Air Force joint manual |
| AFPMB | Armed Forces Pest Management Board |
| AMPP | Association for Materials Protection and Performance |
| API | American Petroleum Institute |
| ASTM | American Society for Testing and Materials |
| °C | degrees Celsius |
| DD | Defense Department |
| DESC | Defense Energy Support Center |
| DESR | defense explosive safety regulation |
| DLAR | Defense Logistics Agency regulation |
| DoD | Department of Defense |
| DoDD | Department of Defense directive |
| DoDI | Department of Defense instruction |
| DoDM | Department of Defense manual |
| DTR | defense transportation regulation |
| EPN | ethyl p-nitrophenyl benzenethiophosphonate |
| °F | degrees Fahrenheit |
| FCT | field-constructed tank |
| FIC | facility incident commander |

| | |
|---|---|
| FRT | facility response team |
| GDF | gasoline dispensing facility |
| GOJ | Government of Japan |
| HMIRS | Hazardous Material Information Resource System |
| IPM | integrated pest management |
| JEGS | Japan Environmental Governing Standards |
| kPa | kilopascal |
| LEC | Lead Environmental Component |
| LOQ | limit of quantitation |
| MCO | Marine Corps order |
| NAVSUP PUB | Naval Supply Systems Command publication |
| ng | nanogram |
| O&M | operations and maintenance |
| OSD | Office of the Secretary of Defense |
| PEI | Petroleum Equipment Institute |
| POL | petroleum, oil, and lubricants |
| psia | pounds per square inch absolute |
| RQ | reportable quantity |
| SDS | safety data sheet |
| SPRP | spill prevention and response plan |
| STI | Steel Tank Institute |
| TM | technical manual |
| UFC | Unified Facilities Criteria |
| USFJ | United States Forces, Japan |
| UST | underground storage tank |
| WCD | worst-case discharge |

# CHAPTER 10: HAZARDOUS MATERIALS

## 10.1 INTRODUCTION

This chapter contains standards on the safe handling and storage of hazardous materials. It addresses some of the hazard communication, safety, and occupational health topics covered more fully in DoDI 6050.05, DoD Hazard Communication (HAZCOM) Program. It does not cover:

10.1.1 Solid, hazardous, and medical waste, which are covered in JEGS Chapters 15, 16 and 17, respectively.

10.1.2 Storage of POL, UST systems, and related spill planning and response requirements, which are covered in JEGS Chapters 11, 12, and 13, respectively.

10.1.3 Transportation of hazardous materials, which is covered in Defense Transportation Regulation (DTR) 4500.9-R (Parts I through IV).

10.1.4 Ammunition and explosives, which are covered in Defense Explosive Safety Regulation (DESR) 6055.09 (Edition 1).

10.1.5 Radioactive materials, which are covered in DoDI 4715.27, DoD Low-Level Radioactive Waste (LLRW) Disposal Program.

## 10.2 GENERAL

10.2.1 Materials that exhibit any of the characteristics in Table 10.1 are considered hazardous.

10.2.2 All personnel who use, handle, or store hazardous materials must be trained in accordance with, and comply with, DoDI 6050.05, DoD Hazard Communication (HAZCOM) Program.

10.2.3 DoD installations should reduce the use of hazardous materials where practical through reissuance, resource recovery, recycling, source reduction, sustainable procurement, substitution, or other minimization strategies in accordance with Service Component guidance on improved hazardous material management processes and techniques.

10.2.4 All hazardous materials excess to the installation must be processed through the Defense Logistics Agency Disposition Services in accordance with the procedures in DoDM 4160.21 (Volume 4), Defense Materiel Disposition: Instructions For Hazardous Property and Other Special Processing Materiel. This chapter is not intended to prohibit the transfer of usable hazardous materials between DoD activities.

## 10.3 STORAGE AND HANDLING

10.3.1 Installations must store hazardous materials in such a way as to prevent exposure to precipitation, facilitate spill response, and provide appropriate secondary containment.

Hazardous material facility requirements are outlined in Unified Facilities Criteria (UFC) 4-440-01, Warehouses and Storage Facilities, and DLAR 4145.11/TM 38-410/NAVSUP PUB 573/AFJMAN 23-209/MCO 4450.12A, Storage and Handling of Hazardous Materials.

10.3.2 Each installation must maintain a master listing of all hazardous material storage locations as well as an inventory of all hazardous materials contained therein. Refer to JEGS Paragraph 13.2.3.3 for details regarding hazardous substance inventory.

10.3.3 The installation must prevent the unauthorized entry of persons or livestock into hazardous material storage areas.

10.3.4 All hazardous materials on DoD installations must have a hazardous material warning label in accordance with DoDI 6050.05, DoD Hazard Communication (HAZCOM) Program. Hazardous materials must also have safety data sheet (SDS) information either available or in the Hazardous Material Information Resource System (HMIRS) in accordance with DoDI 6050.05 and other DoD Service Component instructions. Materials containing ozone depleting substances must be labeled in accordance with JEGS Paragraph 4.9.3. These requirements apply throughout the life-cycle of these materials.

10.3.5 Each work center must maintain a file of SDSs for each hazardous material procured, stored, or used at the work, center that’s accessible to personnel. SDSs that are not contained in the HMIRS and SDSs prepared for locally purchased items must be submitted by the installation for addition into the HMIRS. SDSs must be submitted through HMIRS points of contact. Each SDS must be in both English and Japanese, if Japanese is the predominant language in the workplace, and include information on:

10.3.5.1 Identification.

10.3.5.2 Hazard(s) identification.

10.3.5.3 Composition and information on ingredients.

10.3.5.4 First-aid measures.

10.3.5.5 Firefighting measures.

10.3.5.6 Accidental release measures.

10.3.5.7 Handling and storage.

10.3.5.8 Exposure control and personal protection.

10.3.5.9 Physical and chemical properties.

10.3.5.10 Stability and reactivity.

10.3.5.11 Toxicology information.

10.3.5.12 Preparation or last revision.

10.3.5.13 Ecological information (optional).

10.3.5.14 Disposal considerations (optional).

10.3.6 Hazardous material dispensing areas must be properly maintained. Installations must:

10.3.6.1 Ensure drums and containers are not leaking.

10.3.6.2 Provide appropriate secondary containment and place drip pans and absorbent materials under containers, as necessary, to collect drips or spills.

10.3.6.3 Clearly mark container contents.

10.3.6.4 Locate dispensing areas away from catch basins and floor and storm drains.

## 10.4 PRE-TRANSPORT REQUIREMENTS

Installations must ensure that before each hazardous material shipment:

10.4.1 The shipment is accompanied by shipping papers that clearly describe the quantity and identity of the material and includes an SDS.

10.4.2 All drivers:

10.4.2.1 Have the appropriate valid driver’s license in accordance with Part II of DTR 4500.9- R, Cargo Movement.

10.4.2.2 Are trained on the hazardous material included in the shipment, including health risks of exposure and the physical hazards of the material, including potential for fire, explosion, and reactivity.

10.4.2.3 Are trained on spill control and emergency notification procedures.

10.4.2.4 Perform a walk-around inspection before and after the hazardous material is loaded.

10.4.3 Hazardous material containers are labeled in accordance with Paragraph 10.3.4.

10.4.4 The requirements for transport outlined in Part II of DTR 4500.9-R have been met before releasing the shipment.

10.4.5 Vehicle placarding is prohibited outside U.S. exclusive use facilities and areas in Japan.

**Table 10.1: Typical Characteristics of Hazardous Materials**

| TYPE OF HAZARD | CHARACTERISTICS |
|---|---|
| Physical | Explosive, flammable (gases, aerosols, liquids, or solids), oxidizer (liquid, solid or gas), self-reactive, pyrophoric (liquid or solid), self- heating, organic peroxide, corrosive to metal, gas under pressure, or when in contact with water emits flammable gas. |
| Health | Acute toxicity (any route of exposure), skin corrosion or irritation, serious eye damage or eye irritation, respiratory or skin sensitization, germ cell mutagenicity, carcinogenicity, reproductive toxicity, specific target organ toxicity (single or repeated exposure), or aspiration hazard. |
| Asphyxiant | Simple asphyxiant that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death. |
| Combustible Dust | Solid particles of a substance or mixture suspended in a gas (usually air) that are combustible. |
| Pyrophoric Gas | A gas that will ignite spontaneously in air at a temperature of 54.4 degrees Celsius [130 degrees Fahrenheit] or below. |
| Japan-specified(1) | The item or its disposal is regulated in Japan because of its hazardous nature. |

Note:
1. JEGS Table 16.6 includes a list of Japanese Class I Specified Chemical Substances.

# CHAPTER 11: PETROLEUM, OIL, AND LUBRICANTS (POL)

## 11.1 INTRODUCTION

This chapter contains standards on the prevention and control of pollution resulting from the storage, transport, and distribution of POL.

11.1.1 Standards for UST systems containing POL or hazardous substances are addressed in JEGS Chapter 12, except:

11.1.1.1 USTs that are considered storage vessels and covered in Paragraph 11.4.4.

11.1.1.2 Specialty UST systems that also are considered aboveground storage containers or below ground storage containers. Those systems may also be subject to the standards of this chapter. Installations must evaluate such UST systems to determine applicability of standards and comply with such standards, as practicable.

11.1.2 POL spill prevention and response standards are contained in JEGS Chapter 13.

## 11.2 GENERAL

Installations that are considered POL facilities must comply with the applicable requirements of this chapter based on the type and capacity of POL storage and the type of POL transport and distribution activities. All installations, whether considered POL facilities or not, must comply with the spill prevention and response requirements of JEGS Chapter 13 and the requirements of Paragraphs 11.6.3 and 11.6.4, as applicable.

## 11.3 PERSONNEL TRAINING

At a minimum, all personnel handling POL must be trained annually on:

11.3.1 General facility operations.

11.3.2 Operation and maintenance (O&M) of equipment to prevent accidental discharges.

11.3.3 Spill response procedures.

11.3.4 Contents of the Spill Prevention and Response Plan (SPRP).

## 11.4 POL STORAGE CONTAINERS

11.4.1 <u>Design and Construction</u>

11.4.1.1 <u>All POL Storage Containers</u>. POL storage containers must be designed or modernized in accordance with industry standards and practices to prevent unintentional discharges.

11.4.1.1.1 The material and construction of POL storage containers must be compatible with the material stored.

11.4.1.1.2 Design must be in accordance with industry standards and practices.

11.4.1.1.3 Except for mobile refuelers, POL storage containers must have adequate spill and leak prevention options (such as overfill alarms and flow shutoff or restrictor devices).

11.4.1.2 Below Ground and Partially Buried Aboveground Storage Containers. Completely and partially buried metallic POL containers and piping must be protected from corrosion in accordance with industry standards and practices.

### 11.4.2 Inspections and Testing

### 11.4.2.1 All POL Storage Containers

11.4.2.1.1 All containers must be inspected and tested and results documented in accordance with industry standards and practices, such as American Petroleum Institute (API), Steel Tank Institute (STI), and UFC 3-460-03, Petroleum Fuel Systems Maintenance.

11.4.2.1.2 All aboveground valves, piping, and equipment associated with POL storage containers must be inspected in accordance with industry standards and practices.

11.4.2.1.3 Except for mobile refuelers and mobile aboveground storage containers, liquid level sensing devices must be tested to ensure proper operation.

11.4.2.2 Buried Piping. Buried piping associated with POL storage containers must be tested for integrity and leaks at the time of installation, modification, construction, relocation, or replacement.

11.4.2.3 Below Ground POL Storage Containers. Below ground storage containers must be tested for leaks regularly and at the time of installation, modification, construction, relocation, or replacement.

### 11.4.3 Secondary Containment

11.4.3.1 All POL Storage Containers. If a U.S. licensed professional engineer determines that secondary containment methods are impractical, they may waive these standards while implementing and documenting alternative measures of protection taken to prevent and contain oil discharges.

11.4.3.1.1 POL storage containers must be provided with a sized secondary means of containment (e.g., dike) capable of holding the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation and expansion of product. This does not include mobile refuelers and mobile aboveground storage containers. POL storage containers that are equipped with adequate engineered spill and leak prevention options (such as overfill alarms and flow shutoff or restrictor devices) may provide secondary containment by using a double-wall container.

11.4.3.1.2 POL storage containers (fixed and mobile) must have a general secondary containment analysis to identify and contain likely releases from all parts of the container system. This includes transfer of POL into and out of the container as well as leakage or rupture of all valves and aboveground and underground pipes. Appropriate general secondary containment measures must be identified and put in place.

11.4.3.2 Below Ground Storage Containers. Completely buried containers not subject to UST standards can alternatively meet the secondary containment standards by using a leak barrier with leak detection equipment and basin.

11.4.3.3 Mobile Refuelers and Mobile Aboveground Storage Containers. Mobile refuelers and mobile aboveground storage containers must be provided general secondary containment when parked and positioned to prevent discharges into the Waters of Japan.

11.4.3.4 Containment Area Permeability. Permeability for containment areas may not exceed $10^{-7}$ centimeters per second.

11.4.3.5 Containment Area Drainage. Drainage of stormwater from containment areas must be controlled by a valve that is locked closed when not in active use. Stormwater must be inspected and documented for petroleum sheen before being drained from containment areas. If a petroleum sheen is present, it must be collected with sorbent materials before drainage or treated using an oil-water separator. Sorbent materials exhibiting the hazardous characteristics in JEGS Appendix 16A must be managed and disposed of in accordance with JEGS Chapter 16.

11.4.4 Additional Requirements for Storage Vessels

11.4.4.1 Storage vessel designs must comply with the requirements listed in Table 11.1.

11.4.4.2 Storage vessels and emission controls must follow industry standards and practices for proper O&M.

11.4.5 Storage Container Waste

11.4.5.1 POL storage container waste (e.g., sludges, residues, and bottom waters) must be characterized in accordance with JEGS Paragraph 16.3 to determine if they are hazardous. If a waste exhibits a characteristic of hazardous waste as defined in JEGS Appendix 16A, it must be handled and disposed of in accordance with the requirements of JEGS Chapter 16.

11.4.5.2 If testing confirms that a storage container waste does not exhibit a characteristic and is not hazardous, it must be managed and disposed of in accordance with the solid waste requirements of JEGS Chapter 15 or the wastewater requirements of JEGS Chapter 9, as appropriate.

## 11.5 OIL-FILLED OPERATIONAL EQUIPMENT

General secondary containment must be provided for oil-filled operational equipment. This general secondary containment is not required for facilities that have not had a single discharge from oil-filled operational equipment greater than 3,785 liters [1,000 gallons] or two discharges greater than 159 liters [42 gallons] within the past 12 months. If general secondary containment is not provided, the facility must:

11.5.1 Have a written inspection and monitoring program to detect oil-filled equipment failure or discharges.

11.5.2 Have a written commitment of manpower, equipment, and materials required to expeditiously control and remove any quantity of oil discharged.

11.5.3 Include this information in the installation Spill Prevention and Response Plan (SPRP).

## 11.6 TRANSPORT AND DISTRIBUTION

11.6.1 Loading and Unloading Racks and Transfer Areas

11.6.1.1 Secondary Containment.[95]

11.6.1.1.1 Loading and Unloading Racks. Sized secondary containment must be provided that is designed to handle discharges of at least the maximum capacity of any single compartment of a rail car or tank truck loaded or unloaded at the loading or unloading rack.

11.6.1.1.2 Transfer Areas. General secondary containment, appropriate containment or diversionary structures like dikes, berms, culverts, spill diversion ponds, or equipment such as sorbent materials, weirs, booms, other barriers, must be provided at transfer areas to prevent a discharge of POL.

11.6.1.2 Departing Vehicle Warning Systems and Barriers. At loading and unloading racks, an interlocked warning light or physical barrier system, warning signs, wheel chocks, or vehicle break interlock system must be provided to prevent vehicles from departing before complete disconnection of flexible or fixed oil transfer lines.

11.6.1.3 Vehicle Inspections. At both loading and unloading racks and transfer areas, before departure of any tank car or tank truck, the lowermost drain and all outlets of such vehicles must be closely inspected for discharges and, if necessary, tightened, adjusted, or replaced to prevent liquid discharge while in transit.

11.6.2 POL Pipeline Facilities. All pipeline facilities carrying POL must be inspected, tested, and maintained in accordance with industry standards and practices, including:

11.6.2.1 Each pipeline operator handling POL must prepare and follow a procedural manual for operations, maintenance, and emergencies.

11.6.2.2 Each new pipeline facility, and each facility in which piping has been replaced or relocated, must be tested in accordance with industry standards and practices, without leakage, before being placed in service.

11.6.2.3 All new POL pipeline facilities must be designed and constructed to meet industry standards and practices such as API, STI, or UFC 3-460-01, Design: Petroleum Fuel Facilities.

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[95] Refer to UFC 3-460-01, Design: Petroleum Fuel Facilities for Secondary Containment Requirements at Specific Fueling Facilities.

11.6.3 Bulk Gasoline Plants. The following requirements apply to the loading of gasoline into storage tanks with a capacity of 946 liters [250 gallons] or more, or the loading of gasoline into all cargo tanks. Bulk gasoline plant requirements do not apply to loading of aviation gasoline into storage tanks at airports or the subsequent transfer of aviation gasoline within the airport.

11.6.3.1 Gasoline Handling. Gasoline must not be handled in a manner that results in vapor release to the atmosphere for an extended period of time. Measures to be taken include, but are not limited to:

11.6.3.1.1 Minimize gasoline spills and clean up spills as expeditiously as practicable.

11.6.3.1.2 Cover all open gasoline containers and all gasoline storage tank fill-pipes with a gasketed seal when not in use.

11.6.3.1.3 Minimize gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices, such as oil and water separators.

11.6.3.2 Submerged Filling. Gasoline must only be loaded into storage tanks and cargo tanks using submerged filling.

11.6.3.3 Inspections. Monthly leak inspection of all equipment in gasoline service at the facility must be performed. Document each inspection in a log book. Include a list, summary description, or diagram in the log book showing the location of all equipment in gasoline service.

11.6.3.4 Leak Repair. Initial repair must be performed as soon as possible, but no later than 5 calendar days after the leak is detected. Repair or replacement of leaking equipment must be completed within 15 calendar days after detection, if practicable.

11.6.4 Gasoline Dispensing Facilities (GDFs). The following requirements apply to the loading of gasoline storage tanks at a GDF, based on monthly throughput of the GDF. If an installation has two or more GDFs at separate locations within the installation, each GDF must be treated separately. GDF requirements do not apply to loading of aviation gasoline into storage tanks at airports or the subsequent transfer of aviation gasoline within the airport. Installations must ensure that each gasoline storage tank located at a GDF and gasoline cargo tank (i.e., tanker truck or railcar) that deliver gasoline to or from a GDF complies with the following requirements:

11.6.4.1 GDF with Monthly Throughput Less Than 37,854 Liters [10,000 Gallons]. Gasoline must not be handled in a manner that would result in vapor releases to the atmosphere for extended periods of time. Measures to be taken include, but are not limited to:

11.6.4.1.1 Minimizing gasoline spills and cleaning up spills as expeditiously as practicable.

11.6.4.1.2 Covering all open gasoline containers and all gasoline storage tank fill-pipes with a gasketed seal when not in use.

11.6.4.1.3 Minimizing gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices, such as oil/water separators.

11.6.4.2 <u>GDF with Monthly Throughput Greater Than or Equal to 37,854 Liters [10,000 Gallons]</u>. Measures to be taken include, but are not limited to:

11.6.4.2.1 Complying with the requirements of Paragraph 11.6.4.1.

11.6.4.2.2 Only loading gasoline into storage tanks using submerged filling.

11.6.4.3 <u>GDF with Monthly Throughput Greater Than or Equal to 378,541 Liters [100,000 Gallons]</u>. Measures to be taken include, but are not limited to:

11.6.4.3.1 Complying with the requirements of Paragraphs 11.6.4.1 and 11.6.4.2.

11.6.4.3.2 Installing and operating a vapor balance system on each storage tank at the GDF. At a minimum, each vapor balance system must meet all of these design standards:

11.6.4.3.2.1 All vapor connections and lines on the storage tank must be equipped with closures that seal upon disconnect.

11.6.4.3.2.2 The vapor line from the gasoline storage tank to the gasoline cargo tank must be vapor-tight.

11.6.4.3.2.3 The pressure in the tank truck must not exceed 4.5 kPa [18 inches water] pressure or 1.5 kPa [5.9 inches water] vacuum during product transfer.

11.6.4.3.2.4 The vapor recovery and product adaptors, and the method of connection with the delivery elbow, must prevent the overtightening or loosening of fittings during normal delivery operations.

11.6.4.3.2.5 If a gauge well separate from the fill tube is used, it must be provided with a submerged drop tube.

11.6.4.3.2.6 Liquid fill connections for all systems must be equipped with vapor-tight caps.

11.6.4.3.2.7 Pressure/vacuum vent valves must be installed on the storage tank vent pipes. The pressure specifications for pressure/vacuum vent valves must be a positive pressure setting of 0.6 to 1.5 kPa [2.5 to 6.0 inches of water] and a negative pressure setting of 1.5 to 2.5 kPa [6.0 to 10.0 inches of water].

11.6.4.3.2.8 Storage tanks constructed after November 9, 2006, must be equipped with a dual-point vapor balance system (i.e., a vapor balance system in which the storage tank is equipped with an entry port for a gasoline fill pipe and a separate exit port for a vapor connection).

11.6.4.3.3 Ensuring cargo tanks unloading at a GDF where the storage tanks are equipped with vapor balance systems comply with certain management practices. These practices require meeting all of these conditions before transferring gasoline from the cargo tank to the storage tank:

11.6.4.3.3.1 All hoses in the vapor balance system are properly connected.

11.6.4.3.3.2 The adapters or couplers that attach to the vapor line on the storage tank have closures that seal upon disconnect.

11.6.4.3.3.3 All vapor return hoses, couplers, and adapters used in the gasoline delivery are vapor-tight.

11.6.4.3.3.4 All tank truck vapor return equipment must be compatible in size and form a vapor-tight connection with the vapor balance equipment on the GDF storage tank.

11.6.4.3.3.5 All hatches on the tank truck are closed and securely fastened.

11.6.4.3.3.6 The filling of storage tanks at GDFs is limited to unloading from vapor-tight gasoline cargo tanks.

## 11.7 RECORDKEEPING

Installations must maintain records associated with POL design and construction, inspections and testing, secondary containment, and other standards of this chapter. Such recordkeeping may be performed as part of the spill prevention and response standards in JEGS Chapter 13.

## Table 11.1: Storage Vessels Requirements for Petroleum Liquids

| DATES | STORAGE CAPACITY | REQUIREMENT |
|---|---|---|
| Construction after March 8, 1974 and before May 19, 1978 | Greater than 151,416 liters [40,000 gallons] but not exceeding 246,052 liters [65,000 gallons] | If vapor pressure equal to or greater than 10.3 kPa [1.5 psia] but not greater than 76.6 kPa [11.1 psia], the storage vessel must be equipped with:<br>• A floating roof;<br>• A vapor recovery system; or<br>• Their equivalents.<br>If vapor pressure is greater than 570 millimeters of mercury [11.1 psia], the storage vessel must be equipped with a vapor recovery system or its equivalent. |
| Construction or modification after June 11, 1973 and before May 19, 1978 | Greater than 246,052 liters [65,000 gallons] | |
| Began construction after May 18, 1978 and before July 23, 1984 | Greater than 151,416 liters [40,000 gallons] | If vapor pressure equal to or greater than 10.3 kPa [1.5 psia] but not greater than 76.6 kPa [11.1 psia], the storage vessel must be equipped with:<br>• An external floating roof;<br>• A fixed roof with an internal floating type cover equipped with a continuous closure device between the tank wall and the cover edge; or<br>• A vapor recovery system and a vapor return or disposal system. |
| Began construction, reconstruction, or modification after July 23, 1984 | Greater than or equal to 75,000 liters [19,813 gallons] but less than 151,000 liters [39,890 gallons] | If maximum vapor pressure equal to or greater than 27.6 kPa [4.0 psia] but less than 76.6 kPa [11.1 psia], then each storage vessel must be equipped with:<br>• A fixed roof in combination with an internal floating roof;<br>• An external floating roof; or<br>• A closed vent system and control device. |
| Began construction, reconstruction, or modification after July 23, 1984 | Greater than or equal to 75,000 liters [19,813 gallons] | If maximum vapor pressure equal to or greater than or equal to 76.6 kPa [11.1 psia], then each storage vessel must be equipped with:<br>• A closed vent system and control device, or its equivalent |
| Began construction, reconstruction, or modification after July 23, 1984 | Greater than or equal to 151,000 liters [39,890 gallons] | If maximum vapor pressure equal to or greater than 5.2 kPa [0.75 psia] but less than 76.6 kPa [11.1 psia], then each storage vessel must be equipped with:<br>• A fixed roof in combination with an internal floating roof;<br>• An external floating roof; or<br>• A closed vent system and control device. |

kPa = kilopascal
psia = pounds per square inch absolute

# CHAPTER 12: UNDERGROUND STORAGE TANKS (USTs)

## 12.1 INTRODUCTION

This chapter contains standards on the prevention and control of pollution resulting from POL and hazardous substances stored in UST systems.

## 12.2 GENERAL

12.2.1 The standards in this chapter apply to all UST systems, except for the following excluded UST systems:

12.2.1.1 Any UST system holding hazardous waste. Refer to JEGS Chapter 16.

12.2.1.2 Any wastewater treatment tank that is part of a wastewater treatment facility.

12.2.1.3 Equipment or machinery (operational tanks) that contains hazardous substances or POL for operational purposes such as hydraulic lift tanks and electrical equipment tanks.

12.2.1.4 Any UST system whose capacity is 416 liters [110 gallons] or less. If greater than or equal to 208 liters [55 gallons], this is a below ground storage tank subject to the requirements in JEGS Chapter 11 of this volume.

12.2.1.5 Any UST system that contains de minimis concentration of hazardous substances or POL.

12.2.1.6 Any emergency spill or overflow containment UST system that is expeditiously emptied after use.

12.2.2 Some specialty UST systems may also be considered aboveground storage containers or below ground storage containers and subject to the standards of JEGS Chapter 11. Installations must evaluate such UST systems to determine applicability of standards and comply, as practicable.

12.2.3 Owners and operators of UST systems must implement the requirements of this chapter. Installation commanders and their representatives must oversee implementation and ensure compliance with these requirements, regardless of whether the installation is the owner or operator of the UST system.

## 12.3 NEW AND EXISTING UST SYSTEMS

New UST systems include UST systems where installation began after April 11, 2016. Existing UST systems include UST systems where installation began on or before April 11, 2016.

## 12.4 DESIGN, CONSTRUCTION, AND INSTALLATION

Owners and operators must ensure that all UST systems are properly designed and installed, protected from corrosion, provided with spill and overfill prevention, and incorporate release detection. Specialty UST systems must meet the requirements of this paragraph as prescribed in Paragraph 12.7, which describes the applicability of the design, construction, and installation requirements of this paragraph. These requirements must be addressed in accordance with manufacturer's specifications and applicable design criteria such as UFC 3-460-01, Design: Petroleum Fuel Facilities, and industry standards and practices.

12.4.1 Tank Design, Construction, and Installation. Tanks must have secondary containment and corrosion protection, and be constructed of, or lined with, a material that is compatible with the substances stored.

12.4.1.1 Secondary Containment for Tanks. New and replaced POL tanks, as well as existing, new, and replaced hazardous substance tanks, must be secondarily contained and use interstitial monitoring.

12.4.1.2 Corrosion Protection for Tanks. Any portion of a tank that routinely contains hazardous substances or POL, and is in contact with the ground, must be protected from corrosion in accordance with industry standards and practices. Tanks must be constructed of one of the following:

12.4.1.2.1 A non-corrodible material such as fiberglass-reinforced plastic.

12.4.1.2.2 Steel that is coated and cathodically protected. The corrosion-resistant coating must be a suitable dielectric material. Asphalt does not meet this requirement. Field-installed cathodic protection systems must be designed by a corrosion expert and installed, operated, and maintained in accordance with industry standards and practices. Impressed current systems must be designed to allow determination of current operating status.

12.4.1.2.3 Steel and clad (enclosed or jacketed) with a non-corrodible material that completely isolates the steel from contact with the surrounding soil.

12.4.1.3 Compatibility for Tanks. Tanks must be constructed of, or lined with, materials that are compatible with the substance stored.

12.4.1.4 Release Detection for Tanks in Existing UST Systems

12.4.1.4.1 Existing POL tanks must use at least one of the following release detection methods: automatic tank gauging, groundwater monitoring, interstitial monitoring, statistical inventory reconciliation, or vapor monitoring. Existing POL tanks that meet the requirements of Paragraph 12.4.1 may use tank tightness testing if used in combination with monthly inventory control.

12.4.1.4.2 Existing hazardous substance tanks must, at a minimum, use interstitial monitoring.

12.4.1.5 Release Detection for Tanks in New UST Systems. New POL and hazardous substance tanks must be monitored for releases using at least interstitial monitoring.

12.4.1.6 Standards for Methods of Release Detection for Tanks. Tanks must be monitored for releases at least every 30 days or properly closed. Owners and operators must use the release detection method, or combination of methods, specified for new or existing UST systems that:

12.4.1.6.1 Can detect a release from any portion of the tank that routinely contains hazardous substances or POL.

12.4.1.6.2 Is installed and calibrated in accordance with the manufacturer's specifications.

12.4.1.6.3 Is capable of detecting a leak rate or quantity of at least 0.76 liters [0.2 gallons] per hour or 568 liters [150 gallons] in one month or the rate or quantity for that method as specified in the standards. All must have a probability of detection of 0.95 and a probability of false alarm of 0.05.

12.4.1.6.4 Meets the performance requirements for these specific release detection methods:

12.4.1.6.4.1 Automatic tank gauging must meet industry standards and practices, including those for inventory control and be capable of detecting a 0.76 liter [0.2 gallon] per hour leak rate from any portion of the tank that routinely contains POL or hazardous substances. Automatic tank gauging is performed with the system operating in either in-tank static mode or a continuous in-tank release detection that allows a leak status to be measured at least every 30 days.

12.4.1.6.4.2 Groundwater monitoring must be consistent with industry standards and practices.

12.4.1.6.4.3 Interstitial monitoring may only be used if the system is designed, constructed, and installed to detect a leak from any portion of the tank that routinely contains product.

12.4.1.6.4.4 Statistical inventory reconciliation must meet industry standards and practices and report a quantitative result with a calculated leak rate. It must be capable of detecting a leak rate of 0.76 liters [0.2 gallon] per hour or a release of 568 liters [150 gallons] within 30 days. The threshold must not exceed one-half the minimum detectible leak rate.

12.4.1.6.4.5 Vapor monitoring must be consistent with industry standards and practices. There must be sufficient porosity of the backfill and volatility of the stored substance or tracer compound. Monitoring must assure that known interferences from rain, groundwater, soil moisture, or similar will not allow a release to go undetected for more than 30 days.

12.4.1.6.4.6 Tank tightness testing must be capable of detecting a 0.38 liter [0.1 gallon] per hour leak rate from any portion of the tank that routinely contains product. Tests must account for the effects of thermal expansion or contraction of the product, vapor pockets, tank deformation, evaporation or condensation, and the location of the water table.

12.4.2 Piping Design, Construction, and Installation

12.4.2.1 Secondary Containment for Piping

12.4.2.1.1 For all new and replaced UST systems, all piping must be secondarily contained and use interstitial monitoring, except for suction piping that meets the definition of safe suction piping. Safe suction piping may be single walled.

12.4.2.1.2 For existing hazardous substance UST systems, underground piping must have secondary containment and interstitial monitoring. Existing underground piping that conveys hazardous substances under pressure must have automatic line leak detectors.

12.4.2.1.3 When 50 percent or more of the piping connected to a single tank is removed and replaced, the entire piping run must be replaced with piping that has secondary containment and interstitial monitoring.

12.4.2.2 Corrosion Protection for Piping. Piping that routinely contains hazardous substances or POL, and is in regular contact with the ground, must be properly designed, constructed, and protected from corrosion in accordance with industry standards and practices. Piping must be constructed of:

12.4.2.2.1 A non-corrodible material; or

12.4.2.2.2 Steel that is coated and cathodically protected. The corrosion-resistant coating must be a suitable dielectric material. Asphalt does not meet this requirement. Field-installed cathodic protection systems must be designed by a corrosion expert and be installed, operated, and maintained in accordance with industry standards and practices. Impressed current systems must be designed to allow determination of current operating status.

12.4.2.3 Compatibility for Piping. Piping must be constructed of, or lined with, materials that are compatible with the substance stored.

12.4.2.4 Release Detection for Piping

12.4.2.4.1 Release Detection Methods. Owners and operators must use a release detection method, or combination of methods specified for the particular type of piping, as detailed in Paragraphs 12.4.2.4.2 through 12.4.2.4.5 that:

12.4.2.4.1.1 Can detect a release from any portion of the connected underground piping that routinely contains hazardous substances or POL.

12.4.2.4.1.2 Is installed and calibrated in accordance with the manufacturer's specifications.

12.4.2.4.1.3 Meets the performance requirements for the specific release detection method.

12.4.2.4.1.3.1 Automatic line release detectors must be capable of detecting leaks of 11.36 liters [3 gallons] per hour at 68.9 kPa [10 pounds per square inch] line pressure within one hour.

12.4.2.4.1.3.2 Groundwater monitoring must be consistent with industry standards and practices.

12.4.2.4.1.3.3 Line tightness testing must be capable of detecting a leak rate of 0.38 liters [0.1 gallons] per hour at one and one-half times the operating pressure.

12.4.2.4.1.3.4 Interstitial monitoring may only be used if the system is designed, constructed, and installed to detect a leak from any portion of the piping that routinely contains product.

12.4.2.4.1.3.5 Vapor monitoring must be consistent with industry standards and practices. There must be sufficient porosity of the backfill and volatility of the stored substance or tracer compound. Monitoring must assure that known interferences from rain, groundwater, soil moisture, or similar interferences will not allow a release to go undetected for more than 30 days.

12.4.2.4.1.3.6 Other methods including, but not limited to, electronic pressurized line leak detection may be used if they can detect a 0.2 gallon per hour leak rate with a probability of detection of 0.95 and a probability of false alarm of 0.05.

12.4.2.4.2 Existing Pressurized Piping. Existing piping that conveys:

12.4.2.4.2.1 Hazardous substances under pressure must use interstitial monitoring and automatic line release detection.

12.4.2.4.2.2 POL under pressure must be equipped with an automatic line release detector and have an annual line tightness test conducted or be monitored monthly.

12.4.2.4.3 New Pressurized Piping. New and replaced underground pressurized piping for POL and hazardous substance UST systems must be monitored for releases at least every 30 days via interstitial monitoring and be equipped with an automatic line release detector.

12.4.2.4.4 Existing Suction Piping. Existing underground suction piping for POL and hazardous substance UST systems is not required to have release detection if the piping meets the definition of safe suction. Non-safe suction piping must meet one of these conditions:

12.4.2.4.4.1 Conduct line tightness testing at least every three years; or

12.4.2.4.4.2 Use monthly monitoring methods: automatic tank gauging, groundwater monitoring, interstitial monitoring, or vapor monitoring.

12.4.2.4.5 New Suction Piping. New underground suction piping for POL and hazardous substance UST systems is not required to have release detection if the piping meets the standards for safe suction. If it cannot meet these standards, then it must meet the same requirements as new pressurized piping and be monitored for releases at least every 30 days using interstitial monitoring.

12.4.3 Spill and Overfill Protection Equipment Design, Construction, and Installation. Except where transfers are made in the amounts of 95 liters [25 gallons] or less, owners and operators must ensure all UST systems have:

12.4.3.1 Spill prevention equipment, such as spill buckets or catchment basins that prevents the release of product into the environment when the transfer hose is detached from the fill pipe.

12.4.3.2 Overfill prevention equipment. Ball float valves can no longer be used as overfill prevention equipment for new UST systems. Overfill prevention equipment must be either:

12.4.3.2.1 An automatic shut-off device set at 95 percent of tank capacity; or

12.4.3.2.2 A high-level alarm set at 90 percent of tank capacity that alerts the transfer operator.

12.4.4 Dispenser System Design, Construction, and Installation. Owners and operators must ensure that each UST system is equipped with under-dispenser containment for new dispenser systems (where installation began after April 11, 2016). A dispenser system is considered new when both the dispenser and the equipment needed to connect the dispenser to the UST system are installed. Under-dispenser containment must be liquid tight on its sides and bottom, and at any penetrations. The containment must allow for visual inspection and access to the components or be periodically monitored for leaks.

## 12.5 OPERATIONS AND MAINTENANCE (O&M)

Owners and operators must ensure that O&M is performed in accordance with industry standards and practices. These requirements are intended to protect the environment and do not serve as a replacement for comprehensive fuel storage system O&M manuals. Owners and operators must ensure that these requirements are incorporated into the overall O&M manuals.

12.5.1 Spill and Overfill Prevention O&M. In addition to properly operating and maintaining spill and overfill prevention equipment, owners and operators must operate UST systems in a manner that prevents spills and overfills. Specifically, operators must continuously monitor transfer operations to prevent overfilling and spilling, ensure the available tank volume is greater than the volume of product to be transferred to the tank, and periodically inspect and test spill prevention and overfill equipment during O&M walkthrough inspections.

12.5.1.1 Repairs to Spill and Overfill Prevention Equipment. Within 30 days following repair to spill or overfill prevention equipment, owners and operators must test the repaired equipment in accordance with industry standards and practices to ensure proper operation.

12.5.1.2 Inspection and Testing of Spill Prevention Equipment, Overfill Prevention Equipment, and Containment Sumps. Owners and operators must ensure that walkthrough inspections and tests are conducted that include:

12.5.1.2.1 Inspecting spill prevention equipment at least every 30 days. UST systems receiving deliveries at intervals greater than every 30 days may be checked before each delivery. Inspections must include:

12.5.1.2.1.1 Visually checking for damage.

12.5.1.2.1.2 Removing liquid and debris.

12.5.1.2.1.3 Checking for and removing obstructions in the fill pipe.

12.5.1.2.1.4 Checking the fill cap to ensure it is securely on the fill pipe.

12.5.1.2.1.5 Checking for leaks in interstitial areas of double-walled spill prevention equipment with interstitial monitoring.

12.5.1.2.1.6 Monitoring the integrity of both walls of the double-walled spill prevention equipment by using the vacuum, pressure, or liquid interstitial integrity indicator, if so equipped.

12.5.1.2.2 Inspecting containment sumps annually. Inspections must include:

12.5.1.2.2.1 Visually inspecting for damage.

12.5.1.2.2.2 Checking for leaks to the containment area or releases to the environment.

12.5.1.2.2.3 Removing liquid or debris.

12.5.1.2.2.4 Checking for a leak in the interstitial area for double-walled sumps with interstitial monitoring.

12.5.1.2.3 Using vacuum, pressure, or liquid testing to test spill prevention equipment used for interstitial monitoring of piping at least once every three years to ensure the equipment is liquid tight. All single-walled spill prevention equipment and containment sumps as well as double-walled spill prevention equipment and containment sumps not monitored in accordance with Paragraph 12.5.1.2.1.6 require this triennial testing.

12.5.1.2.4 Inspecting overfill prevention equipment at least every three years to ensure proper operation and prevention of overfills. At a minimum, the inspection must ensure that overfill prevention equipment is set to the correct level and will activate when the POL or hazardous substance reaches that level.

12.5.1.2.5 Maintaining records for O&M inspections in accordance with the requirements in Paragraph 12.10.

12.5.1.2.6 Maintaining records demonstrating compliance for spill and overfill prevention equipment in accordance with the requirements in Paragraph 12.10.

12.5.2 Corrosion Protection O&M. Until permanent closure of an UST system, owners and operators must prevent releases due to corrosion by ensuring all of the following are performed:

12.5.2.1 Properly operating and maintaining UST systems (including cathodic protection systems) to continuously provide corrosion protection to the metal components of tanks and piping in contact with the ground.

12.5.2.2 Within six months of installation of cathodic protection systems, and at least every three years thereafter, inspecting cathodic protection systems for proper operation using qualified cathodic protection experts and in accordance with industry standards and practices.

12.5.2.3 Every 60 days, inspecting UST systems with impressed current cathodic protection systems to validate the equipment is running properly.

12.5.2.4 Within six months of repairs to cathodically protected UST systems, testing cathodic protection system in accordance with industry standards and practices to ensure proper operation. Maintain records for cathodic protection tests as described in Paragraph 12.10.

12.5.3 Compatibility O&M. If the contents of the UST systems are changed, owners and operators must ensure compatibility between the new substance stored and the UST system.

12.5.4 Release Detection System O&M. Owners and operators must maintain and operate release detection systems in accordance with manufacturer's specifications and industry standards and practices. Operators must:

12.5.4.1 Conduct O&M walkthrough inspections of release detection equipment at least every 30 days to confirm:

12.5.4.1.1 Proper operation and no alarms.

12.5.4.1.2 Hand-held release detection equipment is properly functioning.

12.5.4.1.3 Release detection records are reviewed and current.

12.5.4.2 Conduct testing of release detection systems at least annually to verify proper operation in accordance with manufacturer's specifications and industry standards and practices.

12.5.4.3 Conduct annual line tightness testing or monthly monitoring for existing underground piping that conveys POL under pressure. After tanks and piping have been replaced with double-walled systems, only monthly monitoring of the interstitial space is allowed.

12.5.4.4 Maintain records on release detection systems to demonstrate equipment and operational compliance. Detailed recordkeeping requirements for release detection systems are identified in Paragraph 12.10.

12.5.4.5 Report failure of release detection systems and suspected releases in accordance with Service Component-specific guidance.

12.5.5 Repairs to UST Systems. Owners and operators must ensure that repairs to UST systems will prevent releases due to structural failure or corrosion as long as the UST system is used to store hazardous substances or POL.

12.5.5.1 UST System Repairs

12.5.5.1.1 Pipe Sections and Fittings. Metal pipe sections and fittings that have released product as a result of corrosion or other damage must be replaced. Non-corrodible pipes and fittings that are corroded or damaged may be repaired.

12.5.5.1.2 All UST System Repairs. Repairs must be completed in accordance with manufacturer's specifications and industry standards and practices.

12.5.5.2 Testing of Repaired UST Systems

12.5.5.2.1 Secondary Containment Repairs. Within 30 days of repairs to secondary containment areas or containment sumps used for interstitial monitoring of piping, a tightness test of the containment area or sump must be conducted.

12.5.5.2.2 Other Repairs. Within 30 days following the date of repair to tanks or piping components, a tightness test of the UST system must be conducted. This test is not required when:

12.5.5.2.2.1 The repaired tank is internally inspected in accordance with industry standards and practices; or

12.5.5.2.2.2 The repaired portion of the UST system is monitored monthly for releases.

12.5.5.3 Documentation of Repairs. Records of each repair and testing will be maintained until the UST system is permanently closed.

12.5.6 Inventory. Installations must maintain an updated UST system inventory for the entire installation that includes the following items for each UST:

12.5.6.1 Location.

12.5.6.2 Installation date.

12.5.6.3 Capacity.

12.5.6.4 Tank and piping attributes, such as material, protection, secondary containment.

12.5.6.5 Piping delivery type (safe suction, pressurized).

12.5.6.6 Spill and overfill protection equipment details.

12.5.6.7 Under-dispenser containment.

12.5.6.8 Substance stored and confirmation of compatibility.

12.5.6.9 Release detection details for tanks and pipes.

12.5.6.10 Removal details.

12.5.6.11 Replacement details.

12.5.6.12 Closure details, including closure date, location, and related information for all historic UST systems on the UST inventory.

## 12.6 OPERATOR TRAINING

Installations must ensure that the requirements for operator designation, training, and recordkeeping are met for all UST systems. These requirements apply to all UST systems, including specialty UST systems.

12.6.1 Designation of Class A, B, and C Operators. Owners and operators must designate:

12.6.1.1 At least one Class A and one Class B operator for each UST system or group of UST systems at a facility; and

12.6.1.2 Each individual who meets the definition of Class C operator at the UST facility as a Class C operator.

12.6.2 Operator Training Content. Owners and operators must ensure all operators receive the required training, by operator class, as specified in Table 12.1.

12.6.3 Timing of UST System Operator Training

12.6.3.1 New Class A and B operators must meet requirements within 30 days of assuming duties.

12.6.3.2 New Class C operators must be trained before assuming duties of a Class C operator.

12.6.4 Retraining of UST System Operators

12.6.4.1 Class A and B operators must take annual refresher training that covers all the required content in Table 12.1.

12.6.4.2 No later than 30 days after a non-compliance issue is identified, Class A and B operators must be retrained. At a minimum, the training must cover the specific area(s) determined to be out of compliance. Annual refresher training can be used to fulfill this requirement if it includes the non-compliance topics.

12.6.5 Documentation. For as long as operators are designated, UST system owners and operators must maintain records regarding designation and training.

## 12.7 SPECIALTY UST SYSTEMS

12.7.1 Specialty UST System Requirements. Specialty UST systems (i.e., airport hydrant fuel distribution systems and UST systems with field-constructed tanks (FCT)) must meet the standards in this chapter. Owners and operators must use industry standards and practices for design, installation, O&M, and closure of specialty UST systems. Except for the specific exceptions and alternatives described in this paragraph, specialty UST systems are subject to the same requirements as other UST systems, as described in Paragraphs 12.4, 12.5, 12.6, 12.8, 12.9, and 12.10.

12.7.2 Exceptions and Alternatives for Specialty UST Systems

12.7.2.1 Pressurized Piping Exceptions

12.7.2.1.1 Pressurized piping associated with FCTs greater than 189,271 liters [50,000 gallons] and piping associated with airport hydrant systems may use single-walled piping when installing or replacing piping.

12.7.2.1.2 Pressurized piping associated with UST systems with FCTs less than or equal to 189,271 liters [50,000 gallons] and not part of an airport hydrant system must meet the secondary containment requirements for UST systems in Paragraph 12.4.2.1 when installed or replaced.

12.7.2.1.3 Existing piping must comply upon replacement.

12.7.2.2 Additional Corrosion Protection Standards for Specialty UST Systems. In addition to complying with UST system corrosion protection standards in Paragraphs 12.4.1.2 and 12.4.2.2, owners and operators of specialty UST systems must meet these additional requirements:

12.7.2.2.1 Specialty UST systems must be equipped with cathodic protection as a means of corrosion protection.

12.7.2.2.2 Before adding cathodic protection to specialty UST systems, owners and operators must assess tanks greater than 10 years old to ensure the tank is structurally sound and free of corrosion holes. The assessment must be made by an internal inspection or another industry standard or practice that adequately assesses the tank’s structural integrity for soundness and corrosion holes.

12.7.2.3 Additional O&M Requirements for Specialty UST Systems. Owners and operators of specialty UST systems must meet the UST system O&M requirements in Paragraph 12.5, including walkthrough inspections, reporting, recordkeeping, guidance on repairs, and other standards in Paragraph 12.5. In addition, owners and operators of specialty UST systems must also inspect hydrant pits and vaults at least every 30 days. If confined space entry is required, inspections may be performed no less frequently than annually. The additional inspections must include:

12.7.2.3.1 Hydrant Pits. Visually check for damage, remove liquid or debris, and check for leaks.

12.7.2.3.2 Hydrant Piping Vaults. Check for hydrant piping leaks.

12.7.2.4 Release Detection Requirements for FCTs

12.7.2.4.1 Owners and operators of FCTs with a capacity less than or equal to 189,271 liters [50,000 gallons] must meet the release detection requirements for UST systems in Paragraph 12.4.1.4.

12.7.2.4.2 Owners and operators of new and existing FCTs with a capacity greater than 189,271 liters [50,000 gallons] and airport hydrant systems must provide release detection through one of the following options:

12.7.2.4.2.1 Meet the release detection requirements for new UST systems in Paragraph 12.4.1.5.

12.7.2.4.2.2 Meet the release detection requirements for existing UST systems in Paragraph 12.4.1.4 with two exceptions. Use of vapor monitoring and groundwater monitoring must be combined with an inventory control method conducted at least every 30 days and capable of detecting a release of less than 0.5 percent of flow-through; or

12.7.2.4.2.3 Monitor for releases using one or a combination of the following:

12.7.2.4.2.3.1 Conduct an annual tank tightness test that can detect a 1.9 liter [0.5 gallon] per hour leak rate;

12.7.2.4.2.3.2 Use automatic tank gauging at least every 30 days that can detect a leak rate less than or equal to 3.8 liters [1.0 gallon] per hour. This method must be combined with a tank tightness test that can detect a 0.76 liter [0.2 gallon] per hour leak rate, performed at least every three years;

12.7.2.4.2.3.3 Use automatic tank gauging at least every 30 days that can detect a leak rate less than or equal to 7.6 liters [2.0 gallons] per hour. This method must be combined with a tank tightness test that can detect a 0.76 liter [0.2 gallon] per hour leak rate, performed at least every two years;

12.7.2.4.2.3.4 Perform vapor monitoring capable of detecting a 0.38 liter [0.1 gallon] per hour leak rate at least every two years; or

12.7.2.4.2.3.5 Perform inventory control at least every 30 days that can detect a leak equal to or less than 0.5 percent of flow-through. Using this method also requires a tank tightness test (1.89 liter [0.5 gallon] per hour leak rate minimum) every two years or vapor monitoring or groundwater monitoring at least every 30 days.

12.7.2.5 Release Detection Requirements for Piping

12.7.2.5.1 Owners and operators of pressurized piping for new and existing FCTs with a capacity less than or equal to 189,271 liters [50,000 gallons] must meet the UST system release detection requirements in Paragraph 12.4.2.4.

12.7.2.5.2 Owners and operators of underground pressurized piping associated with airport hydrant systems and FCTs greater than 189,271 liters [50,000 gallons] must follow either the requirements in Paragraph 12.4.2.4 (except vapor monitoring and groundwater monitoring, which must be combined with inventory control) or use at least one of the following alternative methods of release detection:

12.7.2.5.2.1 Perform a semiannual or annual line tightness test at or above the piping operating pressure in accordance with Table 12.2. Piping segment volumes greater than or equal to 378,541 liters [100,000 gallons] not capable of meeting the maximum 11.4 liters [3.0 gallons] per hour leak rate for the semiannual test may be tested at a leak rate up to 22.7 liters [6.0 gallons] per hour according to the schedule in Table 12.3.

12.7.2.5.2.2 Perform vapor monitoring capable of detecting a 0.38 liter [0.1 gallon] per hour leak rate at least every two years.

12.7.2.5.2.3 Perform inventory control at least every 30 days that can detect a leak equal to or less than 0.5 percent of flow-through and perform either a line tightness test at least every two years or perform vapor monitoring or groundwater monitoring at least every 30 days.

## 12.8 RELEASE RESPONSE

12.8.1 Installations must ensure proper response to suspected and confirmed releases from UST systems.

12.8.2 Owners and operators must:

12.8.2.1 Investigate suspected leaks, including conducting confirmation sampling, as appropriate.

12.8.2.2 Notify appropriate authorities of verified leaks.

12.8.2.3 Ensure that any verified leaking tanks or piping are immediately removed from service.

12.8.2.4 Repair or replace UST systems that are still required.

12.8.2.5 In accordance with Paragraph 12.9, properly close and remove from the ground UST systems that are no longer required. When a leaking UST system is removed, exposed free product and obviously contaminated soil in the immediate vicinity of the tank must be appropriately removed and managed in accordance with the spill response requirements in JEGS Chapter 13.

12.8.3 Installations must maintain records of releases and response actions until the installation is permanently closed.

## 12.9 OUT-OF-SERVICE SYSTEMS AND CLOSURE

Installations must properly close UST systems using the following standards.

12.9.1 Temporary Closure. When an UST system is temporarily closed, corrosion protection and release detection systems (if the UST system is not empty) must be operated and maintained. If an UST system is temporarily closed for three months or greater, the following requirements must be met:

12.9.1.1 Vent lines must be left open and functioning.

12.9.1.2 All other lines, pumps, manways, and ancillary equipment must be secured and capped.

12.9.2 Change in Service. When the product stored in an UST system is changed to a product that is neither a hazardous substance nor a POL, the UST system must be emptied and cleaned by removing all liquid and accumulated sludge.

12.9.3 Permanent Closure. When an UST system has not been used or has been temporarily closed for 1 year, or is determined to no longer be required, all of the product and sludge must be emptied and the UST system removed from the ground. All components must be drained, cleaned, and monitored, as applicable, during the closure process. Under extenuating circumstances, such as large FCTs and where the UST system is located under a building, the UST system can be cleaned and filled with an inert material and closed in place. Examples of acceptable inert material include sand, soil, foam, concrete, and grout. If there is a confirmed or suspected release, installations must undertake the release response activities in Paragraph 12.8.

12.9.4 Disposal of UST System Waste. Liquids, sludges, and other waste generated from change of service or closure of UST systems must be characterized in accordance with JEGS Paragraph 16.3 to determine if they are hazardous. If a waste exhibits a characteristic of hazardous waste as defined in JEGS Appendix 16A, it must be handled and disposed of in accordance with the requirements of JEGS Chapter 16. If testing confirms that a waste does not exhibit a characteristic and is not hazardous, it must be managed and disposed of in accordance with the solid waste requirements of JEGS Chapter 15 or the wastewater requirements of JEGS Chapter 9, as appropriate.

12.9.5 Closure Records. After permanent UST system closure or change-in-service, the installation must ensure records on the previous tank system, including previous location and closure reports, are maintained for the duration of the installation operations.

## 12.10 RECORDKEEPING

Owners and operators must maintain records of UST system design, construction, and installation; O&M; release response; and closure. They must make UST system records available upon request during inspections. Table 12.4 identifies specific UST system recordkeeping requirements.

**Table 12.1: UST System Operator Training Requirements**

| OPERATOR CLASS | MINIMUM TRAINING REQUIREMENTS |
|---|---|
| Class A | Training must include the purpose, method, and function of:<br>• Spill and overfill prevention<br>• Release detection<br>• Corrosion protection<br>• Emergency response<br>• Product and equipment compatibility and demonstration<br>• Temporary and permanent closure<br>• Related reporting, recordkeeping, testing, and inspections<br>• Environmental and regulatory consequences of releases<br>• Training requirements for Class B and C operators<br>The training program must evaluate Class A operators to determine if these individuals have the knowledge and skills to make informed decisions regarding compliance. The program also will evaluate whether appropriate individuals are fulfilling the operation, maintenance, and recordkeeping requirements for UST systems. |
| Class B | Training must include the purpose, method, and function of:<br>• O&M<br>• Spill and overfill prevention<br>• Release detection and related reporting<br>• Corrosion protection<br>• Emergency response<br>• Product and equipment compatibility and demonstration<br>• Reporting, recordkeeping, testing, and inspections<br>• Environmental and regulatory consequences of releases<br>• Training requirements for Class C operators<br>The training program must evaluate Class B operators to determine if these individuals have the knowledge and skills to implement applicable UST system regulatory requirements. These requirements apply in the field on the components of typical UST systems or, as applicable, site-specific equipment used at an UST facility. |
| Class C | Training must include appropriate emergency response actions, including notification procedures, in response to emergencies or alarms caused by spills or releases resulting from UST system operations.<br>The training program must evaluate Class C operators to determine if these individuals have the knowledge and skills to take appropriate action (including notifying appropriate authorities) in response to emergencies or alarms caused by spills or releases from an UST system. |

### Table 12.2: Specialty UST System Maximum Release Detection Rate per Test Section Volume

| PIPING TEST SECTION VOLUME | SEMIANNUAL TEST – LEAK DETECTION RATE NOT TO EXCEED | ANNUAL TEST – LEAK DETECTION RATE NOT TO EXCEED |
|---|---|---|
| Liters [gallons] | Liters [gallons] per hour | |
| Less than 189,271 [50,000] | 3.8 [1.0] | 1.9 [0.5] |
| Greater than or equal to 189,271 [50,000] and less than 283,906 [75,000] | 5.7 [1.5] | 2.8 [0.75] |
| Greater than or equal to 283,906 [75,000] and less than 378,541 [100,000] | 7.6 [2.0] | 3.8 [1.0] |
| Greater than or equal to 378,541 [100,000] | 11.36 [3.0] | 5.7 [1.5] |

### Table 12.3: Specialty UST System Phase-in for Piping Segments Greater Than or Equal to 378,541 Liters [100,000 Gallons] in Volume

| TEST | FREQUENCY | LEAK RATE |
|---|---|---|
| First Test | As soon as possible but no later than 24 months after publication of this manual | May use up to 22.7 liters [6.0 gallons] per hour leak rate |
| Second Test | Within 36 months after first test | May use up to 22.7 liters [6.0 gallons] per hour leak rate |
| Third Test | Within 12 months after second test | Must use up to 11.36 liters [3.0 gallons] per hour leak rate |
| Subsequent Tests | Semiannual or annual testing (based on the date of the third test) according to maximum leak detection rate per test section volume as specified in Table 12.2 | |

**Table 12.4: UST System Recordkeeping Requirements**

| TYPES OF RECORDS | | RETENTION PERIOD |
|---|---|---|
| UST System Inventory | UST system inventory for the entire installation that includes the items listed in Paragraph 12.5.6 | Life of installation |
| Spill and Overfill Prevention | Testing and inspection records for spill and overfill prevention equipment and containment sumps used for interstitial monitoring of piping | 3 years |
| | Documentation showing spill prevention equipment and containment sumps used for interstitial monitoring of piping is double-walled and the integrity of both walls is periodically monitored | For as long as periodic monitoring is conducted |
| Corrosion Protection | Records of 60-day inspections for impressed current corrosion protection system | Three most recent inspections |
| | Records of cathodic protection tests for corrosion protection system | Two most recent tests |
| Release Detection | 30-day monitoring results | 1 year |
| | Tightness test results | Until the next test |
| | Records for annual release detection equipment operability tests | 3 years |
| | Copies of performance claims provided by release detection equipment manufacturers or equipment installers | Life of system |
| | Schedules of required calibration and maintenance provided by release detection equipment manufacturers | 5 years after installation |
| | Records of maintenance, repair, and calibration of on-site release detection equipment | 1 year after servicing is completed |
| | Records of releases and response actions | Life of installation |
| | If using vapor monitoring or groundwater monitoring, records of a site assessment showing that the monitoring system is set up properly | As long as vapor monitoring or groundwater monitoring is used |

### Table 12.4: UST System Recordkeeping Requirements, Continued

| TYPES OF RECORDS | | RETENTION PERIOD |
|---|---|---|
| Walkthrough Inspections | Records showing performance of periodic walkthrough inspections. Records must include:<br>• A list of the areas checked<br>• Whether each area was acceptable or needed action<br>• A description of actions taken to correct an issue<br>Delivery records if spill prevention equipment is checked less frequently than every 30 days due to infrequent deliveries | 1 year |
| Operator Training | Records for each designated Class A, B, and C operator showing they have been trained | As long as the operator is designated at the facility |
| Repairs | Records showing that a repaired UST system was properly repaired | Until the UST system is permanently closed |
| Closure | Records for permanent closure, including:<br>• Closure reports<br>• Decommissioning reports<br>Sampling records (when applicable) | Life of the installation |

# CHAPTER 13: SPILL PREVENTION AND RESPONSE

## 13.1 INTRODUCTION

This chapter contains standards for planning, prevention, control, and reporting of spills of POL and hazardous substances. JEGS Chapters 10, 11, and 12 provide related standards for hazardous materials, POL, and USTs, respectively. Remediation beyond that required for the initial response is conducted in accordance with DoDI 4715.08, Remediation of Environmental Contamination Outside the United States.

## 13.2 SPILL PREVENTION AND RESPONSE PLAN

All DoD installations must prepare, maintain, and implement a Spill Prevention and Response Plan (SPRP) that provides for the prevention and control of all POL and hazardous substance spills, and for the reporting of all significant spills. The Spill Prevention and Response Plan is referred to as "the plan" in this chapter. The plan must provide measures to prevent and, to the maximum extent practicable, mitigate a worst-case discharge (WCD) from the facility. Appendix 13A provides guidance for determining the WCD planning volume. The plan should be kept in a location easily accessible to the facility incident commander (FIC) and facility response team (FRT).

13.2.1 Plan Updates. The plan must be updated at least every five years or:

13.2.1.1 Within six months of any significant changes to operations.

13.2.1.2 When there have been two significant spills to the Waters of Japan in any 12-month period.

13.2.1.3 When there has been a spill of 3,785 liters [1,000 gallons] or greater.

13.2.2 Plan Certification. The plan must be certified by a U.S. licensed professional engineer who is familiar with spill prevention and response requirements. The plan must consider industry standards and practices for spill prevention and environmental protection, be prepared in accordance with good engineering practice, and be adequate for the facility. Technical changes (i.e., non-administrative changes) to the plan require recertification.

13.2.3 Prevention Section. At a minimum, the prevention section of the plan must include:

13.2.3.1 Name, title, responsibilities, duties, and telephone number of the designated FIC and an alternate.

13.2.3.2 General information on the installation including name, type or function, location and address, charts of drainage patterns, designated water protection areas, maps showing locations of facilities described in Paragraph 13.2.3.3, critical water resources, land uses, and possible migration pathways.

13.2.3.3 An inventory that identifies:

13.2.3.3.1 Storage, handling, transfer areas, loading and unloading racks, and areas that have one or more POL storage containers.

13.2.3.3.2 Storage, handling, or transfer areas where POL and hazardous waste or hazardous substances could possibly produce a significant spill. For each listing, using maps as appropriate, a prediction of the direction and rate of flow should be included, as well as the total quantity of POL or hazardous substances that might be spilled as a result of a major failure.

13.2.3.3.3 POL and hazardous substance containers with capacities of 208 liters [55 gallons] or more at the locations described in Paragraphs 13.2.3.3.1 and 13.2.3.3.2, including the total capacity of each container and the substance stored.

13.2.3.4 Procedures for the periodic integrity testing of storage containers in accordance with JEGS Paragraph 11.4.2.1.

13.2.3.5 Procedures for the periodic integrity testing of aboveground valves in accordance with JEGS Paragraph 11.4.2.1.2.

13.2.3.6 Procedures for testing buried piping associated with POL storage containers for integrity and leaks in accordance with JEGS Paragraph 11.4.2.2.

13.2.3.7 Procedures for performing leak tests for below ground storage containers in accordance with JEGS Paragraph 11.4.2.3.

13.2.3.8 A detailed description of the facility’s prevention, control, and countermeasures, including sized secondary containment and general secondary containment as required by JEGS Paragraph 11.4.3 for diversion and containment of spills, for each site listed in the inventory. Measures should permit, as far as practical, reclamation of spilled substances. Chapters governing hazardous waste (JEGS Chapter 16), POL (JEGS Chapter 11), USTs (JEGS Chapter 12), and polychlorinated biphenyls (PCBs, JEGS Chapter 7) provide specific standards for containment structure requirements.

13.2.3.9 When secondary containment is not feasible for any container listed in the inventory, the plan must include a detailed explanation of measures that will be taken to prevent spills (e.g., pre-booming, integrity testing, frequent inspection) as determined by the licensed or certified technical authority.

13.2.3.10 A description of deficiencies in spill prevention and control measures at each site listed in the inventory, including required corrective measures, procedures to be followed to correct listed deficiencies, and any interim control measures in place. Corrective actions must be implemented within 24 months of the date of the plan preparation or revision.

13.2.3.11 Written procedures for:

13.2.3.11.1 Operations to preclude spills of POL and hazardous substances.

13.2.3.11.2 Inspections.

13.2.3.11.3 Testing for integrity and leaks.

13.2.3.11.4 Recordkeeping requirements.

13.2.3.12 Site-specific procedures should be maintained at each site on the facility where significant spills could occur.

13.2.3.13 Installations with hazardous waste storage areas or hazardous material storage areas capable of producing a significant spill, or aboveground storage containers with a combined capacity of greater than or equal to 4,997 liters [1,320 gallons], must have a plan that contains:

13.2.3.13.1 A list of all emergency equipment at the facility such as fire extinguishing systems, spill control equipment, communications and alarm systems (internal and external), decontamination equipment, and medical first-aid kit, where this equipment is required. This list must be kept up-to-date. In addition, the plan must include the location and a physical description of each item on the list and a brief outline of its capabilities.

13.2.3.13.2 An evacuation plan for facility personnel where there is a possibility that evacuation would be necessary. This plan must describe signals used to begin evacuation, evacuation routes, and alternate evacuation routes (in cases where the primary routes could be blocked by releases of hazardous waste or fires).

13.2.4 Spill Control Section. The control section of the plan (which may be considered a contingency plan) must identify resources for cleaning up spills at installations and activities, and provide assistance to other agencies when requested. At a minimum, this section of the plan must contain:

13.2.4.1 Provisions specifying the responsibilities, duties, procedures, and resources to be used to contain and clean up spills.

13.2.4.2 A description of immediate response actions that should be taken when a spill is first discovered.

13.2.4.3 The responsibilities, composition, and training requirements of the FRT.

13.2.4.4 The command structure that will be established to manage a WCD including an organization chart and the responsibilities and composition of the organization.

13.2.4.5 Procedures for FRT alert and response to include provisions for:

13.2.4.5.1 Access to a reliable communications system for timely notification of a POL spill or hazardous substance spill.

13.2.4.5.2 Public affairs involvement.

13.2.4.5.3 A current roster of the persons and alternates who must receive notice of a POL or hazardous substance spill, including a Defense Energy Support Center (DESC) representative, if applicable. The roster must include name, organization mailing address, and current telephone numbers (work, home, mobile). Without compromising security, the plan must include provisions for the notification of the emergency coordinator after normal working hours.

13.2.4.6 A description of arrangements with installation and local police departments, fire departments, hospitals, contractors, and emergency response teams to coordinate emergency services.

13.2.4.7 A telephone number or other means to contact the appropriate emergency service provider (e.g., installation fire department) on a 24-hour basis.

13.2.4.8 A requirement to notify the FIC, installation commander, and local authorities in the event of hazard to human health or environment.

13.2.4.9 Assignment of responsibilities for making the necessary notifications, including notification to the emergency services providers.

13.2.4.10 Surveillance procedures for early detection of POL and hazardous substance spills.

13.2.4.11 A prioritized list of various critical water and natural resources that will be protected in the event of a spill.

13.2.4.12 Other resources addressed in pre-arranged agreements that are available to the installation to respond to a large spill due to DoD activities, if the spill exceeds the response capability of the installation.

13.2.4.13 Spill response methods, including procedures and techniques used to identify, contain, disperse, reclaim, and remove POL and hazardous substances used in bulk quantity on the installation.

13.2.4.14 Procedures for the proper reuse and disposal of recovered substances, decontamination waste, contaminated POL and absorbent materials, and procedures to be accomplished before resumption of operations.

13.2.4.15 A description of general health, safety, and fire prevention precautions for spill response actions.

13.2.4.16 A public affairs section that describes the procedures, responsibilities, and methods for releasing information in the event of a spill.

13.2.5 Reporting Section. The reporting section of the plan must address how the required reporting contained in Paragraph 13.4 will be accomplished, including recordkeeping when emergency procedures are invoked.

13.2.6 Training Section. The training section of the plan must identify and describe how the required training and response drills required in Paragraph 13.5 will be accomplished.

## 13.3 SPILL RESPONSE

13.3.1 In the event of a spill, installations must respond immediately to control the source, contain any free product (for spills to water, “free product” means floating POL or other contaminants), and remove and manage the spill. Installations must perform sampling during spill response when and as directed by the USFJ Command Engineer. Prompt response should reduce and mitigate substantial threat to human and environmental health and welfare of Japan from the discharge. Potential casualties include, but are not limited to, fish, shellfish, wildlife, other natural resources, public and private beaches, shorelines, and cultural or historic properties of Japan.

13.3.2 Any byproducts of the initial spill response that are being disposed of must be characterized in accordance with JEGS Paragraph 16.3 to determine if they are hazardous. If the byproducts are a hazardous waste, the waste must be handled and disposed of in accordance with the requirements of JEGS Chapter 16. If testing confirms that the byproducts do not exhibit a characteristic of a hazardous waste, the byproducts must be managed and disposed of in accordance with the solid waste requirements of JEGS Chapter 15 or the wastewater requirements of JEGS Chapter 9, as appropriate.

13.3.3 After the spill has been contained and is under control, any remaining free product and contaminated soil resulting from the spill must be appropriately removed and managed. Installations should perform sampling, if necessary, to confirm contaminated soil has been properly removed, using the contaminated soil disposal criteria in JEGS Table 15.6. Installations must also perform sampling of contaminated soil and/or remove the contaminated soil when directed by the USFJ Command Engineer. Installations will recover soil that exceeds any contaminant standard in JEGS Table 15.6 that is in excess of naturally occurring levels, and dispose of it in accordance with JEGS Paragraph 15.11.[96]

13.3.4 Any off-installation spill response must be coordinated with appropriate local governmental authorities before taking action outside a U.S. exclusive use facility or area.

13.3.5 Remediation of environmental contamination that remains after completion of initial spill response actions must be performed in accordance with applicable international agreements and DoDI 4715.08, Remediation of Environmental Contamination Outside the United States. Notwithstanding this provision, the JEGS do not create any new responsibilities or requirements for remediation. Applicable international agreements, DoDI 4715.08, and specific OSD/DoD Service Component direction define the responsibilities, if any, for remediation. The installation must remove all free product and contaminated soil from a contemporaneous spill in accordance with Paragraphs 13.3.1 through 13.3.3, even in the event the installation determines a contemporaneous spill may have mixed with previously existing contamination. Recovery of this previously existing contamination as part of the spill response process is not remediation. In the event the installation cannot determine the boundaries of the spill, the installation must consult with the USFJ Command Engineer for advice on how to proceed.

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[96] The contaminated soil disposal criteria in JEGS Table 15.6 are not remediation standards.

13.3.6 Response to Spills of Firefighting Foam. In the event of a leak or spill of firefighting foam, installation response must include the following actions: [97]

13.3.6.1 Promptly take necessary measures to prevent the spread of leakage.

13.3.6.2 Endeavor to the maximum extent possible to recover the leaked firefighting foam.

13.3.6.3 Store any recovered firefighting foam, spill-impacted soil, and materials used in the recovery operations that may have become contaminated with firefighting foam, in sealable containers.

13.3.6.4 Dispose of the recovered foam, spill-impacted soil, and other contaminated materials using high-temperature incineration that meets the destruction and removal efficiency of hazardous waste incinerators as outlined in JEGS Paragraph 16.9.4.2.1. Disposal of the spill material in this manner does not change the characterization of the material, i.e., if the spill material does not exhibit a characteristic of a hazardous waste, then disposal of the material per JEGS Paragraph 16.9.4.2.1 does not change its characterization to a hazardous waste. However, if the spill material does exhibit a characteristic of a hazardous waste, then it must be disposed of in accordance with the hazardous waste disposal requirements of JEGS Chapter 16.

## 13.4 REPORTING

13.4.1 Concurrent with undertaking a spill response, any significant spill must be reported to the FIC immediately.

13.4.2 The FIC must immediately notify the installation commander who will report to the LEC and Service Component Commander and submit a follow-up written report when any one of the following situations occur:[98]

13.4.2.1 The spill is significant as defined in JEGS Volume IV.A;

13.4.2.2 The spill has polluted or threatens to pollute a water resource;

13.4.2.3 The spill is uncontained and involves any quantity of a Class I Specified Chemical Substance listed in Table 16.6.[99]

13.4.3 When a significant spill occurs inside a U.S. exclusive use facility and area and cannot be contained within the facility and area, or threatens a local Japanese water resource, the installation commander must immediately notify the appropriate Service Component Commander, LEC, and appropriate local governmental authorities.

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[97] GOJ Order for Enforcement of the Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. (Supplementary Provision, 21 September 2021), Article 6.

[98] USFJ Form 50, Spill Report meets this reporting requirement.

[99] GOJ Water Pollution Prevention Act, Article 14-2.

13.4.4 If a significant spill is caused by DoD installation personnel or activities outside of a U.S. exclusive use facility and area, the person in charge at the scene must immediately notify the authorities listed in Paragraph 13.2.4.5.3. The FIC will perform further notifications of local emergency personnel, as appropriate, and immediately notify the appropriate Service Component Commander, LEC, and appropriate local governmental authorities.

13.4.5 Spill reporting is an installation commander responsibility. Installation commanders will not delegate spill reporting authority to an organization outside of their direct command, such as a tenant unit hosted on the installation. Tenant units will not assume responsibility from the host installation commander for spill reporting to the LEC and local governmental authorities without the approval of the LEC.

## 13.5 PERSONNEL TRAINING

Installations must provide necessary training and accidental release response drills, in accordance with the plan, to ensure the effectiveness of personnel, equipment, and protective measures. Oil-handling personnel must be identified by job title, responsibilities, or job duties, and trained annually as required by JEGS Paragraph 11.3.

## 13.6 RECORDKEEPING

Installations must maintain records associated with spill prevention and response. Appropriate records include plans, procedures, inspection results, records of spills and response activation, and reports. Recordkeeping must be consistent with the procedures established by the plan (refer to Paragraph 13.2.3.11).

# APPENDIX 13A: DETERMINATION OF WCD PLANNING VOLUME

## 13A.1 PURPOSE

This appendix provides standards to determine:

13A.1.1 On an installation-specific basis, the extent of a WCD.

13A.1.2 The volume of POL or hazardous substance to be used in planning for a WCD. Installations should calculate the WCD volume that applies to the installation's design and the WCD volume that applies to operation, and use the larger of the two as the WCD planning volume.

## 13A.2 TRANSFER OF POL TO AND FROM VESSELS

For installations transferring POL to and from vessels with tank capacities of 39,747 liters [10,500 gallons] or more, the WCD planning volume is calculated as follows:

13A.2.1 Where applicable, the loss of the entire capacity of all in-line and break-out tank(s) needed for the continuous operation of the pipelines used for the purposes of handling or transporting POL, in bulk, to or from a vessel regardless of the presence of secondary containment; plus

13A.2.2 The discharge from all piping carrying POL between the marine transfer manifold and the valve or manifold adjacent to the POL storage container. The discharge from each pipe is calculated as shown in Figure 13A.1.

**Figure 13A.1: Pipe Discharge Calculation**

| CALCULATION |
|---|
| Discharge =<br>[the maximum time to discover the release from the pipe in hours + the maximum time to shut down flow from the pipe in hours(1)] x<br>[the maximum flow rate expressed in gallons per hour(2)] +<br>[the total line drainage volume expressed in gallons for the pipe between the marine transfer manifold and the valve or manifold adjacent to the POL storage container] |
| Notes:<br>1. Based on historic discharge data or the best estimate in the absence of historic discharge data for the installation.<br>2. Based on the maximum relief valve setting or maximum system pressure when relief valves are not provided. |

## 13A.3 POL OR HAZARDOUS SUBSTANCE STORAGE CONTAINERS

For installations with POL or hazardous substance storage containers:

13A.3.1 <u>Facilities with a Single Storage Container</u>. For facilities containing only one aboveground POL or hazardous substance storage container, the WCD planning volume equals the capacity of the POL or hazardous substance storage container. If adequate secondary containment exists for the POL storage container, multiply the capacity of the container by 0.8. Adequate secondary containment is that which is sufficiently large to contain the capacity of the aboveground POL or hazardous substance storage container, plus sufficient freeboard to allow for precipitation.

13A.3.2 <u>Facilities with Multiple Storage Containers</u>

13A.3.2.1 <u>Facilities Having No Secondary Containment</u>. If none of the aboveground storage containers at the facility have adequate secondary containment, the WCD planning volume equals the total aboveground POL and hazardous substance storage capacity at the facility.

13A.3.2.2 <u>Facilities Having Complete Secondary Containment</u>. If every aboveground storage container at the facility has adequate secondary containment, the WCD planning volume equals the capacity of the largest single aboveground POL or hazardous substance storage container.

13A.3.2.3 <u>Facilities Having Partial Secondary Containment</u>. If some, but not all aboveground storage containers at the facility have adequate secondary containment, the WCD planning volume equals the sum of:

13A.3.2.3.1 The total capacity of the aboveground POL and hazardous substance storage container that lacks adequate secondary containment; plus

13A.3.2.3.2 The capacity of the largest single aboveground POL or hazardous substance storage container that has adequate secondary containment. Secondary containment is considered adequate when it includes an impervious containment system such as a dike, berm, containment curb, drainage system, or other device that prevents the escape of spilled material into the surrounding soil.

# CHAPTER 14: PESTICIDES

## 14.1 INTRODUCTION

This chapter contains standards on the prevention of threats to human health and the environment from the storage and use of pesticides. This chapter does not address:

14.4.1 The personal use of pesticides by individuals in residences or gardens.

14.1.2 The storage of pesticides as hazardous materials, which is addressed in JEGS Chapter 10, and requirements for spill prevention and response, which are addressed in JEGS Chapter 13.

14.1.3 The details of DoD policy implementation, assigned responsibilities, and prescribed standards and procedures that apply outside the United States as part of the DoD Integrated Pest Management (IPM) Program covered in DoDM 4150.07, DoD Pest Management Program Elements and Implementation.

## 14.2 INTEGRATED PEST MANAGEMENT (IPM) PLANS

Installations must prepare, implement, and maintain an IPM plan that includes measures for all installation activities that perform pest control, consistent with the program elements in DoDM 4150.07.[100] This written plan must:

14.2.1 Include IPM procedures to control pests and minimize the use of pesticides.

14.2.2 Include appropriate security procedures to prevent unauthorized access to, or use of, pesticides.

14.2.3 Identify the designated coordinator to oversee all aspects of implementation.

14.2.4 Be implemented using trained personnel and certified pesticide applicators.

14.2.5 Be reviewed, updated, and approved annually by a designated pest management consultant and reviewed, revised as necessary, and approved by the installation commander every five years.

## 14.3 INTEGRATED PEST MANAGEMENT (IPM) COORDINATOR

Each installation must have a designated IPM coordinator to oversee the installation's pest management program including development, implementation, maintenance, and annual update of the IPM plan. The IPM coordinator must have the educational background, training, technical knowledge, and management skills to implement and oversee the installation pest management program.

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[100] DoDM 4150.07 (Volume 1), DoD Pest Management Program Elements and Implementation: Structure and Operation, Section 3.

## 14.4 PEST MANAGEMENT CONTRACTORS

All pest management contractors must use the installation's IPM plan and comply with certification, licensing, registration, and other requirements of DoDM 4150.07.[101]

## 14.5 REQUIREMENTS FOR PESTICIDE APPLICATORS

Installations must ensure:

14.5.1 All pesticides are applied by pesticide applicators certified for the specific application category in accordance with DoDM 4150.07,[101] with the following exceptions:

14.5.1.1 New DoD employees who are not certified may apply pesticides during an apprenticeship period not to exceed two years and only under the supervision of a certified pesticide applicator.

14.5.1.2 Arthropod repellents applied to skin and clothing.

14.5.1.3 Pesticides applied as part of an installation's self-help program.

14.5.2 All pesticide applicators are included in a medical surveillance program to monitor the health and safety of persons occupationally exposed to pesticides in accordance with DoDI 6055.05, Occupational and Environmental Health (OEH) and DoDM 6055.05, Medical Surveillance and Medical Qualifications.

14.5.3 All pesticide applicators are provided with personal protective equipment appropriate for the work they perform and the types of pesticides to which they may be exposed.

## 14.6 STORAGE, USE, AND DISPOSAL OF PESTICIDES

Installations must ensure:

14.6.1 Pesticides are included in the installation Spill Prevention and Response Plan (SPRP). Refer to JEGS Chapter 13 for Spill Prevention and Response Plan requirements.

14.6.2 Pest management facilities, including mixing and storage areas, comply with design requirements of Armed Forces Pest Management Board (AFPMB) Technical Guide 17, Military Handbook Design of Pest Management Facilities.

14.6.3 SDSs and labels for all pesticides are available at the storage facility. Labels must comply with the guidelines in JEGS Paragraph 10.3.4. Labels must bear the appropriate use instructions and precautionary messages based on the toxicity category of the pesticide. If foreign nationals will be using the pesticides, the use instructions and precautionary messages must be in English and Japanese.

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[101] DoDM 4150.07 (Volume 1), DoD Pest Management Program Elements and Implementation: Structure and Operation, Section 4.2.

14.6.4 Pesticide storage areas contain a readily accessible current inventory of all items in storage, including items awaiting disposal, and are regularly inspected and secured to prevent unauthorized access.

14.6.5 Only registered pesticides approved in writing by the appropriate pest management consultant and procured from the Federal Supply System or other approved commercial sources are used. This may be documented as part of the approval of the IPM plan.

14.6.6 All pesticides are applied in accordance with the procedures established in DoDM 4150.07 for specific pest management operations and consistent with the label.[102]

14.6.7 The unintended discharge of pesticides to the Waters of Japan is minimized by implementing the following measures:

14.6.7.1 Use only the amount of pesticide and frequency of pesticide application necessary to control the target pest, using equipment and application procedures appropriate for this task.

14.6.7.2 Maintain pesticide application equipment in proper operating condition by calibrating, cleaning, and repairing such equipment to prevent leaks, spills, or other unintended discharges.

14.6.7.3 Assess weather conditions (e.g., temperature, precipitation, wind speed) in the treatment area to ensure pesticide application is consistent with industry standards and practices, and other prudent provisions to reduce or eliminate pesticide discharges to the Waters of Japan.

14.6.8 Unless otherwise restricted or canceled, pesticides in excess of installation needs are redistributed within the supply system or disposed of in accordance with procedures outlined below:

14.6.8.1 The generator of pesticide waste must determine whether or not the waste is hazardous in accordance with JEGS Chapter 16.

14.6.8.2 Pesticide waste determined to be hazardous waste must be disposed of in accordance with the standards for hazardous waste disposal in JEGS Chapter 16.

14.6.8.3 Pesticide waste determined not to be a hazardous waste must be disposed of in accordance with the label instructions as a solid waste. Empty pesticide containers that have been triple rinsed are not considered hazardous waste, and can be disposed of as normal solid waste. Pesticide containers must be handled in accordance with AFPMB Technical Guide 21, Pesticide Disposal Guide for Pest Control Shops.

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[102] DoDM 4150.07 (Volume 1), DoD Pest Management Program Elements and Implementation: Structure and Operation, Section 5.

## 14.7 REPORTS AND RECORDKEEPING

For recordkeeping, DoDM 4150.07 prescribes DD Form 1532, Pest Management Report.[103] A computer-generated equivalent may be used in its place. Daily records will report all in-house, formally contracted, and government purchase card-procured pest control activities conducted anywhere on the installation, to include such sites as out-leased lands, golf courses, and locations of natural resources. Records must be submitted to the designated pest management consultant at least monthly. Installation commanders must ensure these records are archived after two years for permanent retention.

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[103] DoDM 4150.07 (Volume 1), DoD Pest Management Program Elements and Implementation: Structure and Operation, Section 4.5.

# VOLUME V: WASTE

## VOLUME V.A: DEFINITIONS

Unless otherwise noted, these terms and their definitions are for the purpose of this volume.

Acute hazardous waste. Waste listed in JEGS Table 16.3 with a waste number with the "P" designator, or hazardous waste in JEGS Table 16.5 with the Hazard Code "H."

Bulky waste. Large items of solid waste, such as household appliances, furniture, large auto parts, trees, branches, stumps, and other oversize waste whose large size precludes or complicates their handling by normal solid waste collection, processing, or disposal methods.

Category A infectious substance. An infectious substance which is transported in a form that, if exposure occurs, is capable of causing permanent disability, or life-threatening or fatal disease, to otherwise healthy humans or animals.

Cathodic protection. A technique to prevent corrosion of a metal surface by making that surface the cathode of an electrochemical cell. For example, a tank system can be cathodically protected through the application of either galvanic anodes or impressed current.

Characteristic hazardous waste.[104] A solid waste that exhibits a property identified in 40 CFR §261 Subpart C which, when present in the waste, indicates that the waste poses a sufficient threat to merit regulation as a hazardous waste. Includes any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

Class I specified chemical substance.[105] A chemical substance that: (1) is not likely to undergo a chemical transformation through natural processes and is bioaccumulative; and (2) poses a risk of impairing human health if ingested continuously, or poses a risk of interfering with the inhabitation and/or growth of predator animals at higher trophic levels and are most likely to bioaccumulate through the food chain.

Collection. In the context of solid waste management in JEGS Chapter 15, the act of consolidating solid waste, or materials that have been separated for the purpose of recycling, from various locations.

Colony forming unit (CFU). A unit that estimates the number of microbial cells in a sample that are viable and able to multiply via binary fission under controlled conditions.

Commercial solid waste. All types of municipal solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities at industrial facilities and other similar institutional establishments or facilities, excluding residential and institutional solid waste. Also referred to as retail solid waste.

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[104] 40 CFR §261.3: Identification and Listing of Hazardous Waste, General, Definition of Hazardous Waste.

[105] GOJ Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc., Article 2.

Construction and demolition debris. The waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures.

Contaminated soil. Soil that contains any substance that exceeds naturally-occurring levels and poses a human health or environmental risk.

Contingency. A situation requiring installation response to natural disasters and the activities of terrorists or other subversives.

Cover material. Material that is used to cover compacted solid waste in a land disposal site.

Daily cover. Soil that is spread and compacted or synthetic material that is placed on the top and side slopes of compacted solid waste at least at the end of each operating day to control vectors, fire, moisture, and erosion and assure an aesthetic appearance. Mature compost or other natural material may be substituted for soil if soil is not reasonably available in the vicinity of the landfill and the substituted material will control vectors, fire, moisture, and erosion and assure an aesthetic appearance.

Disposal. In the context of hazardous waste management in JEGS Chapter 16, the discharge, deposit, injection, dumping, spilling, leaking, or placing of any hazardous waste into or on any land or water that would allow the waste or constituent to enter the environment. Proper disposal effectively mitigates hazards to human health and the environment.

Elementary neutralization. A process of neutralizing a hazardous waste that is hazardous only because of the corrosivity characteristic. It must be accomplished in a tank, transport vehicle, or container.

Enduring location.[106] A location is enduring when DoD intends to maintain access and use of that location for the foreseeable future. The following types of sites are considered enduring for U.S. Government purposes: main operating base, forward operating site, and cooperative security location. All three types of locations may be composed of more than one distinct site. Enduring locations are published in the OSD-approved Enduring Location Master List.

Final cover. A layer of soil, mature compost, other natural material, or synthetic material with an equivalent minimum permeability that is applied to the landfill after completion of a cell or trench, including a layer of material that will sustain native vegetation, if any.

Food waste. The organic residues generated by the handling, storage, sale, preparation, cooking, and serving of foods, commonly called garbage.

Free product. For spills to water, any contamination that exists as a separate material that does not mix with or dissolve in water.

Generation. The act or process of producing waste.

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[106] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

<u>Generator</u>. An installation, or a unit or activity on an installation, whose act or process produces hazardous waste. Installation contractors, who generate hazardous waste and use the established installation waste disposal process, are considered generators.

<u>Hazardous constituent</u>. A chemical compound listed by name in JEGS Table 16.3 or that possesses the characteristics described in JEGS Paragraph 16A.1.

<u>Hazardous substance</u>. Any substance having the potential to do serious harm to human health or the environment if spilled or released in RQ. A list of these substances and the corresponding RQs is provided in JEGS Table 16.3. Hazardous substances do not include:

(1) Petroleum, including crude petroleum, oil, and lubricants or any fraction thereof, that is not otherwise specifically listed or designated in JEGS Table 16.3 as a hazardous substance.

(2) Natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

<u>Hazardous waste</u>. A waste that may be solid, semi-solid, liquid, or contained gas, and either exhibits a characteristic of a hazardous waste as detailed in JEGS Paragraph 16A.1 or is listed as a hazardous waste in JEGS Tables 16.2 through 16.8. Does not include domestic sewage sludge, household waste, and medical waste.

<u>Hazardous waste accumulation point (HWAP)</u>. A shop, site, or other work center where hazardous waste is accumulated until removed to an HWSA or shipped for treatment or disposal.

<u>Hazardous waste log</u>. A listing of hazardous waste deposited and removed from an HWSA. Information such as the waste type, volume, location, and storage removal dates should be recorded.

<u>Hazardous waste profile sheet (HWPS)</u>. A document that identifies and characterizes the waste by providing the user’s knowledge of the waste and lab analysis, and details the physical, chemical, and other descriptive properties or processes that created the hazardous waste.

<u>Hazardous waste storage area (HWSA)</u>. Any location on a DoD installation where hazardous waste is collected before shipment for treatment or disposal. An HWSA may store more than the equivalent of a 208-liter [55-gallon] drum of hazardous waste, or a 1.0-liter [1.0-quart] container of an acute hazardous waste, from each waste stream.

<u>Hazardous waste storage area (HWSA) manager</u>. A person or agency on the installation assigned the operational responsibility for receiving, storing, inspecting, and general management of the installation’s HWSA or HWSA program.

<u>Incompatible waste</u>. A hazardous waste that is unsuitable for: placement in a particular device or facility because it may cause corrosion or decay of containment materials (e.g., container inner liners or tank walls); or commingling with another waste or material under uncontrolled conditions because the commingling might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes, or gases, or flammable fumes or gases.

Industrial waste. Solid waste generated by industrial processes and manufacturing that is not characterized as hazardous waste in accordance with JEGS Chapter 16.

Infectious agent. Any organism, such as a virus or bacterium, that is capable of being communicated by invasion and multiplication in body tissues and capable of causing disease or adverse health impacts in humans.

Infectious hazardous waste. Mixtures of infectious medical waste and hazardous waste including solid waste, such as fluids from a laboratory.

Infectious medical waste. Solid waste produced by medical facilities that is specially managed because it has the potential for causing disease in humans or animals, or may pose a risk to both individuals or community health if not managed properly, and that includes the following classes:

(1) Microbiology waste, including cultures and stocks of etiologic agents that, due to their species, type, virulence, or concentration, are known to cause disease in humans.

(2) Pathology waste, including tissues and organs, amputated limbs or other body parts, fetuses, placentas, and similar tissues from surgery, delivery, or autopsy procedures. Waste contaminated with an infectious agent, including carcasses, body parts, blood, and bedding are also included. Non-contaminated carcasses of animals that died from natural causes or vehicular impact are not considered pathology waste and are disposed of as solid waste in accordance with JEGS Chapter 15 where local regulations permit.

(3) Blood and blood products (including serum, plasma, and other blood components), items contaminated with liquid or semi-liquid blood or blood products and items saturated or dripping with blood or blood products, and items caked with blood or blood products that are capable of releasing these materials during handling.

(4) Potentially infectious materials, including fluids such as semen, vaginal secretions, cerebrospinal fluid, pericardial fluid, pleural fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any bodily fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.

(5) Sharps, including hypodermic needles, syringes, biopsy needles, and other types of needles used to obtain tissue or fluid specimens, needles used to deliver intravenous solutions, scalpel blades, Pasteur pipettes, specimen slides, cover slips, glass petri plates, and broken glass potentially contaminated with infectious pathogens.

(6) Infectious waste from isolation rooms, but only including those items that were contaminated or likely to have been contaminated with infectious agents or pathogens, including bodily excretions and discarded materials contaminated with blood.

Installation.[107] An enduring location consisting of a base, camp, post, station, yard, center, or other DoD activity under the operational control of the Secretary of a Military Department or the Secretary of Defense.

Institutional solid waste. Municipal solid waste generated by schools, hospitals (nonmedical waste), nonmanufacturing activities at prisons and government facilities, and other similar institutional establishments or facilities.

International agreement.[107] A multilateral or bilateral agreement, such as a base rights or access agreement, a status-of-forces agreement, or any other instrument defined as a binding international agreement in accordance with DoDD 5530.3, International Agreements.

Land application unit. An area where waste is applied onto or incorporated into the soil surface, excluding manure spreading operations, for agricultural purposes or for treatment or disposal.

Land disposal. Placement in or on the land including, but not limited to, land treatment, facilities, surface impoundments, underground injection wells, salt dome formations, salt bed formations, and underground mines or caves.

Limit of quantitation (LOQ). The smallest concentration that produces a quantitative result with known and recorded precision and bias.

Listed hazardous waste.[108] A solid waste specifically listed on one of four lists (the F, K, P and U lists) found in 40 CFR §261 Subpart D. Listed hazardous waste is waste from common manufacturing and industrial processes, specific industries, or generated from discarded commercial products.

Lower explosive limit (LEL). The lowest percentage by volume of a mixture of explosive gases in air that will propagate a flame at 25°C [77°F] and atmospheric pressure.

Medical facility. Medical, dental, research and development, and veterinary facilities that generate waste in the diagnosis, treatment, or immunization of human beings or animals or in the production or testing of biological subjects.

Medical waste.[109] Any solid waste produced by medical, dental, and veterinary treatment facilities in the diagnosis, treatment, or immunization of human beings or animals that requires special handling if it is infectious medical waste but does not if it is noninfectious medical waste.

Municipal solid waste (MSW). Institutional, residential, and commercial solid waste generated within a community, not including yard waste.

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[107] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions.

[108] 40 CFR §261.3: Identification and Listing of Hazardous Waste, General, Definition of Hazardous Waste.

[109] DoDM 4160.21 (Volume 4), Defense Materiel Disposition: Instructions for Hazardous Property and Other Special Processing Materiel, Glossary Part II: Definitions.

Municipal solid waste landfill (MSWLF) unit. A discrete area of land or an excavation, on or off an installation, that receives institutional, commercial, residential, or industrial solid waste, and is not a land application unit, surface impoundment, injection well, or waste pile. Employs an engineered method of disposing of solid waste that minimizes environmental hazards by spreading the solid waste in thin layers, compacting the solid waste to the smallest practical volume, and applying and compacting cover materials daily.

Noninfectious medical waste. Solid waste created that does not require special management because it has been determined to be incapable of causing disease in humans or animals, or that has been treated to render it noninfectious. This waste should be disposed of as solid waste in accordance with JEGS Chapter 15 if local regulations permit.

Open burning. Burning of solid waste in the open, not in a commercially manufactured incinerator or other equipment specifically designed and manufactured for the burning of solid waste.

Open dump. A land disposal site where solid waste is disposed of in a manner that does not protect the environment, is susceptible to open burning, and is exposed to the elements, vectors, and scavengers. Includes sites that do not meet the design and operational requirements of JEGS Paragraph 15.6.

pH. A scale used to specify the acidity or basicity of aqueous solutions. The pH scale is logarithmic and inversely indicates the activity of hydrogen ions in the solution.

Reportable quantity (RQ). A quantity of a substance that has the potential to do serious harm to human health or the environment if spilled or released.

Residential solid waste. Municipal solid waste generated by normal household activities, including, but not limited to, food waste, rubbish, ashes, and bulky waste, including material discarded from residential dwellings, hotels, motels, and other similar permanent or temporary housing.

Rubbish. A general term for solid waste, excluding food waste and ashes, taken from residences, commercial establishments, and institutions.

Scavenging. The uncontrolled and unauthorized removal of materials at any point in the solid waste management system.

Secondary containment. A system that provides an essential line of defense in the event of a failure of the primary containment, such as a bulk storage container, a mobile or portable container, piping, or oil-filled equipment.

Service component. A command consisting of the Service Component Commander and all those Service forces, such as individuals, units, detachments, organizations, and installations under that command, including the support forces that have been assigned to a combatant command or further assigned to a subordinate unified command or joint task force.

Sludge. The accumulated semi-liquid suspension of settled solids deposited from wastewaters or other fluids in tanks or basins. It does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluent, dissolved materials in irrigation return flows, or other common water pollutants.

Small electrical and electronic equipment.[110] Electronic equipment and other electrical equipment, excluding home appliances, used by general consumers in their daily lives and for which recycling is especially necessary for achieving proper disposal of waste and effective use of resources, and there are no significant economic constraints for the recycling thereof.

Small waste electrical and electronic equipment.[111] Small electrical and electronic equipment whose use has been terminated.

Solid waste. Garbage, refuse, sludge, and other discarded materials, including solid, semi-solid, liquid, and contained gaseous materials resulting from institutional, industrial, residential, and commercial operations and from community activities. It does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluent, dissolved materials in irrigation return flows, or other common water pollutants.

Solvent-contaminated wipe. A woven or non-woven shop towel, rag, pad, or swab made of wood pulp, fabric, cotton, polyester blends, or other material that, after use or after cleaning up a spill, either:

(1) Contains one or more of the F001 through F005 solvents listed in JEGS Table 16.5 or the corresponding P- or U-listed solvents found in in JEGS Table 16.3;

(2) Exhibits a hazardous characteristic found in JEGS Paragraph 16A.1 when that characteristic results from a solvent listed in JEGS Tables 16.3 or 16.5; or

(3) Exhibits only the hazardous waste characteristic of ignitability found in JEGS Paragraph 16A.1.1, due to the presence of one or more solvents that are not listed in JEGS Tables 16.3 or 16.5.

Specially controlled municipal solid waste (SCMW).[112] Municipal solid waste that exhibits the characteristics of explosivity, corrosivity, infection, or harm to human health or environment originating from non-industrial sources. SCMW is a term relevant to the transportation, treatment, or disposal of waste by Japanese contractors, not to the management of municipal solid waste within DoD installations.

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[110] GOJ Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment, Article 2-1.
[111] GOJ Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment, Article 2-2.
[112] GOJ Act on Waste Management and Public Cleansing, Article 2.

<u>Specially controlled industrial waste (SCIW)</u>.[113] Industrial waste having a nature likely to harm human health or the living environment, such as explosive, toxic, or infectious. SCIW is a term relevant to the transportation, treatment, or disposal of industrial waste by Japanese contractors, not to the management of industrial waste within DoD installations.

<u>Specified hazardous industrial waste (SHIW)</u>.[114] A subcategory of specially controlled industrial waste (SCIW), which includes PCB waste; PCB-contaminated substances; materials treated for PCBs; slag; waste asbestos; dust and cinder dust; waste oil, waste sludge, acid, and alkali; and waste consisting of mercury or mercury compounds.

<u>Standards</u>. Substantive elements of U.S. laws and Federal regulations applicable to DoD installations, facilities, and actions in the United States or that have extraterritorial application, or are determined necessary to protect human health and environment on installations outside the United States.

<u>Storage</u>. The interim containment of waste after generation and before collection for ultimate recovery or disposal.

<u>Storage site</u>. In the context of medical waste management in JEGS Chapter 17, an interim (e.g., soiled utility room) or final location where infectious medical waste is stored before treatment or disposal. This does not include point-of-use collection sites.

<u>Total suspended solids (TSS)</u>. The insoluble solid matter suspended in water that is separable by filtration.

<u>Toxic equivalence (TEQ)</u>. A weighted quantity measure based on the toxicity of each member of the dioxin and dioxin-like compounds category relative to the most toxic member of the category.

<u>Treatment</u>.

(1) In the context of hazardous waste management in JEGS Chapter 16, any method, technique, or process, excluding elementary neutralization, designed to change the physical, chemical, or biological characteristics or composition of any hazardous waste that would render such waste nonhazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduced in volume.

(2) In the context of medical waste management in JEGS Chapter 17, any method, technique, or process designed to change the physical, chemical, or biological character or composition of any infectious hazardous or infectious medical waste so as to render such waste noninfectious; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduced in volume. Treatment methods for infectious medical waste must eliminate infectious agents so that they no longer pose a hazard to persons who may be exposed.

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[113] GOJ Act on Waste Management and Public Cleansing, Article 2.
[114] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 2-4.

Unique identification number. A number assigned to generators of hazardous waste to identify the generator and used to assist in tracking the waste from point of generation to ultimate disposal. The number is typically the DoD Activity Address Code but could be another unique identifier, as shown for specially controlled industrial waste (SCIW) in JEGS Table 16.8.

United States.[115] The several States, the District of Columbia, the Commonwealths of Puerto Rico and the Northern Mariana Islands, American Samoa, Guam, Midway and Wake Islands, any other territory or possession of the United States, and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States.

Used oil. Any oil or other waste petroleum, oil, or lubricant product that has been refined from crude oil or is synthetic oil and, as a result of being used, is contaminated by physical or chemical impurities or is off-specification and cannot be used as intended. Although used oil may exhibit the characteristics of reactivity, toxicity, ignitability, or corrosivity, it is still considered used oil unless it has been mixed with hazardous waste. Used oil mixed with hazardous waste is a hazardous waste and is managed as such.

Used oil fuel. Used oil that is burned for energy recovery is termed "used oil fuel." Used oil fuel includes any fuel produced from used oil by processing, blending, or other treatment.

Vector. A carrier that is capable of transmitting a pathogen from one organism to another.

Yard waste. Grass and shrubbery clippings, tree limbs, leaves, and similar organic materials commonly generated in residential yard maintenance (also known as green waste).

## VOLUME V.B: ACRONYMS

| | |
|---|---|
| ANTU | alpha-naphthyl thiourea |
| API | American Petroleum Institute |
| BHC | benzenehexachloride |
| $BOD_5$ | biochemical oxygen demand (5-day measure) |
| °C | degrees Celsius |
| CAS | Chemical Abstracts Service |
| CFR | Code of Federal Regulations |
| CFC | chlorofluorocarbon |
| CFU | colony forming unit |

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[115] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Glossary Part II: Definitions

| | |
|---|---|
| cm | centimeter |
| COD | chemical oxygen demand |
| D | dichlorophenoxyacetic acid |
| DBCP | 1,2-dibromo-3-chloropropane |
| DD | Defense Department |
| DDD | dichlorodiphenyl dichloroethane |
| DDT | dichlorodiphenyl trichloroethane |
| DEHP | di-2-ethylhexylphthalate |
| DESR | defense explosive safety regulation |
| DLA | Defense Logistics Agency |
| DoD | Department of Defense |
| DoDD | Department of Defense directive |
| DoDI | Department of Defense instruction |
| DoDM | Department of Defense manual |
| DWTP | domestic wastewater treatment plant |
| EDTA | ethylenediamine tetraacetic acid |
| EPN | ethyl p-nitrophenyl benzenethiophosphonate |
| °F | degrees Fahrenheit |
| GOJ | Government of Japan |
| HW No. | hazardous waste number |
| HWAP | hazardous waste accumulation point |
| HWPS | hazardous waste profile sheet |
| HWSA | hazardous waste storage area |
| JEGS | Japan Environmental Governing Standards |
| kg | kilogram |
| L | liter |
| LEC | Lead Environmental Component |
| LEL | lower explosive limit |

| | |
|---|---|
| LOQ | limit of quantitation |
| mg | milligram |
| MBOCA | 4,4’-methylene bis(2-chloroaniline) |
| MDI | methylene diphenyl diisocyanate |
| MSW | municipal solid waste |
| MSWLF | municipal solid waste landfill |
| ng | nanogram |
| PCB | polychlorinated biphenyl |
| PCNB | pentachloronitrobenzene |
| PCP | pentachlorophenol |
| PFHxS | perfluorohexane sulfonic acid |
| PFOA | perfluorooctanoic acid |
| PFOS | perfluorooctane sulfonic acid |
| PFOSF | perfluorooctane sulfonyl fluoride |
| pg | picogram |
| RQ | reportable quantity |
| SCMW | specially controlled municipal solid waste |
| SCIW | specially controlled industrial waste |
| SHIW | specified hazardous industrial waste |
| SIC | standard industrial classification |
| T | trichlorophenoxyacetic acid |
| TEPP | tetraethyl pyrophosphate |
| TEQ | toxic equivalence |
| TP | trichlorophenoxypropionic acid |
| TSS | total suspended solids |
| UDMH | 1,1-dimethylhydrazine |
| USEPA | United States Environmental Protection Agency |
| USFJ | United States Forces, Japan |

# CHAPTER 15: SOLID WASTE

## 15.1 INTRODUCTION

This chapter contains standards on solid waste so it is collected, transported, stored, and recycled or disposed of in a manner protective of human health and the environment. These integrated waste management standards:

15.1.1 Apply to institutional, residential, commercial, and industrial solid waste generated at the installation.

15.1.2 Address solid waste not otherwise classified or specially managed. Refer to Table 15.1 for the location of additional standards for the disposal of specially managed solid waste.

**Table 15.1: Additional Standards Related to Specially Managed Solid Waste**

| For: | Refer to JEGS: |
|---|---|
| Asbestos | Chapter 5 |
| Polychlorinated biphenyls (PCBs) | Chapter 7 |
| Wastewater | Chapter 9 |
| Contaminated soil | Chapter 15 |
| Hazardous waste | Chapter 16 |
| Medical waste | Chapter 17 |

In Japan, solid waste is classified as either municipal solid waste or industrial waste. Municipal solid waste in Japan is categorized as either household waste or business waste. Industrial waste falls into 19 different categories, along with the waste generated by the treatment of any of those 19 categories of waste. Table 15.3 summarizes the classification of solid waste in Japan.

## 15.2 GENERAL

15.2.1 DoD solid waste must be collected, stored, and recycled in a manner that is protective of human health and the environment and consistent with Paragraphs 15.3, 15.4, and 15.5.

15.2.2 DoD solid waste must be treated or disposed of at facilities that meet the requirements for landfills in Paragraph 15.6, incinerators in Paragraph 15.7, or sludge land application in Paragraph 15.8, as appropriate.

15.2.3 The disposal of solid waste in landfills that do not meet the standards of Paragraph 15.6 constitutes open dumping and is prohibited.

15.2.4 Except as provided in Paragraph 15.6.3.5, open burning of solid waste is prohibited.

15.2.5 Personnel performing solid waste management activities should be trained in accordance with assigned responsibilities.

15.2.6 Installations must maintain records associated with the design, operation, and maintenance of solid waste management facilities, as appropriate.

15.2.7 Installations will segregate municipal solid waste.[116]

15.2.8 Installations utilizing off-base disposal facilities must ensure that the transportation and disposal facility contractor(s) are properly licensed by the appropriate local governmental authority for the solid waste being disposed.[117] Installations are not required to inspect these facilities. Installations must ensure the disposal contractor maintains a current license with the appropriate governmental licensing authority. Installations are required to comply with all requirements of the licensed transportation and disposal facility contractors for acceptance of the waste.

15.2.9 Generators of solid waste are prohibited from contracting with a licensed transporter that requires the transporter to then subcontract with a licensed disposal facility.[118] The installation must either contract with a single contractor who is licensed to both transport and dispose/recycle the waste, or contract separately with a licensed transporter and a licensed disposal/recycling facility.

15.2.10 Installations must ensure all industrial waste leaving an installation and destined for disposal in a Japanese facility is accompanied by a serially-numbered manifest to confirm a complete audit trail from point of origin to the final disposal location.[119] The installation will maintain a copy of this manifest for a minimum of five years.

## 15.3 COLLECTION

Installations must:

15.3.1 Ensure all vehicles used for the collection and transportation of solid waste are enclosed or have adequate provisions so there is no spillage when vehicles are in transit.

15.3.2 Collect solid waste frequently enough to inhibit the propagation or attraction of vectors and pests. At a minimum, collect solid waste containing food waste weekly. In some climates, it may be necessary to collect waste more often to inhibit the propagation or attraction of vectors and pests.

15.3.3 Collect and transport SCMW and SCIW, to include either Type I or Type II asbestos waste, separately from other solid waste to avoid comingling.[120]

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[116] GOJ Act on Waste Management and Public Cleansing, Article 2-4.
[117] GOJ Act on Waste Management and Public Cleansing, Articles 7, 14.
[118] GOJ Act on Waste Management and Public Cleansing, Article 14.
[119] GOJ Act on Waste Management and Public Cleansing, Article 12-3.
[120] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Articles 4-2, 6.

## 15.4 STORAGE

Installations must:

15.4.1 At a minimum, store bulky waste by removing all doors from large household appliances and covering the items, unless the bulky waste is properly stored in a secured facility with limited accessibility by authorized disposal personnel. Such practices are necessary to reduce the attractive nuisance (i.e., hazard to children) and the accumulation of solid waste and water in and around the bulky items. Refer to JEGS Chapter 4 for solid waste management requirements associated with municipal waste combustor units.

15.4.1.1 Screen bulky waste for the presence of ozone-depleting substances in accordance with JEGS Chapter 4 or hazardous constituents in accordance with JEGS Chapter 16.

15.4.1.2 Segregate and dispose of readily detachable or removable hazardous waste in accordance with JEGS Chapter 16, or asbestos and PCBs in accordance with JEGS Chapters 5 and 7, respectively.

15.4.2 Design all buildings or other facilities that are constructed, modified, or leased after the effective date of this manual to:

15.4.2.1 Provide adequate storage to accommodate the anticipated volume of solid waste and recyclables.

15.4.2.2 Ensure storage areas are easily cleaned and maintained and allow for safe, efficient collection.

15.4.3 Securely store solid waste that contains food waste in containers that:

15.4.3.1 Are leak-proof, waterproof, and vermin-proof, including sides, seams, and bottoms.

15.4.3.2 Are durable enough to withstand anticipated use and environmental conditions without rusting, cracking, or deforming in a manner that impairs serviceability.

15.4.3.3 Have functional lids.

15.4.4 Store containers on a firm, level, well-drained surface that is large enough to accommodate all of the containers and is maintained in a clean, spillage-free condition.

## 15.5 RECYCLING

Installations must:

15.5.1 Recycle:

15.5.1.1 Office paper if there are more than 100 office workers.[121]

15.5.1.2 Cardboard if more than 10 tons are generated per month.

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[121] This requirement does not supersede local installation destruction policy.

15.5.1.3 Newspapers if more than 500 families reside on the installation.

15.5.1.4 Small waste electrical and electronic equipment if there are no significant economic constraints.[122]

15.5.2 Store all solid waste or materials that have been separated for recycling so they:

15.5.2.1 Do not create a fire, health, or safety hazard.

15.5.2.2 Do not provide food or harborage for vectors and pests.

15.5.2.3 Are contained or bundled to avoid spillage.

15.5.3 If implementing a qualified recycling program, institute it in accordance with DoDI 4715.23, Integrated Recycling and Solid Waste Management.

## 15.6 LANDFILLS

Installations must comply with these standards for the expansion and construction of new landfill units and the operation of existing and new landfills. Landfills failing to satisfy these standards constitute open dumps, which are prohibited. Landfills within U.S. exclusive use facilities and areas must meet all of the requirements of this paragraph. Installations disposing of solid waste at Japanese landfills must ensure the landfills comply with the requirements of Paragraph 15.6.3. If the landfill complies with the standards of this paragraph, sewage sludge may be disposed of in a municipal solid waste landfill (MSWLF). Installations must:

15.6.1 Not initiate new landfill units or expand existing waste landfill units without consulting with the LEC who has responsibility for the area where the landfill would be located. New construction or expansion is only permissible after the installation commander provides sufficient justification to the LEC that no suitable alternative exists.

15.6.2 Design and operate new DoD MSWLF units that incorporate these factors:

15.6.2.1 Location restrictions regarding airport safety (e.g., bird hazards), floodplains, wetlands, aquifers, seismic zones, and unstable areas.

15.6.2.2 Procedures for excluding hazardous waste.

15.6.2.3 Cover material standards (e.g., daily cover), disease vector control, explosive gas control, air quality standards (e.g., no open burning), access requirements, liquids restrictions, and recordkeeping requirements.

15.6.2.4 An inspection program.

15.6.2.5 A liner and leachate collection system designed and installed in consideration of the location to prevent groundwater contamination that would adversely affect human health. The ceiling concentrations and sampling frequencies for the leachate water are shown in

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[122] GOJ Act on Promotion of Recycling of Small Waste Electrical and Electronic Equipment, Article 7.

Table 15.4. If the leachate collection system connects to a treatment system (e.g., wastewater treatment plant), the standards of Table 15.4 do not apply.

15.6.2.5.1 Liners must consist of a minimum 30-mil [0.762-millimeter] flexible membrane liner and at least a 0.6-meter [2.0-foot] layer of compacted soil with a hydraulic conductivity of no more than $1.0 \times 10^{-7}$ centimeters (cm) per second [$3.94 \times 10^{-8}$ inches per second]. Liner components consisting of high-density polyethylene must be at least 60-mil [1.524-millimeter] thick.

15.6.2.5.2 Leachate collection systems must be designed and constructed to maintain less than 30-cm [11.8-inch] depth of leachate over the liner.

15.6.2.6 A groundwater monitoring system unless the installation operating the landfill, after consultation with the LEC, determines that there is no reasonable potential for migration of hazardous constituents from the MSWLF to the uppermost aquifer during the active life of the facility and the post-closure care period. Monitoring should include at least two points that are suitable for judging the effect of leachate on the quality of the groundwater at the site. The ceiling concentrations and sampling frequencies for the groundwater are shown in Table 15.4.

15.6.2.7 A written closure plan that is kept as part of the installation's permanent records, with a minimum period of five years post-closure period. The plan must include, at a minimum:

15.6.2.7.1 Monitoring and maintenance activities required to ensure the integrity of the final cover.

15.6.2.7.2 Planned uses of the site during the post-closure period.

15.6.2.7.3 Plans for continuing (during the post-closure period) leachate collection, groundwater monitoring, and methane monitoring. The ceiling concentrations and sampling frequencies for the leachate water and groundwater are shown in Table 15.4.

15.6.2.7.4 A survey plot showing the exact site location.

15.6.3 When operating MSWLF units:

15.6.3.1 Use standard landfilling techniques of spreading and compacting solid waste and placing daily cover over disposed solid waste at the end of each operating day to control disease vectors, fires, odors, blowing litter, and scavenging.

15.6.3.2 Establish standards for unacceptable waste based on site-specific factors, such as hydrology, chemical and biological characteristics of the waste, available alternative disposal methods, environmental and health effects, and the safety of personnel.

15.6.3.3 Implement a program to detect and prevent the disposal of hazardous waste, infectious medical waste, PCBs, and waste determined unsuitable for the specific MSWLF unit.

15.6.3.4 Investigate options for composting municipal solid waste (MSW) as an alternative to landfilling or treatment before landfilling.

15.6.3.5 Prohibit open burning, except for infrequent burning of agricultural waste, silvicultural waste, land-clearing debris, diseased trees, or debris from emergency cleanup operations.

15.6.3.6 Develop procedures to divert recyclables, yard waste, and construction and demolition debris from MSWLF units to the maximum extent possible (e.g., composting, recycling).

15.6.3.7 Operate the MSWLF unit in a manner to protect the health and safety of personnel associated with the operation.

15.6.3.8 Maintain conditions that are unfavorable for the harboring, feeding, and breeding of disease vectors.

15.6.3.9 Ensure that methane gas generated by the MSWLF unit does not exceed 25 percent of the lower explosive limit for methane in structures on or near the MSWLF.

15.6.3.10 Operate in an aesthetically acceptable manner.

15.6.3.11 Operate in a manner to protect aquifers.

15.6.3.12 Control public access to landfill facilities to prevent illegal dumping of waste and scavenging.

15.6.3.13 Prohibit the disposal of sewage sludge with a water content greater than or equal to 85 percent.[123]

15.6.3.14 If possible, prohibit the disposal of bulk or non-containerized liquids.

15.6.3.15 Maintain records of MSWLF operations specified in Paragraphs 15.6.3.1 through 15.6.3.14.

15.6.4 During closure and post-closure:

15.6.4.1 Install a final cover system that is designed to minimize infiltration and erosion.

15.6.4.2 Ensure the infiltration layer is composed of a minimum of 46 cm [18 inches] of earthen material, geotextiles, or a combination of the two, with a permeability:

15.6.4.2.1 Less than or equal to the permeability of any bottom liner system or natural subsoil present, or

15.6.4.2.2 No greater than $5.0 \times 10^{-5}$ cm per second [$1.97 \times 10^{-5}$ inch per second], whichever is less.

15.6.4.3 Ensure the final layer consists of a minimum of 21 cm [8.0 inches] of earthen material that is capable of sustaining native plant growth.

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[123] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 6-1.

15.6.4.4 If possible, revegetate the final cap with native plants that are compatible with the landfill design, including the liner.

## 15.7 INCINERATION

15.7.1 Installations operating incinerators must meet the air quality requirements in JEGS Chapter 4.

15.7.2 Installations operating MSW incinerators processing, or designed to process, more than 50 tons per day aggregate must also:

15.7.2.1 Establish standards for acceptable and unacceptable waste based on facility capability, chemical and biological characteristics of the waste, environmental and health effects, and personnel safety.

15.7.2.2 Treat all waters discharged from the facility to meet the more protective of applicable water quality standards. Refer to JEGS Chapter 9 for wastewater and stormwater standards.

15.7.2.3 Maintain conditions that are unfavorable for the harboring, feeding, and breeding of disease vectors.

15.7.2.4 Operate in an aesthetically acceptable manner (e.g., perform routine housekeeping and regularly remove waste that cannot be processed by the facility).

15.7.2.5 Characterize and dispose of residue and other solid waste resulting from incineration in an environmentally acceptable manner. Refer to JEGS Chapter 16 for waste characterization and hazardous waste management standards.

15.7.3 Sewage sludge may be incinerated in an MSW incinerator if the incinerator accepts sewage sludge and has appropriate storage for the sludge while it awaits processing.

## 15.8 LAND APPLICATION OF SEWAGE SLUDGE

Installations must comply with the following requirements for land application of sewage sludge.

15.8.1 Landfilling, incineration, and land application are acceptable methods of disposal of sewage sludge. Sewage sludge that is landfilled or incinerated must meet the requirements in Paragraph 15.6 or 15.7, respectively.

15.8.2 Sewage sludge that has been properly treated and processed becomes biosolids, and can be applied to the land for beneficial reuse to either condition the soil or fertilize crops or other vegetation grown in the soil. Biosolids must meet pollutant limits, pathogen reduction requirements, and vector attraction reduction requirements before land application.

15.8.2.1 Ensure biosolids applied to the land meet:

15.8.2.1.1 The ceiling concentration for the contaminants shown in Table 15.2.

15.8.2.1.2 Either the cumulative pollutant loading rate, monthly average concentration, or annual loading rate.

## 15.9 ALTERNATIVE TECHNOLOGIES

Alternative technologies and methods of treatment and disposal of solid waste must be protective of human health and the environment and meet the requirements of this volume, as appropriate.

## 15.10 LANDFILL DISPOSAL OF INDUSTRIAL WASTE

Installations must comply with the following requirements for landfill disposal of industrial waste.[124]

15.10.1 Landfill disposal of industrial waste must be at a site that is enclosed and marked as a site for disposal of industrial waste.

15.10.2 The following stable industrial waste items are acceptable for landfill disposal in a non-leachate type landfill unit provided visual evaluation demonstrates the waste is free of any other types of waste/contaminant prior to land disposal:

15.10.2.1 Plastic (non-lead containing, free of organic matter, free of the contaminants listed in JEGS Table 16.8, and excluding mercury added products).

15.10.2.2 Rubber.

15.10.2.3 Scrap metal (excluding the electrodes of lead-acid batteries, printed circuit boards, lead pipe and plates, and mercury-added products).

15.10.2.4 Glass (excluding shredded vehicles, cathode-ray tubes, and mercury-added products) and ceramics (excluding waste plasterboard).

15.10.2.5 Construction and demolition debris.

15.10.3 Landfill disposal of industrial waste other than stable industrial waste items must be in a leachate-controlled type landfill unit or in an isolated type landfill unit (refer to JEGS Chapter 16). Installations must test for the leaching requirements of Table 15.5 prior to disposal in a landfill the following waste:[125]

15.10.3.1 Cinders or soot and dust.

15.10.3.2 Polluted sludge.

15.10.3.3 Sewage sludge.

15.10.3.4 Slag.

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[124] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Article 6-1.

[125] GOJ Ministry Ordinance for Provide for Criteria for Determination Pertaining to Industrial Waste Including Metals, Article 3.

15.10.3.5 Cinders, polluted sludge, or soot and dust generated by the incineration of waste PCBs.

15.10.3.6 Cinders, polluted sludge, or soot and dust generated by the incineration of PCB-contaminated waste.

## 15.11 OFF-SITE DISPOSAL OF CONTAMINATED SOIL

15.11.1 Installations will sample contaminated soil, identified for disposal in accordance with JEGS Paragraph 7.7 or JEGS Paragraph 13.3, for the contaminants listed in Table 15.6 prior to disposal.

15.11.2 Installations must handle contaminated soil as follows:[126]

15.11.2.1 Do not mix contaminated soil with other materials in the process of loading and transportation.

15.11.2.2 Do not separate rocks, concrete waste, and other materials from contaminated soil in the process of loading and transportation.

15.11.2.3 Segregate soil excavated from different locations based on their waste characteristics to prevent mixing. This requirement, however, does not apply when the contaminated soil is processed in a facility that is capable of treating soils with different waste characteristics.

15.11.2.4 Do not unload contaminated soil except at a licensed contaminated soil treatment facility.

15.11.3 Installations that dispose of contaminated soil off-site using a contaminated soil treatment contractor, must use a contractor that is licensed by the appropriate governmental authority, and must use the appropriate governmental contaminated soil manifest. There are five categories of licensed contaminated soil treatment facilities in Japan, as follows:[127]

15.11.3.1 Soil treatment facilities;

15.11.3.2 Cement manufacturing facilities;

15.11.3.3 Landfill treatment facilities;

15.11.3.4 Separating treatment facilities; or

15.11.3.5 Facilities using naturally originating and other soils.

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[126] GOJ Ordinance of Enforcement of Soil Contamination Countermeasures Act, Article 65.

[127] GOJ Ministerial Ordinance on Contaminated Soil Processing Business, Article 1.

## Table 15.2: Sewage Sludge Contaminant for Land Application

| CONTAMINANT | CEILING CONCENTRATION | CUMULATIVE CONTAMINANT LOADING RATE | MONTHLY AVERAGE CONCENTRATION | ANNUAL CONTAMINANT LOADING RATE |
|---|---|---|---|---|
| | (mg/kg)(1) | (kg/hectare) | (mg/kg)(1) | (kg/hectare/ 365-day period) |
| Arsenic | 75 | 41 | 41 | 2.0 |
| Cadmium | 85 | 39 | 39 | 1.9 |
| Copper | 4,300 | 1,500 | 1,500 | 75 |
| Lead | 840 | 300 | 300 | 15 |
| Mercury | 57 | 17 | 17 | 0.85 |
| Molybdenum | 75 | | | |
| Nickel | 420 | 420 | 420 | 21 |
| Selenium | 100 | 100 | 100 | 5.0 |
| Zinc | 7,500 | 2,800 | 2,800 | 140 |

mg = milligram
kg = kilogram
Note:
1. Dry weight basis.

## APPENDIX 15A: JAPANESE SOLID WASTE STANDARDS

### Table 15.3: Solid Waste Classification System in Japan

| WASTE TYPE | WASTE CATEGORY | | DESCRIPTION |
|---|---|---|---|
| Municipal Solid Waste | Night Soil | | Human excrement collected at night from buckets, cesspools, and privies and sometimes used as manure |
| | Municipal refuse | Household waste | Waste generated from households |
| | | Business waste | Waste generated from business activities other than industrial waste |
| | Specially Controlled Municipal Solid Waste (SCMW) | | Municipal solid waste which is explosive, toxic, or infectious; refer to JEGS Table 16.7 |
| Industrial Waste | 1. Cinder | | Generated from all business activities |
| | 2. Sludge | | |
| | 3. Waste oil | | |
| | 4. Waste acid | | |
| | 5. Waste alkali | | |
| | 6. Waste plastics | | |
| | 7. Waste rubber | | |
| | 8. Scrap metal | | |
| | 9. Slag | | |
| | 10. Waste pieces of glass, concrete and ceramics | | Generated from all business activities, excluding glass and concrete produced through new building, rebuilding, or removal of structures |
| | 11. Pieces of broken concrete | | Generated from new construction, through new building, rebuilding or removal of structures, and other similar waste |

### Table 15.3: Solid Waste Classification System in Japan, Continued

| WASTE TYPE | WASTE CATEGORY | DESCRIPTION |
|---|---|---|
| Industrial Waste (continued) | 12. Soot and dust | Generated at soot and smoke emitting facilities prescribed in the Air Pollution Control Act, specified facilities prescribed in the Act on Special Measures Concerning Dioxins, and at waste incineration facilities, which are collected by dust-collecting facilities |
| | 13. Waste paper | Generated from the construction industry, pulp and paper manufacturing industries, and newspaper, publishing, and bookbinding businesses |
| | 14. Wood waste | Generated from the construction industry occurring during new building, remodeling or dismantling of structures, pulp manufacturers, and that from pallets in the distribution of freight in which PCB soaks |
| | 15. Waste fibers | Generated from the construction industry during new building, remodeling or dismantling of structures, and from the textile industry in which PCB soaks |
| | 16. Solid waste related to animals or plants which have been used as raw materials | Generated from activities in the food industry, pharmaceuticals industry, and the spicery industry |
| | 17. Solid waste related to livestock | Generated when slaughtered or dismembered at a slaughterhouse |
| | 18. Excrement of animals | Generated from the livestock industry |
| | 19. Dead animals | |
| | 20. Waste generated by treatment of any of the above 19 categories of industrial waste | |
| | Specially Controlled Industrial Waste (SCIW) | Industrial waste that exhibits the characteristics of explosivity, corrosivity, infection, or harm to human health or environment; refer to JEGS Table 16.7 |

Sources: Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 15 June 2017; Order for Enforcement of the Management and Public Cleansing Act, revised 7 October 2020.

## Table 15.4: Leachate Water/Groundwater Standards for Landfills

| CONTAMINANT | LEACHATE WATER[1] (mg/L) | GROUNDWATER[2] (mg/L) |
|---|---|---|
| INORGANICS | | |
| Ammonia, ammonium compounds, nitrate and nitrite[3] | 200 | |
| Arsenic | 0.1 | 0.01 |
| Boron | 50 (public water area)[4] / 230 (sea area) | |
| Cadmium | 0.03 | 0.003 |
| Chromium | 2.0 | |
| Chromium (hexavalent) | 0.5 | 0.05 |
| Copper | 3.0 | |
| Cyanide (total) | 1.0 | < LOQ |
| Fluorine | 15 | |
| Iron (dissolved) | 10 | |
| Lead | 0.1 | 0.01 |
| Manganese (dissolved) | 10 | |
| Mercury | 0.005 | 0.0005 |
| Mercury (alkyl compounds) | < LOQ | < LOQ |
| Nitrogen (total) | 120 (60 for daily) | |
| Phosphorus | 16 (8.0 for daily) | |
| Selenium | 0.1 | 0.01 |
| Zinc | 2.0 | |
| VOLATILE ORGANICS | | |
| Benzene | 0.1 | 0.01 |
| Carbon tetrachloride | 0.02 | 0.002 |
| 1,2-Dichloroethane | 0.04 | 0.004 |
| 1,1-Dichloroethylene | 1.0 | 0.1 |
| cis-1,2-Dichloroethylene | 0.4 | 0.04[5] |
| Dichloromethane | 0.2 | 0.02 |
| 1,3-Dichloropropene | 0.02 | 0.002 |
| Tetrachloroethylene | 0.1 | 0.01 |
| 1,1,1-Trichloroethane | 3.0 | 1.0 |
| 1,1,2-Trichloroethane | 0.06 | 0.006 |
| Trichloroethylene | 0.1 | 0.01 |
| PESTICIDES | | |
| Organic phosphorus[6] | 1.0 | |
| Simazine | 0.03 | 0.003 |
| Thiobencarb | 0.2 | 0.02 |
| Thiuram | 0.06 | 0.006 |

## Table 15.4: Leachate Water/Groundwater Standards for Landfills, Continued

| CONTAMINANT | LEACHATE WATER(1) (mg/L) | GROUNDWATER(2) (mg/L) |
|---|---|---|
| OTHER ORGANICS | | |
| Animal/vegetable oils and fats(7) | 30 | |
| 1,4-Dioxane | 0.5 | 0.05 |
| Dioxins | 10 pg-TEQ/L | |
| Mineral oils(7) | 5.0 | |
| PCBs | 0.003 | < LOQ |
| Phenols | 5.0 | |
| Vinyl chloride monomer | | 0.002 |
| OTHER PARAMETERS | | |
| BOD$_5$ | 60 | |
| COD | 90 | |
| Coliforms (total) | 3,000 CFU/mL | |
| pH | Between 5.8 to 8.6 (rivers, lakes) / between 5.0 to 9.0 (ocean) | |
| TSS | 60 | |

Sources: Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 15 June 2017; Act on Special Measures Against Dioxins, Cabinet Order No. 105 of 1999, revised 17 June 2022; Ministerial Ordinance Specifying the Technical Standards for Municipal Solid Waste Final Disposal Sites and Industrial Waste Final Disposal Sites, Ordinance of the Prime Minister's Office and the Ministry of Health and Welfare No. 1 of 1977, revised 27 June 2019.

< LOQ = below the limit of quantitation
mg/L = milligrams per liter
TEQ = toxic equivalence
CFU = colony forming unit

Notes:

1. Sampling frequency:
   (a) Pre-Closure: pH, BOD$_5$, COD, TSS, and Nitrogen monthly, reduced to annually if no exceedances; all other contaminants annually.
   (b) Post-Closure: pH, BOD$_5$, COD, TSS, and Nitrogen every three months, all other contaminants semiannually. After two years of no exceedances, sampling can cease.
2. Sampling frequency: All contaminants prior to operating a new DoD MSWLF; annually during active life of the landfill and the post-closure period.
3. [0.4 x $NH_3$-N] + $NO_3$-N + $NO_2$-N.
4. Public water area includes rivers, lakes, ports and harbors, and coastal seas, including connected public waterways and irrigation waterways.
5. Sum of cis-1,2- and trans-1,2-dichloroethylene.
6. Includes parathion, methyl parathion, methyl demeton, and EPN only.
7. n-Hexane extract.

## Table 15.5: Industrial Waste Landfill Disposal Standards

| CONTAMINANT | INDUSTRIAL WASTE STANDARD (mg/L OF LEACHATE) |
|---|---|
| INORGANICS | |
| Arsenic | 0.3 |
| Cadmium | 0.09 |
| Chromium (hexavalent) | 1.5 |
| Cyanide (total) | 1.0 |
| Lead | 0.3 |
| Mercury | 0.005 |
| Mercury (alkyl compounds) | < LOQ |
| Selenium | 0.3 |
| VOLATILE ORGANICS | |
| Benzene | 0.1 |
| Carbon tetrachloride | 0.02 |
| 1,2-Dichloroethane | 0.04 |
| 1,1-Dichloroethylene | 1.0 |
| cis-1,2-Dichloroethylene | 0.4 |
| Dichloromethane | 0.2 |
| 1,3-Dichloropropene | 0.02 |
| Tetrachloroethylene | 0.1 |
| 1,1,1-Trichloroethane | 3.0 |
| 1,1,2-Trichloroethane | 0.06 |
| Trichloroethylene | 0.1 |
| PESTICIDES | |
| Organic phosphorus(1) | 1.0 |
| Simazine | 0.03 |
| Thiuram | 0.06 |
| Thiobencarb | 0.2 |
| OTHER ORGANICS | |
| 1,4-Dioxane | 0.5 |
| Dioxins | 3.0 ng/g(2) |
| PCBs | 0.003 |

Sources: Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 15 June 2017; Ordinance of Ministry to Provide for Criteria for Determination Pertaining to Industrial Waste Including Metals, Ordinance No. 5 of the Prime Minister’s Office of 1973, revised 9 June 2017.

< LOQ = below the limit of quantitation

mg/L = milligrams per liter

Notes:

1. Includes parathion, methyl parathion, methyl demeton, and EPN only.
2. nanograms per gram of test liquid.

## Table 15.6: Contaminated Soil Disposal Standards

| CONTAMINANT | TOTAL SOIL CONCENTRATION STANDARD (mg/kg) | SOIL PRIMARY LEACHATE STANDARD (mg/L) |
|---|---|---|
| INORGANICS | | |
| Arsenic | 150 | 0.01 |
| Boron | 4,000 | 1.0 |
| Cadmium | 45 | 0.003 |
| Chromium (hexavalent) | 250 | 0.05 |
| Cyanide | 50(1) | < LOQ(2) |
| Fluorine | 4,000 | 0.8 |
| Lead | 150 | 0.01 |
| Mercury | 15 | 0.0005 |
| Mercury (alkyl compounds) | | < LOQ |
| Selenium | 150 | 0.01 |
| VOLATILE ORGANICS | | |
| Benzene | | 0.01 |
| Carbon tetrachloride | | 0.002 |
| Chloroethylene | | 0.002 |
| 1,2-Dichloroethane | | 0.004 |
| 1,1-Dichloroethylene | | 0.1 |
| cis-1,2 Dichloroethylene | | 0.04 |
| Dichloromethane | | 0.02 |
| 1,3-Dichloropropene | | 0.002 |
| Tetrachloroethylene | | 0.01 |
| 1,1,1-Trichloroethane | | 1.0 |
| 1,1,2-Trichloroethane | | 0.006 |
| Trichloroethylene | | 0.01 |
| PESTICIDES | | |
| Organic phosphorus(3) | | < LOQ |
| Simazine | | 0.003 |
| Thiuram | | 0.006 |
| Thiobencarb | | 0.02 |
| OTHER ORGANICS | | |
| PCBs | | < LOQ |

Sources: Soil Contamination Countermeasures Act, Act No. 53 of 2002, revised 2 June 2017; Ordinance for Enforcement of Soil Contamination Countermeasures Act, Ordinance of the Ministry of the Environment No. 29 of 2002, revised 25 March 2021.
< LOQ = below the limit of quantitation
mg/L = milligrams per liter
Notes:
1. Cyanide (free).
2. Cyanide (total).
3. Includes parathion, methyl parathion, methyl demeton, and EPN only.

# CHAPTER 16: HAZARDOUS WASTE

## 16.1 INTRODUCTION

This chapter contains standards on all hazardous waste generated so it is identified, characterized, stored, transported, treated, and recycled or disposed of in a manner protective of human health and the environment. It covers waste that exhibits one or more characteristics of a hazardous waste (ignitability, corrosivity, reactivity, or toxicity) or is a listed hazardous waste. It does not cover:

16.1.1 Ammunition and explosives, which are covered in Defense Explosives Safety Regulation (DESR) 6055.09 (Edition 1).

16.1.2 Radioactive materials, which are covered in DoDI 4715.27, DoD Low-Level Radioactive Waste (LLRW) Program.

In Japan there are categories of municipal solid waste and industrial waste that require special handling and disposal similar to those for hazardous waste in the United States. These categories are specially controlled municipal solid waste (SCMW) and specially controlled industrial waste (SCIW). Table 16.7 lists these categories and Table 16.8 summarizes their disposal criteria in Japan. Installations manage hazardous waste on-base in a manner similar to the way hazardous waste is managed in the United States. However, installations manage off-site disposal of hazardous waste in accordance with Japanese regulations and the requirements of this chapter.

## 16.2 PERSONNEL QUALIFICATIONS

Installations must ensure that personnel and their supervisors who are assigned duties involving actual or potential exposure to hazardous waste successfully complete an appropriate training program before assuming those duties. Personnel assigned to such duties must work under direct supervision until they have completed appropriate training.

16.2.1 Refresher Training. All personnel performing hazardous waste duties must successfully complete annual refresher hazardous waste training.

16.2.2 Training Contents and Requirements. The training program must:

16.2.2.1 Include sufficient information to enable personnel to perform their assigned duties and fully comply with pertinent hazardous waste requirements.

16.2.2.2 Be conducted by qualified personnel who have completed a training program in the subject, have comparable academic credentials, or possess relevant experience.

16.2.2.3 Be designed to ensure that facility personnel are able to respond effectively to emergencies by familiarizing them with emergency procedures, emergency equipment, and emergency systems.

16.2.2.4 Address the following areas, in particular for personnel whose duties include hazardous waste handling and management:

16.2.2.4.1 Emergency procedures (response to fire, explosion, and spills; use of communications and alarm systems; body and equipment decontamination).

16.2.2.4.2 Drum and container handling and storage (including waste compatibility and segregation requirements); safe use of hazardous waste equipment; proper sampling procedures.

16.2.2.4.3 Employee protection, including personal protective equipment, safety and health hazards, hazard communication, and worker exposure.

16.2.2.4.4 Recordkeeping, security, inspections, spill prevention and response plans, storage requirements, and transportation requirements.

16.2.3 Documentation of Training. Installations must document all hazardous waste training for each individual assigned duties involving actual or potential exposure to hazardous waste. Updated training records must be kept by the responsible facility manager or installation office and retained for at least three years after termination of duty of these personnel.

## 16.3 HAZARDOUS WASTE DETERMINATION AND CHARACTERIZATION

Generators must:

16.3.1 Identify and characterize the solid waste generated at their site using their knowledge of the materials and processes that generated the waste, or through laboratory analysis of the waste.

16.3.2 Identify inherent hazardous characteristics associated with a solid waste in terms of physical properties (e.g., solid, liquid, contained gases), chemical properties (e.g., chemical constituents, technical or chemical name), or other descriptive properties (e.g., ignitable, corrosive, reactive, toxic). The properties defining the characteristics should be measurable by standardized and available testing protocols, to include Japanese and/or equivalent USEPA analytical methods. A hazardous waste or any mixture of a solid waste and a hazardous waste that is listed solely because it exhibits one or more characteristics of ignitability, corrosivity, or reactivity, is not a hazardous waste if the waste no longer exhibits any characteristic of hazardous waste. Refer to JEGS Tables 16.1 through 16.8 for characteristic hazardous waste and listed hazardous waste.

16.3.3 Prepare and maintain a Hazardous Waste Profile Sheet (HWPS) to identify each hazardous waste stream. The HWPS must be updated by the generator, as necessary, to reflect any new waste streams or process modifications that change the character of the hazardous waste being generated.

16.3.4 Use a unique (generator specific) identification number for all recordkeeping, reports, and turn-in documents for hazardous waste.

## 16.4 HAZARDOUS WASTE ACCUMULATION POINTS (HWAPs)

Installations must ensure that HWAPs comply with the following standards.

16.4.1 An HWAP must be at or near the point of generation and under the control of the operator.

16.4.2 Each HWAP must be designed and operated to provide appropriate segregation for different waste streams, including those that are chemically incompatible. Each HWAP must have warning signs appropriate for the waste being accumulated at that site. Each HWAP container must be labeled with an indication of the hazards of the contents (e.g., hazardous waste characteristic, hazard statement, chemical hazard label).[128]

16.4.3 An HWAP may accumulate no more than the equivalent of a 208-liter [55-gallon] drum of hazardous waste, or a 1.0-liter [1.0-quart] container of acute hazardous waste, from each waste stream, at or near the point of generation. When these limits have been reached, the generator has five working days to move the hazardous waste to a hazardous waste storage area (HWSA) or ship it off-site for treatment or disposal. Waste designated to be recycled or used for energy recovery (e.g., used oil or antifreeze), in accordance with the installation's hazardous waste management program, are exempt from the 208-liter [55-gallon] and 1.0-liter [1.0-quart] volume accumulation limits, but must be transported off-site to a final destination facility within one year of first accumulation start date.

16.4.4 Installations must have procedures in place to deal with unknown waste.

16.4.5 All standards for use and management of containers in Paragraph 16.6 apply to HWAPs with the exception of weekly inspections in Paragraph 16.6.2.5.

16.4.6 The recordkeeping requirements for turn-in documents, manifests, and waste analysis and characterization records in Paragraphs 16.11.3.1, 16.11.3.4, and 16.11.3.5 apply to HWAPs.

## 16.5 HAZARDOUS WASTE STORAGE AREAS (HWSAs)

Installations must ensure that HWSAs comply with the following standards.

16.5.1 <u>Location Standards</u>. To the maximum extent possible, all HWSAs must be located to minimize the risk of release due to seismic activity, floods, or other natural events. For facilities located where they may face such risks, the installation spill prevention and response plan must address minimization of the risk.

16.5.2 <u>Design and Operation of HWSAs</u>. HWSAs must be designed, constructed, maintained, and operated to minimize the possibility of fire, explosion, or any unplanned release of hazardous waste or hazardous waste constituents to air, soil, groundwater or surface water that could threaten human health or the environment. Hazardous waste must not be stored longer than one year in an HWSA. Installations generating more than 1,000 kg [2,204 pounds] per

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[128] The USFJ hazardous waste labels shown in Appendix 16C meet this labeling requirement.

month of hazardous waste, or 1.0 kg [2.2 pounds] per month of acute hazardous waste, should remove waste within 90 days.

16.5.3 Waste Analysis and Verification

16.5.3.1 Waste Analysis Plan. The HWSA manager, in conjunction with the generator(s) served, will develop a plan to determine how and when waste is to be analyzed. The waste analysis plan will include procedures for characterization and verification testing. The plan must include parameters for testing and the rationale for choosing them, frequency of analysis, test methods, and sampling methods.

16.5.3.2 Waste Analysis Records. The HWSA must have, and keep on file, an HWPS for each waste stream that is stored at that HWSA.

16.5.3.3 Waste Verification. Generating activities will provide identification of incoming waste on the HWPS to the HWSA manager. Before accepting the waste, the HWSA manager will:

16.5.3.3.1 Inspect the waste to ensure it matches the description provided.

16.5.3.3.2 Ensure that no waste is accepted for storage unless an HWPS is provided, or is available and properly referenced.

16.5.3.3.3 Request a new HWPS from the generator if there is reason to believe that the process generating the waste has changed.

16.5.3.3.4 Analyze waste shipments in accordance with the waste analysis plan to determine whether it matches the waste description on the accompanying turn-in document.

16.5.3.3.5 Reject wastes that do not match the accompanying waste descriptions unless the generator provides an accurate description.

16.5.3.4 Waste Identification. HWSA managers should have an appropriate plan in place for the acceptance or identification of unknown waste.

16.5.4 Security

16.5.4.1 General. The installation must prevent the accidental entry, and minimize the possibility for unauthorized entry, of persons or livestock onto the HWSA grounds.

16.5.4.2 Security System Design. An acceptable security system for an HWSA consists of either:

16.5.4.2.1 A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or other designated personnel) that continuously monitors and controls entry into the HWSA; or

16.5.4.2.2 An artificial or natural barrier (e.g., a fence in good repair or a fence combined with a cliff) that completely surrounds the HWSA, combined with a means to control entrance at all times (e.g., an attendant, television monitors, locked gate, or controlled roadway access).

16.5.4.3 Required Signs. A sign with the legend "Danger: Unauthorized Personnel Keep Out," must be posted at each entrance to the HWSA, and at other locations, in sufficient numbers to be seen from any approach to the HWSA. The legend must be written in English and Japanese, and must be legible from a distance of at least 7.62 meters [25 feet]. Existing signs with a legend other than "Danger: Unauthorized Personnel Keep Out," may be used if the legend on the sign indicates that only authorized personnel are allowed to enter the HWSA, and that entry can be dangerous.

16.5.5 Required Aisle Space. Aisle space must allow for unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of facility operation during an emergency. Containers must not obstruct an exit.

16.5.6 Required Equipment

16.5.6.1 All HWSAs must be equipped with the following:

16.5.6.1.1 An internal communications or alarm system capable of providing immediate emergency instruction (voice or signal) to HWSA personnel.

16.5.6.1.2 A device, such as an intrinsically safe telephone (immediately available at the scene of operations), a hand-held two-way radio, or mobile telephone capable of summoning emergency assistance from installation security, fire departments, or emergency response teams.

16.5.6.1.3 Portable fire extinguishers, fire control equipment appropriate to the material in storage (including special extinguishing equipment, as needed, such as that using foam, inert gas, or dry chemicals), spill control equipment, and decontamination equipment.

16.5.6.1.4 Water at adequate volume and pressure to supply water hose streams, foam-producing equipment, automatic sprinklers, or water spray systems.

16.5.6.1.5 Readily available personal protective equipment appropriate to the materials stored, and eyewash and shower facilities.

16.5.6.2 Communications alarm systems, fire protection equipment, spill control equipment, and decontamination equipment, where required, must be maintained to ensure its proper operation in time of emergency.

16.5.7 Access to Communications or Alarm System

16.5.7.1 Whenever hazardous waste is being poured, mixed, or otherwise handled, all personnel involved in the operation must have immediate access to an internal alarm or emergency communication device, either directly or through visual or voice contact with another person.

16.5.7.2 If there is only one person on duty at the HWSA premises, that person must have immediate access to a device, such as a telephone (immediately available at the scene of operation) or a hand-held two-way radio, capable of summoning external emergency assistance.

16.5.8 General Inspection Requirements

16.5.8.1 General. Installations must inspect the HWSAs for malfunctions and deterioration, operator errors, and discharges that may be causing, or may lead to, a release of hazardous waste constituents to the environment or threat to human health.

16.5.8.2 Types of Equipment Covered. Inspections must include all equipment and areas that are involved in the storage and handling of hazardous waste and are important to preventing, detecting, or responding to environmental or human health hazards. This includes all containers and areas with containers, tank systems and associated piping, and all monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment (such as dikes and sump pumps).

16.5.8.3 Inspection Schedule. Inspections must be conducted according to a written schedule that is kept at the HWSA. The schedule must identify the types of problems (e.g., malfunctions or deterioration) that are to be looked for during the inspection (e.g., inoperative sump pump, leaking fitting, or eroding dike).

16.5.8.4 Frequency of Inspections. Minimum frequencies for inspecting containers and container storage areas are found in Paragraph 16.6.2.5. Minimum frequencies for inspecting tank systems are found in Paragraph 16.7.4.2. For equipment not covered by those paragraphs, inspection frequency should be based on the rate of possible deterioration of the equipment and probability of an environmental or human health incident if the deterioration or malfunction or any operator error goes undetected between inspections. Areas subject to spills, such as loading and unloading areas, must be inspected daily when in use.

16.5.8.5 Remedy of Problems Revealed by Inspection. If an inspection reveals any deterioration or malfunction of equipment or structures, the installation must remedy that deficiency in a timely manner to prevent an environmental or human health hazard. Where a hazard is imminent or has already occurred, action must be taken immediately.

16.5.8.6 Maintenance of Inspection Records. The installation must record inspections in an inspection log or summary and keep the records for at least three years from the date of inspection. At a minimum, these records must include the date and time of inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions.

16.5.9 Storage Practices

16.5.9.1 Incompatible Wastes. Incompatible wastes must be stored so that they do not threaten human health or the environment. Dangers resulting from improper storage of incompatible wastes include generation of extreme heat, fire, explosion, and generation of toxic gases.

16.5.9.2 Ignitable or Reactive Waste. Ignitable or reactive waste must be stored so that it does not threaten human health or the environment. The HWSA manager must take precautions to prevent accidental ignition or reaction of ignitable or reactive waste.

16.5.9.2.1 This waste must be separated and protected from sources of ignition or reaction including, but not limited to, open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), spontaneous ignition (e.g., from heat-producing chemical reactions), and radiant heat.

16.5.9.2.2 While ignitable or reactive waste is being handled, the HWSA personnel must confine smoking and open flame to specially designated locations. “No Smoking” signs, or signs with the appropriate “No Smoking” icon, must be conspicuously placed wherever there is a hazard from ignitable or reactive waste. In areas where access by Japanese speaking persons is expected, the “No Smoking” legend must be written in English and Japanese.

16.5.9.2.3 Water reactive waste cannot be stored in the same area as flammable and combustible liquid.

16.5.10 Closure and Closure Plans

16.5.10.1 Closure Plan. Installations must prepare closure plans for all new and existing HWSAs. Closure plans for a new HWSA must be developed before the HWSA is opened. The closure plan will be implemented concurrent with the decision to close the HWSA. The closure plan must include estimates of the storage capacity of the hazardous waste, steps to be taken to remove or decontaminate all waste residues, and an estimate of the expected date for closure.

16.5.10.2 Closure. When the decision is made to close an HWSA, the closure plan must be implemented. Closure should be done:

16.5.10.2.1 In a manner that eliminates or minimizes the need for future maintenance or the potential for future releases of hazardous waste.

16.5.10.2.2 According to the closure plan, including removal of all hazardous waste and hazardous waste residues from the containment system, including remaining containers, liners, and bases.

## 16.6 USE AND MANAGEMENT OF CONTAINERS

Installations must ensure that hazardous waste containers comply with the following standards.

16.6.1 Container Handling and Storage

16.6.1.1 Containers holding hazardous waste must be in good condition, free from severe rusting, bulging, or structural defects.

16.6.1.2 Containers used to store hazardous waste, including overpack containers, must be compatible with the materials stored.

16.6.2 Management of Containers

16.6.2.1 Containers holding hazardous waste must always be closed during storage, except when it is necessary to add or remove waste.

16.6.2.2 Containers holding hazardous waste must not be opened, handled, or stored in a manner that may rupture the container or cause it to leak.

16.6.2.3 Containers of flammable liquids must be grounded when transferring flammable liquids from one container to the other.

16.6.2.4 Containers holding hazardous waste must be labeled with a hazardous waste marking.[129]

16.6.2.5 HWSAs where containers are stored must be inspected weekly for leaking and deteriorating containers as well as deterioration of the containment system caused by corrosion or other factors. Secondary containment systems must be inspected for defects and emptied of accumulated releases or retained stormwater.

16.6.3 Secondary Containment Systems. HWAPs and HWSAs with containers must have a secondary containment system that meets the following standards:

16.6.3.1 Must be sufficiently impervious to contain leaks, spills, and accumulated precipitation until the collected material is detected and removed.

16.6.3.2 Must have sufficient capacity to contain 10 percent of the volume of stored containers or the volume of the largest container, whichever is greater.

16.6.3.3 HWAPs and HWSAs with containers holding only waste that does not contain free liquids do not need to have a containment system as described in Paragraphs 16.6.3.1 and 16.6.3.2 provided:

16.6.3.3.1 The area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation; or

16.6.3.3.2 The containers are elevated or are otherwise protected from contact with accumulated liquid.

16.6.3.4 Spilled or leaked waste and accumulated precipitation must be removed from the sump or collection area in as timely a manner as is necessary to prevent overflow of the collection system. Stormwater captured in secondary containment areas should be inspected or tested before release. The inspection or testing must be reasonably capable of detecting contamination by the hazardous waste in the containers. Contaminated water must be treated as hazardous waste until determined otherwise.

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[129] The USFJ hazardous waste labels shown in Appendix 16C meet this labeling requirement.

16.6.4 Incompatible Wastes

16.6.4.1 Incompatible wastes and materials must not be placed in the same container.

16.6.4.2 Hazardous waste must not be placed in an unwashed container that previously held an incompatible waste or material.

16.6.4.3 A storage container holding hazardous waste that is incompatible with any waste or other materials stored nearby in other containers, piles, open tanks, or surface impoundments, must be separated from the other materials or protected from them by means of a dike, berm, wall, or other device.

16.6.5 Ignitable or Reactive Waste. Areas that store containers holding ignitable or reactive waste must be located at least 15 meters [50 feet] inside the installation's boundary.

16.6.6 Residues of Hazardous Waste in Containers. All containers must be emptied of hazardous waste residues before they are disposed. Hazardous waste residues must be managed as hazardous waste. Empty containers may be disposed of as normal solid waste. A container is considered empty when all waste has been removed through normal practices (e.g., pouring or pumping) and for containers holding:

16.6.6.1 Hazardous waste, where all waste has been removed with no more than 2.5 cm [1.0 inch] of residue remains or, if the container is less than or equal to 450 liters [119 gallons], no more than three percent by weight of total capacity of the container remains, or, if the container is greater than 450 liters [119 gallons], no more than 0.3 percent by weight of the total capacity if the container remains.

16.6.6.2 Acute hazardous waste, where the container or inner liner has been triple rinsed using a solvent capable of removing acute hazardous waste or has been cleaned by another method that has been shown in scientific literature, or by tests conducted by the generator, to achieve equivalent removal. A container with a liner is empty when the liner has been removed if the liner has prevented contact of the container with the acute hazardous waste.

16.6.6.3 Compressed gas hazardous waste, when the pressure in the container approaches atmospheric. Compressed gas cylinders should be managed in accordance with DLA Instruction 4145.25, Storage and Handling of Liquefied and Gaseous Compressed Gasses and Their Full and Empty Containers.

## 16.7 TANK SYSTEMS

Installations must ensure that all tanks (including underground storage tanks) used to treat or store hazardous waste comply with the following standards. Refer to JEGS Chapter 12 for standards dealing with underground storage tanks containing petroleum, oil, and lubricants and hazardous substances. Tank systems that are used to store or treat hazardous waste that contain no free liquids and are situated inside a building with an impermeable floor are exempted from the secondary containment requirements in Paragraph 16.7.3. Tank systems, including sumps that serve as part of a secondary containment system to collect or contain releases of hazardous waste, are exempt from the requirements in Paragraph 16.7.3.

16.7.1 Assessment of Existing Tank System Integrity. For each existing tank system that does not have secondary containment meeting the requirements of Paragraph 16.7.3, installations must determine annually whether the tank system is leaking or is fit for use. Installations must obtain, and keep on file at the HWSA, a written assessment of tank system integrity reviewed and certified by a competent authority.

16.7.2 Design and Installation of New Tank Systems or System Components. Managers of HWSAs installing new tank systems or system components must obtain a written assessment, reviewed and certified by a U.S. licensed professional engineer, attesting that the tank system has sufficient structural integrity and is acceptable for storing and treating hazardous waste. The assessment must show that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste to be stored or treated, and corrosion protection to ensure that it will not collapse, rupture, or fail.

16.7.3 Containment and Detection of Releases. To prevent the release of hazardous waste or hazardous constituents from tank systems to the environment, installations must:

16.7.3.1 Provide secondary containment that includes a liner (external to the tank), a vault, a double-walled tank, or an equivalent device for all new and existing tank systems or components storing hazardous waste.

16.7.3.2 Design, install, and operate secondary containment to prevent any migration of waste or accumulated liquid out of the system to the soil, groundwater, or surface water at any time during the use of the tank system.

16.7.3.3 Construct secondary containment of, or line it with, materials that are compatible with the waste to be placed in the tank system and have sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operation (including stresses from nearby vehicular traffic).

16.7.3.4 Place the secondary containment on a foundation or base capable of providing support to the system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compressions, or uplift.

16.7.3.5 Provide a leak-detection system that is designed and operated to detect the failure of either the primary or secondary containment structure or the presence of any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time.

16.7.3.6 Slope or otherwise design or operate the secondary containment system to drain and remove liquids resulting from leaks, spills, or precipitation. Spilled or leaked waste and accumulated precipitation must be removed from the secondary containment system within 24 hours, or in as timely a manner as possible, to prevent harm to human health and the environment.

16.7.4 Operation and Inspection

16.7.4.1 Hazardous waste or treatment reagents must not be placed in a tank system if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, corrode, or otherwise fail.

16.7.4.2 The installation must inspect and log at least once each operating day:

16.7.4.2.1 The aboveground portions of the tank system, if any, to detect corrosion or releases of waste.

16.7.4.2.2 Data gathered from monitoring and leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design.

16.7.4.2.3 The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion or signs of releases of hazardous waste (e.g., wet spots, dead vegetation).

16.7.4.3 The installation must inspect cathodic protection systems to ensure that they are functioning properly. The proper operation of the cathodic protection system must be confirmed within six months after initial installation and annually thereafter. All sources of impressed current must be inspected or tested, as appropriate, or at least every other month. The installation manager must document the inspections in the operating record of the HWSA.

16.7.5 Response to Leaks or Spills. A tank system or secondary containment system from which there has been a leak or spill, or that is unfit for use, must be removed from service and immediately repaired or closed. Spills must be addressed in accordance with JEGS Chapter 13. Installations must immediately:

16.7.5.1 Stop the flow of hazardous waste into the tank system or secondary containment system and inspect the system to determine the cause of the release.

16.7.5.2 Conduct an inspection of the release and based on that inspection:

16.7.5.2.1 Prevent further migration of the leak or spill to soil or surface water.

16.7.5.2.2 Remove and properly dispose of any contaminated soil or surface water in accordance with JEGS Paragraph 13.3.

16.7.5.2.3 Remove free product to the maximum extent possible.

16.7.5.2.4 Continue monitoring and mitigating for any additional fire and safety hazards posed by vapors or free products in subsurface structures.

16.7.5.3 Make required notifications and reports.

16.7.6 Closure. At closure of a tank system, the installation must remove or decontaminate hazardous waste residues, contaminated containment system components (liners, etc.), contaminated soil to the extent practicable, and structures and equipment.

## 16.8 MANAGEMENT OF USED OIL, BATTERIES, ANTIFREEZE, AND WIPES

Installations must ensure that used oil, batteries, antifreeze, and wipes are managed and disposed of in accordance with the following standards.

16.8.1 Used Oil Burned for Energy Recovery. Used oil fuel may be burned only in the following devices:

16.8.1.1 Industrial furnaces.

16.8.1.2 Boilers that are identified as:

16.8.1.2.1 Industrial boilers located on the site of a facility engaged in a manufacturing process where substances are transformed into new products, including the component parts of products, by mechanical or chemical processes.

16.8.1.2.2 Utility boilers used to produce electric power, steam, heated or cooled air, or other gases or fluids.

16.8.1.2.3 Used oil-fired space heaters, provided that:

16.8.1.2.3.1 The heater burns only used oil that the installation generates.

16.8.1.2.3.2 The heater is designed to have a maximum capacity of not more than 527.5 kilojoules [0.5 million British thermal unit per hour].

16.8.1.2.3.3 The combustion gases from the heater are properly vented to the ambient air.

16.8.2 Prohibitions on Dust Suppression or Road Treatment. Installations must not use used oil, hazardous waste, or used oil contaminated with any hazardous waste for dust suppression or road treatment.

16.8.3 Disposal of Batteries. Installations should recycle all batteries when possible. Installations will manage lead-acid batteries that are to be recycled as industrial waste in accordance with JEGS Chapter 15 when transported off the installation, except when sold as a commodity through a Qualified Recycling Program (QRP). Batteries that are not recycled may be managed as solid waste if determined not to be hazardous in accordance with Paragraph 16.3.

16.8.4 Disposal of Antifreeze. Installations should recycle all antifreeze when possible. Antifreeze that is not recycled may be managed as solid waste if determined not to be hazardous in accordance with Paragraph 16.3.

16.8.5 Management of Used Wipes. Used wipes must be characterized in accordance with Paragraph 16.3. and managed accordingly. Solvent-contaminated wipes may be managed as follows:

16.8.5.1 Solvent-contaminated wipes that are sent for cleaning at an industrial laundry or dry cleaner and reused are not hazardous waste when all free liquid has been removed and they are stored in closed, non-leaking containers labeled as "reusable wipes." The solvent-contaminated wipes may be accumulated for up to 180 days from the start date of accumulation for each container before being sent for cleaning.

16.8.5.2 Disposable solvent-contaminated wipes (except those containing trichloroethylene) are not hazardous waste when all free liquid has been removed and they are stored in closed, non-leaking containers labeled as "disposable wipes." The solvent-contaminated wipes may be accumulated for up to 180 days from the start date of accumulation for each container before being sent for disposal.

16.8.5.3 The conditions in Paragraphs 16.8.5.1 and 16.8.5.2 only apply to the solvent-contaminated wipes themselves. Any free liquid removed from the solvent-contaminated wipes or from the container holding the wipes must still be managed according to applicable requirements of this chapter.

## 16.9 HAZARDOUS WASTE DISPOSAL

Installations must ensure that hazardous waste is disposed of in accordance with the following standards.

16.9.1 Disposal Through DLA Disposition Services. All DoD hazardous waste must be disposed of through the DLA Disposition Services, except as follows:

16.9.1.1 A decision not to use DLA Disposition Services for hazardous waste disposal may be made in accordance with DoDM 4160.21 (Volume 2), Defense Materiel Disposition: Property Disposal and Reclamation, to best accomplish the installation mission.

16.9.1.2 A decision must have the concurrence of the DoD Service Component chain of command to ensure that, if waste is disposed of in Japan, the standards of Paragraph 16.9.2 have been met and installation contracts and disposal standards are at least as protective as those used by the DLA Disposition Services.

16.9.1.3 Decisions must be documented in accordance with DoD Service Component guidelines.

16.9.2 Disposal Location. DoD Service Components must ensure that hazardous waste generated by DoD operations and considered hazardous under either U.S. law or applicable Japanese standards is not disposed of in Japan unless the disposal complies with this manual and is in accordance with any applicable international agreements. If there is no international agreement that grants disposal authority, DoD Service Components must obtain concurrence from the appropriate authorities of Japan. The United States will not have continuing responsibility for the hazardous waste after it has been disposed of in accordance with the JEGS or applicable international agreements. To the maximum extent practicable, DoD Service Components will dispose of hazardous waste so as to not retain any future liability for the waste or contractually retain any markings or other indication of ownership of the waste.

16.9.2.1 When the requirements of Paragraph 16.9.2 cannot be met, DoD Service Components will dispose of hazardous waste in the United States or in another foreign nation where the applicable conditions are met.

16.9.2.2 The determination of whether particular DoD-generated hazardous waste may be disposed of in Japan will be made by the LEC, in coordination with the Service Component Commander, the Director, DLA, other relevant DoD Service Component heads, and the chief of the U.S. diplomatic mission, in accordance with Paragraph 16.9.3.6.

16.9.3 Disposal Procedures

16.9.3.1 Pre-Transport. When transporting hazardous waste via commercial transportation on Japanese public roads and highways, hazardous waste generators will prepare off-installation hazardous waste shipments in compliance with applicable Japanese transportation regulations. Requirements may include placarding, marking, containerization, and labeling. Hazardous waste designated for international transport will be prepared in accordance with applicable international regulations. In the absence of Japanese regulations, international standards will be used.

16.9.3.2 Transportation. When transporting hazardous waste via military vehicle on Japanese public roads and highways, generators will ensure compliance with Defense Transportation Regulation 4500.9-R Parts I, II, III, and IV, applicable international agreements, and Japanese transportation regulations. Vehicle placarding is prohibited outside U.S. exclusive use facilities and areas in Japan.

16.9.3.3 Manifesting. All hazardous waste leaving the installation must be accompanied by a manifest issued by the generator of the hazardous waste to ensure a complete audit trail from point of origin to ultimate disposal.[130] Industrial waste manifests must be used when the destination is a Japanese facility. This manifest must include:[131]

16.9.3.3.1 Generator’s name, signature, address, and telephone number.

16.9.3.3.2 Generator’s unique identification number.

16.9.3.3.3 Transporter’s name, address, and telephone number.

16.9.3.3.4 Destination name, address, and telephone number.

16.9.3.3.5 Description of waste (including HW number from Tables 16.1 through 16.4, and JEGS HW number from Tables 16.7 and 16.8).

16.9.3.3.6 Total quantity of waste.

16.9.3.3.7 Date of shipment.

16.9.3.3.8 Date of receipt.

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[130] GOJ Act on Waste Management and Public Cleansing, Article 12-3.

[131] GOJ Ordinance for Enforcement of the Act on Waste Management and Public Cleansing, Article 8-21.

16.9.3.3.9 Packaging style.

16.9.3.4 Labeling. Generators will label hazardous waste in accordance with the requirements of Appendix 16C.

16.9.3.5 Audit Trail. Generators must maintain an audit trail of hazardous waste from the point of generation to disposal.

16.9.3.5.1 Generators using DLA Disposition Services will maintain a record from the initial DLA Disposition Services receipt of the waste, including receipt in place at which time the DLA Disposition Services assumes responsibility of the waste. DLA must provide a copy of the final manifest after final disposal. A generator that uses the hazardous waste management or disposal program of a DoD Service Component with a different unique identification number must maintain documentation from the receiving component. The receiving component assumes responsibility for subsequent storage, transfer, and disposal of the waste.

16.9.3.5.2 If DLA does not provide disposal services at a particular installation, generators desiring to dispose of their hazardous waste outside of the DLA Disposition Services system must provide an audit trail from point of generation to the final disposal location.

16.9.3.6 Disposal in Japan

16.9.3.6.1 In addition to meeting the requirements in DoDI 4715.05 to determine whether hazardous waste may be disposed of in Japan,[132] the LEC must also consider whether the means of treatment and containment technologies employed in the Japanese program, as enacted and enforced, effectively mitigate the hazards of such waste to human health and the environment. The LEC must consider whether the Japanese program includes:

16.9.3.6.1.1 An effective system for tracking the movement of hazardous waste to its ultimate destination.

16.9.3.6.1.2 An effective system for granting authorization or permission to those engaged in the collection, transportation, storage, treatment, and disposal of hazardous waste.

16.9.3.6.1.3 Appropriate standards and limitations on the methods that may be used to treat and dispose of hazardous waste.

16.9.3.6.1.4 Standards designed to minimize the possibility of fire, explosion, or any unplanned release or migration of hazardous waste or its constituents to air, soil, surface, or groundwater.

16.9.3.6.2 The LEC must also be satisfied, either through reliance on the Japanese regulatory system or provisions in the disposal contracts, that:

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[132] DoDI 4715.05, Environmental Compliance at Installations Outside the United States, Enclosure 3 Paragraph 5.c.

16.9.3.6.2.1 Persons and facilities in the waste management process have demonstrated the appropriate level of training and reliability.

16.9.3.6.2.2 Effective inspections, monitoring, and recordkeeping have taken place.

16.9.3.6.2.3 Japanese facilities that store, treat, or dispose of DoD-generated waste have been evaluated and approved by the appropriate governmental authority as being in compliance with their regulatory requirements. This evaluation and approval may consist of having a valid license or Japanese equivalent for the hazardous waste that will be handled.

16.9.3.6.3 Generators of hazardous waste are prohibited from contracting with a licensed transporter that requires the transporter to subcontract with a disposal facility.[133] The hazardous waste generator must either contract with a single contractor who is licensed to both transport and dispose of hazardous waste, or contract separately with a licensed hazardous waste transportation contractor and a licensed hazardous waste disposal facility.

16.9.3.6.4 The standard for hazardous waste transfer from ship-to-shore or airplane-to-port is that no hazardous waste originating from any country other than Japan will be accepted for disposal in Japan, with the following exception: units operating/training away from Okinawa and mainland Japan where there is no DLA Disposition Services to receive hazardous waste generated during the deployment are allowed to return the hazardous waste to Okinawa/Japan, where it can be properly disposed of in accordance with this chapter.

16.9.3.6.5 Japanese facilities that either store, treat, or dispose of DoD-generated hazardous waste must be evaluated and approved by the appropriate governmental authority (or its duly designated representative) as being in compliance with their regulatory requirements. This evaluation and approval may consist of having a valid license or governmental (or its duly designated representative) equivalent for the hazardous waste that will be handled.[134]

16.9.3.6.6 Specially controlled waste types (SCMW and SCIW) must not be comingled with other solid waste during collection or transportation.[135]

16.9.3.7 <u>Recycling and Reuse</u>. Hazardous waste must be recycled or reused to the maximum extent practical. Installations must safely store hazardous waste that is intended for recycling or reuse to minimize risks to health and the environment.

16.9.3.8 <u>Land Disposal</u>. Installations must not dispose of hazardous waste in land disposal facilities on the installation. DLA Disposition Services may dispose of hazardous waste through qualified land disposal facilities that have:

16.9.3.8.1 Location restrictions regarding floodplains, wetlands, aquifers, seismic zones, and other unstable areas.

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[133] GOJ Act on Waste Management and Public Cleansing, Article 14.

[134] GOJ Act on Waste Management and Public Cleansing, Article 14-4.

[135] GOJ Order for Enforcement of the Waste Management and Cleansing Act, Articles 4-2, 6.

16.9.3.8.2 A liner that is designed, constructed, and installed to prevent any migration of waste out of the landfill to the adjacent subsurface soil or groundwater or surface water. The liner system must include:

16.9.3.8.2.1 A top liner designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into such liner.

16.9.3.8.2.2 A composite bottom liner consisting of at least two components. The upper component must be designed and constructed of materials (e.g., a geomembrane) to prevent the migration of hazardous constituents into this component. The lower component must be designed and constructed of materials to minimize the migration of hazardous constituents if a breach in the upper component were to occur. The lower component must be constructed of at least 91 cm [3.0 feet] of compacted soil material with a hydraulic conductivity of no more than $1.0 \times 10^{-7}$ cm per second [$3.94 \times 10^{-8}$ inches per second].

16.9.3.8.3 A leachate collection and removal system immediately above the liner that is designed, constructed, maintained, and operated to collect and remove leachate from the landfill. The design and operating conditions must ensure that the leachate depth over the liner does not exceed 30 cm [1.0 foot].

16.9.3.8.4 The leachate collection and removal system between the liners, and immediately above the bottom composite liner in the case of multiple leachate collection and removal systems, is also a leak detection system. This leak detection system must be capable of detecting, collecting, and removing leaks of hazardous constituents at the earliest practicable time through all areas of the top liner likely to be exposed to waste or leachate. The requirements for a leak detection system in this paragraph are satisfied by installation of a system that is, at a minimum:

16.9.3.8.4.1 Constructed with a bottom slope of one percent or more.

16.9.3.8.4.2 Constructed of granular drainage materials with a hydraulic conductivity of $1.0 \times 10^{-2}$ cm per second [$3.94 \times 10^{-3}$ inches per second] or more and a thickness of 30.5 cm [12 inches] or more; or constructed of synthetic or geonet drainage materials with a transmissivity of $3.0 \times 10^{-5}$ square meter per second [$3.2 \times 10^{-4}$ square feet per second] or more.

16.9.3.8.4.3 Constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the landfill.

16.9.3.8.4.4 Designed and operated to minimize clogging.

16.9.3.8.4.5 Constructed with sumps and liquid removal methods (e.g., pumps) of sufficient size to collect and remove liquids from the sump and prevent liquids from backing up into the drainage layer.

16.9.3.8.5 A groundwater monitoring program capable of determining the facility's impact on the quality of water in the aquifers underlying the facility.

16.9.3.9 Underground Injection Wells. Installations must not dispose of hazardous waste by underground injection.

16.9.4 Incinerators. This paragraph applies to incinerators that incinerate hazardous waste as well as boilers and industrial furnaces that burn hazardous waste for any recycling purposes.

16.9.4.1 Incinerators used to dispose of hazardous waste must be licensed by an appropriate governmental authority or approved by the LEC. This license or approval must comply with the standards listed in Paragraph 16.9.4.2.

16.9.4.2 A license or LEC approval for incineration of hazardous waste requires the incinerator is designed including appropriate equipment as well as operated according to management practices. Required management practices include proper combustion temperature, waste feed rate, combustion gas velocity, and other relevant specifications to effectively destroy hazardous constituents and control harmful emissions. A licensing or approval scheme that would require an incinerator to achieve the standards set forth in either Paragraphs 16.9.4.2.1 or 16.9.4.2.2 is acceptable.

16.9.4.2.1 The incinerator achieves a destruction and removal efficiency of 99.99 percent for the organic hazardous constituents that represent the greatest degree of difficulty of incineration in each waste or mixture of waste. The incinerator must minimize carbon monoxide in stack exhaust gas, minimize emission of particulate matter, and emit no more than 1.8 kg [4.0 pounds] of hydrogen chloride per hour.

16.9.4.2.2 The incinerator has demonstrated, as a condition for obtaining a license or LEC approval, the ability to effectively destroy the organic hazardous constituents that represent the greatest degree of difficulty of incineration in each waste or mixture of waste to be burned. For example, this standard may be met by requiring the incinerator to conduct a trial burn, submit a waste feed analysis, and provide a detailed engineering description of the facility. The appropriate governmental authority or the LEC uses the provided information to conclude that the incinerator will effectively destroy the principal organic hazardous constituents of each waste to be burned.

16.9.5 Treatment. Treatment technologies may be used to reduce the volume or hazardous characteristics of waste. Waste categorized as hazardous on the basis of Paragraph 16A.1 that, after treatment as described herein, no longer exhibit any hazardous characteristic, may be disposed of as solid waste. Treatment of waste residue categorized as hazardous under any other paragraph of Appendix 16A will continue to be managed as hazardous waste under the standards of this manual, including those for disposal. The treatment technologies listed in Paragraphs 16.9.5.1 through 16.9.5.5 are provided as baseline treatment and disposal technologies for use in determining suitability of Japanese disposal alternatives. These technologies should not be implemented without consultation with the LEC.

16.9.5.1 Organics

16.9.5.1.1 Incineration. The waste is incinerated in accordance with the requirements of Paragraph 16.9.4.

16.9.5.1.2 Fuel Substitution. The waste is destructed by fuel substitution where the units are operated such that destruction of hazardous constituents is at least as efficient as, and hazardous emissions are no greater than those produced by, incineration.

16.9.5.1.3 Biodegradation. The waste is degraded by microbial action. Such units will be operated under aerobic or anaerobic conditions so that the concentrations of a representative compound or indicator parameter (e.g., total organic carbon) have been substantially reduced in concentration. The level to which biodegradation must occur and the process time vary depending on the hazardous waste being biodegraded.

16.9.5.1.4 Recovery. The waste is treated to recover organic compounds. This will be done using, but not limited to, one or more of the following technologies: distillation; thin film evaporation; steam stripping; carbon adsorption; critical fluid extraction; liquid extraction; precipitation and crystallization, or phase separation techniques, such as decantation, filtration, and centrifugation when used in conjunction with one of the above techniques.

16.9.5.1.5 Chemical Degradation. The waste is chemically degraded in such a manner to destroy hazardous constituents and control harmful emissions.

16.9.5.2 Heavy Metals

16.9.5.2.1 Stabilization or Fixation. The waste is treated in such a way that soluble heavy metals are fixed by oxidation or reduction, or by some other means that renders the metals immobile in a landfill environment.

16.9.5.2.2 Recovery. The waste is treated to recover the metal fraction by thermal processing, precipitation, exchange, carbon absorption, or other techniques that yield nonhazardous levels of heavy metals in the residuals.

16.9.5.3 Reactives. Any treatment that changes the chemical or physical composition of a material so it no longer exhibits the characteristic for reactivity defined in Paragraph 16A.1.3.

16.9.5.4 Corrosives. Corrosive waste as defined in Paragraph 16A.1.2 will be neutralized to a pH value between 6.0 and 9.0. Other acceptable treatments include recovery, incineration, chemical or electrolytic oxidation, chemical reduction, or stabilization.

16.9.5.5 Batteries. Mercury, nickel-cadmium, lithium, and lead-acid batteries will be processed in accordance with Paragraphs 16.9.5.2.1 or 16.9.5.2.2 to stabilize, fix, or recover heavy metals, as appropriate, and in accordance with Paragraph 16.9.5.4 to neutralize any corrosives before disposal.

16.9.6 Treatment at the Point of Generation. Generators of hazardous waste may only perform elementary neutralization at the point of generation. No other treatment of hazardous waste is authorized.

## 16.10 SPILL PREVENTION AND RESPONSE PLAN

16.10.1 Each installation must have a Spill Prevention and Response Plan (SPRP), including a contingency plan, that describes planning and actions to be taken to contain and clean up spills and releases of hazardous waste in accordance with JEGS Chapter 13.

16.10.2 The installation spill prevention and response plan must address each HWSA and HWAP. Each HWSA must maintain a current copy of the plan. Each HWAP must, at a minimum, maintain portions of the plan that are pertinent to its facilities and operations.

## 16.11 RECORDKEEPING REQUIREMENTS

Installations must ensure that the following records are maintained.

16.11.1 HWSAs. Maintain all of the records identified in Paragraphs 16.11.3.1 through 16.11.3.5.

16.11.2 HWAPs. Maintain the records identified in Paragraphs 16.11.3.1, 16.11.3.4, and 16.11.3.5.

16.11.3 Records

16.11.3.1 Turn-in Documents. Turn-in documents must be maintained for five years.

16.11.3.2 Hazardous Waste Log. A hard copy or electronic hazardous waste log will be maintained at the HWSA to record all hazardous waste handled. The hazardous waste log will be available to emergency personnel in the event of a fire or spill. Logs will be maintained until closure of the installation and should consist of:

16.11.3.2.1 Name and address of generator.

16.11.3.2.2 Description and hazard class of the hazardous waste.

16.11.3.2.3 Number and types of containers.

16.11.3.2.4 Quantity of hazardous waste.

16.11.3.2.5 Date stored.

16.11.3.2.6 Storage location.

16.11.3.2.7 Disposition data, including dates received, sealed, and transported, and transporter used.

16.11.3.3 Inspection Logs. Records of inspections should be maintained for a period of three years.

16.11.3.4 Manifests. Manifests of incoming and outgoing hazardous waste will be retained for a period of five years.

16.11.3.5 Waste Analysis and Characterization Records. HWAPs and other waste analysis and characterization records must be retained until five years after closure of the HWSA.

# APPENDIX 16A: CHARACTERISTIC HAZARDOUS WASTE, LISTED HAZARDOUS WASTE, AND HAZARDOUS SUBSTANCES

## 16A.1 CHARACTERISTIC HAZARDOUS WASTE

16A.1.1 Ignitability

16A.1.1.1 A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

16A.1.1.1.1 It is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has a flash point less than 70 Celsius (°C) [158 Fahrenheit (°F)], as determined by a:

16A.1.1.1.1.1 Pensky-Martens Closed Cup Tester, using the test method specified in American Society for Testing and Materials Standard D-93-79 or D-93-80;

16A.1.1.1.1.2 Setaflash Closed Cup Tester, using the test method specified in American Society for Testing and Materials Standard D-3278-78; or

16A.1.1.1.1.3 An equivalent test method.

16A.1.1.1.2 It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

16A.1.1.1.3 It is an ignitable compressed gas as determined by appropriate test methods.

16A.1.1.1.4 It is an oxidizer.

16A.1.1.2 A solid waste that exhibits the characteristic of ignitability has the United States Environmental Protection Agency (USEPA) Hazardous Waste Number (HW No.) D001.

16A.1.2 Corrosivity

16A.1.2.1 A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

16A.1.2.1.1 It is aqueous and has a pH less than or equal to 2.0, or greater than or equal to 12.5, as determined by a pH meter.

16A.1.2.1.2 It is a liquid and corrodes steel (Society of Automotive Engineers Standard 1020) at a rate greater than 6.35 millimeters [0.25 inches] per year at a test temperature of 55°C [130°F] as determined by Method 1110A in USEPA SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.

16A.1.2.2 A solid waste that exhibits the characteristic of corrosivity has the USEPA HW No. D002.

16A.1.3 Reactivity

16A.1.3.1 A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

16A.1.3.1.1 It is normally unstable and readily undergoes violent change without detonating.

16A.1.3.1.2 It reacts violently with water.

16A.1.3.1.3 It forms potentially explosive mixtures with water.

16A.1.3.1.4 When mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.

16A.1.3.1.5 It is a cyanide or sulfide-bearing waste that, when exposed to pH conditions between 2.0 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.

16A.1.3.1.6 It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

16A.1.3.1.7 It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

16A.1.3.1.8 It is a forbidden explosive.

16A.1.3.2 A solid waste that exhibits the characteristic of reactivity has the USEPA HW No. D003.

16A.1.4 Toxicity

16A.1.4.1 A solid waste exhibits the characteristic of toxicity if, using the Toxicity Characteristic Leaching Procedure, the extract from a representative sample of the waste contains any of the contaminants listed for the toxicity characteristic in Table 16.1, in accordance with Title 40 CFR §261.24, Toxicity characteristic, at the concentration equal to or greater than the respective value given in that table. Where the waste contains less than 0.5 percent filterable solids, the waste itself is considered to be the extract for the purpose of this chapter.

16A.1.4.2 A solid waste that exhibits the characteristic of toxicity has the USEPA HW No. specified in Table 16.1 or 16.2, which corresponds to the toxic contaminant causing it to be hazardous.

## 16A.2 LISTED HAZARDOUS WASTE

16A.2.1 General

16A.2.1.1 A solid waste is a hazardous waste if it is identified in Table 16.3.

16A.2.1.2 Each listed waste was listed because of one or more of the hazard codes shown in Table 16.4.

16A.2.1.3 Each listed hazardous waste is assigned a USEPA HW No.[136]

16A.2.2 Hazardous Waste from Specific Sources. Each solid waste listed in Table 16.3, annotated "K" as the first character of the HW No. column, is a listed hazardous waste from a specific source.

16A.2.3 Hazardous Wastes from Nonspecific Sources. Each solid waste in Table 16.5, annotated with "F" as the first character of the HW No. column, is a listed hazardous waste from a nonspecific sources.

16A.2.4 Discarded Commercial Chemical Products, Off-Specification Species, Container Residues, and Spill Residue

16A.2.4.1 The commercial chemical product or manufacturing chemical intermediate generic name listed in Table 16.3 refers to a chemical substance that is manufactured or formulated for commercial or manufacturing use. These chemicals and chemical intermediates include the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a manufacturing process waste that contains any of the substances listed in Table 16.3, annotated "P" or "U" as the first character in the USEPA HW No., since it is considered used. This manufacturing process waste is deemed a hazardous waste even if containing a substance listed in Table 16.3, annotated "P" or "U" as the first character in the USEPA HW No., when it exhibits a characteristic of hazardous waste or is a listed hazardous waste from a nonspecific source identified in Table 16.5.

16A.2.4.2 Residue intended for discard is a hazardous waste unless it is being beneficially used or reused; legitimately recycled or reclaimed; or being accumulated, stored, transported or treated before such use, reuse, recycling, or reclamation. An example of a legitimate re-use of the residue would be where the residue remains in the container and the container is used to hold the same commercial chemical product or manufacturing chemical intermediate it previously held. An example of the discard of the residue would be where the drum is sent to a drum reconditioner who reconditions the drum but discards the residue.

16A.2.4.3 The following materials or items are a hazardous waste if and when they are discarded or intended to be discarded; mixed with waste oil, used oil, or other material and applied to the land for dust suppression or road treatment; otherwise applied to the land in lieu of their original intended use or contained in products that are applied to the land in lieu of their original intended use; or, in lieu of their original intended use, produced for use as (or as a component of) a fuel, distributed for use as a fuel, or burned as a fuel:

16A.2.4.3.1 Any commercial chemical product or manufacturing chemical intermediate having the generic name listed in Table 16.3, annotated "P" or "U" as the first character in the USEPA HW No.

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[136] A solid waste is a hazardous substance if it is listed in Table 16.3 without a USEPA HW No.

16A.2.4.3.2 Any off-specification commercial chemical product or manufacturing chemical intermediate that, if it met specifications, would have the generic name listed in Table 16.3, annotated “P” or “U” as the first character in the USEPA HW No.

16A.2.4.3.3 Any residue remaining in a container or in an inner liner removed from a container that has held any commercial chemical product or manufacturing chemical intermediate having the generic name listed in Table 16.3, annotated “P” or “U” as the first character in the USEPA HW No., unless the container is empty.

16A.2.4.3.4 Any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in Table 16.3, annotated “P” or “U” as the first character in the USEPA HW No. Any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill into or on any land or water of any off-specification chemical product and manufacturing chemical intermediate that, if it met specifications, would have the generic name listed in Table 16.3, annotated “P” or “U” as the first character in the USEPA HW No.

16A.2.4.3.5 The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in Table 16.3, annotated “P” as the first character in the USEPA HW No. are identified as acute hazardous waste (H). For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters “T” (Toxicity), and “R” (Reactivity). Absence of a letter indicates that the compound is only listed for acute toxicity.

16A.2.4.3.6 The commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products referred to in Table 16.3 are identified as toxic waste (T), unless otherwise designated. For the convenience of the regulated community, the primary hazardous properties of these materials are designated with the letter “T” (Toxicity), “R” (Reactivity), “I” (Ignitability), and “C” (Corrosivity).

### Table 16.1: Maximum Concentration of Contaminants for the Toxicity Characteristic

| HW NO. | CONTAMINANT | CAS NO. | REGULATORY LEVEL (mg/L) |
|---|---|---|---|
| D004 | Arsenic | 7440-38-2 | 5.0 |
| D005 | Barium | 7440-39-3 | 100.0 |
| D018 | Benzene | 71-43-2 | Refer to Table 16.8 |
| D006 | Cadmium | 7440-43-9 | Refer to Table 16.8 |
| D019 | Carbon tetrachloride | 56-23-5 | Refer to Table 16.8 |
| D020 | Chlordane | 57-74-9 | 0.03 |
| D021 | Chlorobenzene | 108-90-7 | 100.60 |
| D022 | Chloroform | 67-66-3 | 6.0 |
| D007 | Chromium | 7440-47-3 | 5.0 |
| D023 | o-Cresol | 95-48-7 | 200.0(1) |
| D024 | m-Cresol | 108-39-4 | 200.0(1) |
| D025 | p-Cresol | 106-44-5 | 200.0(1) |
| D026 | Cresol |  | 200.0(1) |
| D016 | 2,4-D | 94-75-7 | 10.0 |
| D027 | 1,4-Dichlorobenzene | 106-46-7 | 7.5 |
| D028 | 1,2-Dichloroethane | 107-06-2 | Refer to Table 16.8 |
| D029 | 1,1-Dichloroethylene | 75-35-4 | 0.7 |
| D030 | 2,4-Dinitrotoluene | 121-14-2 | 0.13(2) |
| D012 | Endrin | 72-20-8 | 0.02 |
| D031 | Heptachlor (and its epoxide) | 76-44-8 | 0.008 |
| D032 | Hexachlorobenzene | 118-74-1 | 0.13(2) |
| D033 | Hexachlorobutadiene | 87-68-3 | 0.5 |
| D034 | Hexachloroethane | 67-72-1 | 3.0 |
| D008 | Lead | 7439-92-1 | Refer to Table 16.8 |
| D013 | Lindane | 58-89-9 | 0.4 |
| D009 | Mercury | 7439-97-6 | Refer to Table 16.8 |
| D014 | Methoxychlor | 72-43-5 | 10.0 |
| D035 | Methyl ethyl ketone | 78-93-3 | 200.0 |
| D036 | Nitrobenzene | 98-95-3 | 2.0 |
| D037 | Pentachlorophenol | 87-86-5 | 100.0 |
| D038 | Pyridine | 110-86-1 | 5.0(2) |
| D010 | Selenium | 7782-49-2 | 1.0 |
| D011 | Silver | 7440-22-4 | 5.0 |
| D039 | Tetrachloroethylene | 127-18-4 | Refer to Table 16.8 |
| D015 | Toxaphene | 8001-35-2 | 0.5 |
| D040 | Trichloroethylene | 79-01-6 | Refer to Table 16.8 |
| D041 | 2,4,5-Trichlorophenol | 95-95-4 | 400.0 |
| D042 | 2,4,6-Trichlorophenol | 88-06-2 | 2.0 |
| D017 | 2,4,5-TP (Silvex) | 93-72-1 | 1.0 |
| D043 | Vinyl chloride | 75-01-4 | 0.2 |

mg/L = milligrams per liter

Notes:

1. If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 milligrams per liter (mg/L).
2. Quantitation limit is greater than the calculated regulatory level. Quantitation limit becomes the regulatory level.

## Table 16.2: Maximum Concentration of Contaminants for Non-Wastewater

| HW NO. | CONTAMINANT | CAS NO. | REGULATORY LEVEL (mg/L) |
|---|---|---|---|
| D018 | Benzene | 71-43-2 | 0.5 |
| D019 | Carbon tetrachloride | 56-23-5 | 0.5 |
| D020 | Chlordane | 57-74-9 | 0.03 |
| D021 | Chlorobenzene | 108-90-7 | 100.0 |
| D022 | Chloroform | 67-66-3 | 6.0 |
| D023 | o-Cresol | 95-48-7 | 200.0(1) |
| D024 | m-Cresol | 108-39-4 | 200.0(1) |
| D025 | p-Cresol | 106-44-5 | 200.0(1) |
| D026 | Cresol | | 200.0(1) |
| D027 | 1,4-Dichlorobenzene | 106-46-7 | 7.5 |
| D028 | 1,2-Dichloroethane | 107-06-2 | 0.5 |
| D029 | 1,1-Dichloroethylene | 75-35-4 | 0.7 |
| D030 | 2,4-Dinitrotoluene | 121-14-2 | 0.13 |
| D031 | Heptachlor (and its epoxide) | 76-44-8 | 0.008 |
| D032 | Hexachlorobenzene | 118-74-1 | 0.13 |
| D033 | Hexachlorobutadiene | 87-68-3 | 0.5 |
| D034 | Hexachloroethane | 67-72-1 | 3.0 |
| D035 | Methyl ethyl ketone | 78-93-3 | 200.0 |
| D036 | Nitrobenzene | 98-95-3 | 2.0 |
| D037 | Pentachlorophenol | 87-86-5 | 100.0 |
| D038 | Pyridine | 110-86-1 | 5.0(2) |
| D039 | Tetrachloroethylene | 127-18-4 | 0.7 |
| D040 | Trichloroethylene | 79-01-6 | 0.5 |
| D041 | 2,4,5-Trichlorophenol | 95-95-4 | 400.0 |
| D042 | 2,4,6-Trichlorophenol | 88-06-2 | 2.0 |
| D043 | Vinyl chloride | 75-01-4 | 0.2 |

mg/L = milligrams per liter

Notes:

1. If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used.
2. Quantification limit is greater than the calculated regulatory level. Quantification limit becomes the regulatory level.

## Table 16.3: List of Hazardous Wastes and Hazardous Substances

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | REPORTABLE QUANTITY(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Acenaphthene | 83-32-9 | | 100 | 45.4 |
| Acenaphthylene | 208-96-8 | | 5,000 | 2,270 |
| Acetaldehyde | 75-07-0 | U001 | 1,000 | 454 |
| Acetaldehyde, trichloro- | 75-87-6 | U034 | 5,000 | 2,270 |
| Acetamide | 60-35-5 | | 100 | 45.4 |
| Acetic acid | 64-19-7 | | 5,000 | 2,270 |
| Acetic acid, (2,4-dichlorophenoxy)- | 94-75-7 | U240 | 100 | 45.4 |
| Acetic acid ethenyl ester | 108-05-4 | | 5,000 | 2,270 |
| Acetic anhydride | 108-24-7 | | 5,000 | 2,270 |
| Acetone | 67-64-1 | U002 | 5,000 | 2,270 |
| Acetone cyanohydrin | 75-86-5 | P069 | 10 | 4.5 |
| Acetonitrile | 75-05-8 | U003 | 5,000 | 2,270 |
| Acetophenone | 98-86-2 | U004 | 5,000 | 2,270 |
| 2-Acetylaminofluorene | 53-96-3 | U005 | 1.0 | 0.454 |
| Acetyl bromide | 506-96-7 | | 5,000 | 2,270 |
| Acetyl chloride | 75-36-5 | U006 | 5,000 | 2,270 |
| 1-Acetyl-2-thiourea | 591-08-2 | P002 | 1,000 | 454 |
| Acrolein | 107-02-8 | P003 | 1.0 | 0.454 |
| Acrylamide | 79-06-1 | U007 | 5,000 | 2,270 |
| Acrylic acid | 79-10-7 | U008 | 5,000 | 2,270 |
| Acrylonitrile | 107-13-1 | U009 | 100 | 45.4 |
| Adipic acid | 124-04-9 | | 5,000 | 2,270 |
| Aldicarb | 116-06-3 | P070 | 1.0 | 0.454 |
| Aldicarb sulfone | 1646-88-4 | P203 | 100 | 45.4 |
| Aldrin | 309-00-2 | P004 | 1.0 | 0.454 |
| Allyl alcohol | 107-18-6 | P005 | 100 | 45.4 |
| Allyl chloride | 107-05-1 | | 1,000 | 454 |
| Aluminum phosphide | 20859-73-8 | P006 | 100 | 45.4 |
| Aluminum sulfate | 10043-01-3 | | 5,000 | 2,270 |
| 4-Aminobiphenyl | 92-67-1 | | 1.0 | 0.454 |
| 5-(Aminomethyl)-3-isoxazolol | 2763-96-4 | P007 | 1,000 | 454 |
| 4-Aminopyridine | 504-24-5 | P008 | 1,000 | 454 |
| Amitrole | 61-82-5 | U011 | 10 | 4.5 |
| Ammonia | 7664-41-7 | | 100 | 45.4 |
| Ammonia (anhydrous) | 7664-41-7 | | 100 | 45.4 |
| Ammonia (concentration of 20% or greater) | 7664-41-7 | | refer to ammonium hydroxide | |
| Ammonium acetate | 631-61-8 | | 5,000 | 2,270 |
| Ammonium benzoate | 1863-63-4 | | 5,000 | 2,270 |
| Ammonium bicarbonate | 1066-33-7 | | 5,000 | 2,270 |
| Ammonium bichromate | 7789-09-5 | | 10 | 4.5 |
| Ammonium bifluoride | 1341-49-7 | | 100 | 45.4 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Ammonium bisulfite | 10192-30-0 | | 5,000 | 2,270 |
| Ammonium carbamate | 1111-78-0 | | 5,000 | 2,270 |
| Ammonium carbonate | 506-87-6 | | 5,000 | 2,270 |
| Ammonium chloride | 12125-02-9 | | 5,000 | 2,270 |
| Ammonium chromate | 7788-98-9 | | 10 | 4.5 |
| Ammonium citrate, dibasic | 3012-65-5 | | 5,000 | 2,270 |
| Ammonium fluoborate | 13826-83-0 | | 5,000 | 2,270 |
| Ammonium fluoride | 12125-01-8 | | 100 | 45.4 |
| Ammonium hydroxide | 1336-21-6 | | 1,000 | 454 |
| Ammonium oxalate | 5972-73-6 | | 5,000 | 2,270 |
| | 6009-70-7 | | 5,000 | 2,270 |
| | 14258-49-2 | | 5,000 | 2,270 |
| Ammonium picrate | 131-74-8 | P009 | 10 | 4.5 |
| Ammonium silicofluoride | 16919-19-0 | | 1,000 | 454 |
| Ammonium sulfamate | 7773-06-0 | | 5,000 | 2,270 |
| Ammonium sulfide | 12135-76-1 | | 100 | 45.4 |
| Ammonium sulfite | 10196-04-0 | | 5,000 | 2,270 |
| Ammonium tartrate | 3164-29-2 | | 5,000 | 2,270 |
| | 14307-43-8 | | 5,000 | 2,270 |
| Ammonium thiocyanate | 1762-95-4 | | 5,000 | 2,270 |
| Ammonium vanadate | 7803-55-6 | P119 | 1,000 | 454 |
| Amyl acetate | 628-63-7 | | 5,000 | 2,270 |
| iso-Amyl acetate | 123-92-2 | | 5,000 | 2,270 |
| sec-Amyl acetate | 626-38-0 | | 5,000 | 2,270 |
| tert-Amyl acetate | 625-16-1 | | 5,000 | 2,270 |
| Aniline | 62-53-3 | U012 | 5,000 | 2,270 |
| o-Anisidine | 90-04-0 | | 100 | 45.4 |
| Anthracene | 120-12-7 | | 5,000 | 2,270 |
| Antimony(2) | 7440-36-0 | | 5,000 | 2,270 |
| Antimony compounds | | | & | & |
| Antimony pentachloride | 7647-18-9 | | 1,000 | 454 |
| Antimony potassium tartrate | 28300-74-5 | | 100 | 45.4 |
| Antimony tribromide | 7789-61-9 | | 1,000 | 454 |
| Antimony trichloride | 10025-91-9 | | 1,000 | 454 |
| Antimony trifluoride | 7783-56-4 | | 1,000 | 454 |
| Antimony trioxide | 1309-64-4 | | 1,000 | 454 |
| ANTU | 86-88-4 | P072 | 100 | 45.4 |
| Aroclor 1016 | 12674-11-2 | | 1.0 | 0.454 |
| Aroclor 1221 | 11104-28-2 | | 1.0 | 0.454 |
| Aroclor 1232 | 11141-16-5 | | 1.0 | 0.454 |
| Aroclor 1242 | 53469-21-9 | | 1.0 | 0.454 |
| Aroclor 1248 | 12672-29-6 | | 1.0 | 0.454 |
| Aroclor 1254 | 11097-69-1 | | 1.0 | 0.454 |
| Aroclor 1260 | 11096-82-5 | | 1.0 | 0.454 |
| Arsenic(2) | 7440-38-2 | | 1.0 | 0.454 |
| Arsenic acid | 7778-39-4 | P010 | 1.0 | 0.454 |
| Arsenic compounds | | | & | & |
| Arsenic disulfide | 1303-32-8 | | 1.0 | 0.454 |
| Arsenic pentoxide | 1303-28-2 | P011 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Arsenic trioxide | 1327-53-3 | P012 | 1.0 | 0.454 |
| Arsenic trisulfide | 1303-33-9 | | 1.0 | 0.454 |
| Arsenous oxide | 1327-53-3 | P012 | 1.0 | 0.454 |
| Arsenous trichloride | 7784-34-1 | | 1.0 | 0.454 |
| Asbestos (friable) | 1332-21-4 | | 1.0 | 0.454 |
| Auramine | 492-80-8 | U014 | 100 | 45.4 |
| Azaserine | 115-02-6 | U015 | 1.0 | 0.454 |
| Azinphos-methyl | 86-50-0 | | 1.0 | 0.454 |
| Aziridine | 151-56-4 | P054 | 1.0 | 0.454 |
| Aziridine, 2-methyl | 75-55-8 | P067 | 1.0 | 0.454 |
| Barban | 101-27-9 | U280 | 10 | 4.5 |
| Barium cyanide | 542-62-1 | P013 | 10 | 4.5 |
| Bendiocarb | 22781-23-3 | U278 | 100 | 45.4 |
| Bendiocarb phenol | 22961-82-6 | U364 | 1,000 | 454 |
| Benezeneamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)- | 1582-09-8 | | 10 | 4.5 |
| Benomyl | 17804-35-2 | U271 | 10 | 4.5 |
| Benz[c]acridine | 225-51-4 | U016 | 100 | 45.4 |
| Benzal chloride | 98-87-3 | U017 | 5,000 | 2,270 |
| Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl) | 23950-58-5 | U192 | 5,000 | 2,270 |
| Benz[a]anthracene | 56-55-3 | U018 | 10 | 4.5 |
| Benzene | 71-43-2 | U019 | 10 | 4.5 |
| Benzeneacetic acid, 4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-hydroxy-, ethyl ester | 510-15-6 | U038 | 10 | 4.5 |
| Benzene, 2,4-diisocyanato-1-methyl- | 584-84-9 | | 100 | 45.4 |
| Benzene, 1,3-diisocyanato-2-methyl- | 91-08-7 | | 100 | 45.4 |
| Benzene, 1,3-diisocyanatomethyl- | 26471-62-5 | U223 | 100 | 45.4 |
| Benzene, m-dimethyl- | 108-38-3 | U239 | 1,000 | 454 |
| Benzene, o-dimethyl- | 95-47-6 | U239 | 1,000 | 454 |
| Benzene, p-dimethyl- | 106-42-3 | U239 | 100 | 45.4 |
| Benzeneethanamine, alpha,alpha-dimethyl- | 122-09-8 | P046 | 5,000 | 2,270 |
| Benzenemethanol, 4-chloro-.alpha.-4-chlorophenyl)-.alpha.-(trichloromethyl)- | 115-32-2 | | 10 | 4.5 |
| Benzenesulfonyl chloride | 98-09-9 | U020 | 100 | 45.4 |
| Benzenethiol | 108-98-5 | P014 | 100 | 45.4 |
| Benzene, 1,1'-(2,2,2-trichloroethylidene)bis [4-methoxy]- | 72-43-5 | U247 | 1.0 | 0.454 |
| Benzidine | 92-87-5 | U021 | 1.0 | 0.454 |
| Benzo[b]fluoranthene | 205-99-2 | | 1.0 | 0.454 |
| Benzo(k)fluoranthene | 207-08-9 | | 5,000 | 2,270 |
| Benzoic acid | 65-85-0 | | 5,000 | 2,270 |
| Benzoic acid, 3-amino-2,5-dichloro- | 133-90-4 | | 100 | 45.4 |
| Benzoic trichloride | 98-07-7 | U023 | 10 | 4.5 |
| Benzonitrile | 100-47-0 | | 5,000 | 2,270 |
| Benzo(rst)pentaphene | 189-55-9 | U064 | 10 | 4.5 |
| Benzo[g,h,i]perylene | 191-24-2 | | 5,000 | 2,270 |
| Benzo(a)phenanthrene | 218-01-9 | U050 | 100 | 45.4 |
| Benzo[a]pyrene | 50-32-8 | U022 | 1.0 | 0.454 |
| p-Benzoquinone | 106-51-4 | U197 | 10 | 4.5 |
| Benzotrichloride | 98-07-7 | U023 | 10 | 4.5 |

**Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued**

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Benzoyl chloride | 98-88-4 | | 1,000 | 454 |
| Benzyl chloride | 100-44-7 | P028 | 100 | 45.4 |
| Beryllium(2) | 7440-41-7 | P015 | 10 | 4.5 |
| Beryllium chloride | 7787-47-5 | | 1.0 | 0.454 |
| Beryllium compounds | | | & | & |
| Beryllium fluoride | 7787-49-7 | | 1.0 | 0.454 |
| Beryllium nitrate | 7787-55-5 | | 1.0 | 0.454 |
| Beryllium nitrate | 13597-99-4 | | 1.0 | 0.454 |
| alpha-BHC | 319-84-6 | | 10 | 4.5 |
| beta-BHC | 319-85-7 | | 1.0 | 0.454 |
| delta-BHC | 319-86-8 | | 1.0 | 0.454 |
| 2,2'-Bioxirane | 1464-53-5 | U085 | 10 | 4.5 |
| Biphenyl | 92-52-4 | | 100 | 45.4 |
| Bis(2-chloroethoxy) methane | 111-91-1 | U024 | 1,000 | 454 |
| Bis(2-chloroethyl) ether | 111-44-4 | U025 | 10 | 4.5 |
| Bis(chloromethyl) ether | 542-88-1 | P016 | 10 | 4.5 |
| Bis(2-chloro-1-methylethyl) ether | 108-60-1 | U027 | 1,000 | 454 |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | U028 | 100 | 45.4 |
| Bromoacetone | 598-31-2 | P017 | 1,000 | 454 |
| Bromoform | 75-25-2 | U225 | 100 | 45.4 |
| Bromomethane | 74-83-9 | U029 | 1,000 | 454 |
| 4-Bromophenyl phenyl ether | 101-55-3 | U030 | 100 | 45.4 |
| Brucine | 357-57-3 | P018 | 100 | 45.4 |
| 1,3-Butadiene | 106-99-0 | | 10 | 4.5 |
| 1,3-Butadiene, 2-methyl- | 78-79-5 | | 100 | 45.4 |
| 2-Butenal | 4170-30-3 | U053 | 100 | 45.4 |
| 2-Butenal, (e)- | 123-73-9 | U053 | 100 | 45.4 |
| 2-Butene, 1,4-dichloro- | 764-41-0 | U074 | 1.0 | 0.454 |
| 2,4-D butoxyethyl ester | 1929-73-3 | | 100 | 45.4 |
| Butyl acetate | 123-86-4 | | 5,000 | 2,270 |
| iso-Butyl acetate | 110-19-0 | | 5,000 | 2,270 |
| sec-Butyl acetate | 105-46-4 | | 5,000 | 2,270 |
| tert-Butyl acetate | 540-88-5 | | 5,000 | 2,270 |
| n-Butyl alcohol | 71-36-3 | U031 | 5,000 | 2,270 |
| Butylamine | 109-73-9 | | 1,000 | 454 |
| iso-Butylamine | 78-81-9 | | 1,000 | 454 |
| sec-Butylamine | 513-49-5 | | 1,000 | 454 |
| | 13952-84-6 | | 1,000 | 454 |
| tert-Butylamine | 75-64-9 | | 1,000 | 454 |
| Butyl benzyl phthalate | 85-68-7 | | 100 | 45.4 |
| 1,2-Butylene oxide | 106-88-7 | | 100 | 45.4 |
| n-Butyl phthalate | 84-74-2 | U069 | 10 | 4.5 |
| Butyric acid | 107-92-6 | | 5,000 | 2,270 |
| iso-Butyric acid | 79-31-2 | | 5,000 | 2,270 |
| Cacodylic acid | 75-60-5 | U136 | 1.0 | 0.454 |
| Cadmium(2) | 7440-43-9 | | 10 | 4.5 |
| Cadmium acetate | 543-90-8 | | 10 | 4.5 |
| Cadmium bromide | 7789-42-6 | | 10 | 4.5 |
| Cadmium chloride | 10108-64-2 | | 10 | 4.5 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ$^{(1)}$ | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Cadmium compounds | | | & | & |
| Calcium arsenate | 7778-44-1 | | 1.0 | 0.454 |
| | 52740-16-6 | | 1.0 | 0.454 |
| Calcium carbide | 75-20-7 | | 10 | 4.5 |
| Calcium chromate | 13765-19-0 | U032 | 10 | 4.5 |
| Calcium cyanamide | 156-62-7 | | 1,000 | 454 |
| Calcium cyanide | 592-01-8 | P021 | 10 | 4.5 |
| Calcium dodecylbenzenesulfonate | 26264-06-2 | | 1,000 | 454 |
| Calcium hypochlorite | 7778-54-3 | | 10 | 4.5 |
| Camphechlor | 8001-35-2 | P123 | 1.0 | 0.454 |
| Camphene, octachloro- | 8001-35-2 | P123 | 1.0 | 0.454 |
| Captan | 133-06-2 | | 10 | 4.5 |
| Carbamic acid, ethyl ester | 51-79-6 | U238 | 100 | 45.4 |
| Carbamic acid, methyl-, O-(((2,4-dimethyl-1,3-dithiolan- 2-yl)methylene)amino)- | 26419-73-8 | P185 | 100 | 45.4 |
| Carbamothioic acid, bis(1-methylethyl)-S-(2,3-dichloro- 2-propenyl) ester | 2303-16-4 | U062 | 100 | 45.4 |
| Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester | 52888-80-9 | U387 | 5,000 | 2,270 |
| Carbaryl | 63-25-2 | U279 | 100 | 45.4 |
| Carbendazim | 10605-21-7 | U372 | 10 | 4.5 |
| Carbofuran | 1563-66-2 | P127 | 10 | 4.5 |
| Carbofuran phenol | 1563-38-8 | U367 | 10 | 4.5 |
| Carbon disulfide | 75-15-0 | P022 | 100 | 45.4 |
| Carbonic difluoride | 353-50-4 | U033 | 1,000 | 454 |
| Carbonic dichloride | 75-44-5 | P095 | 10 | 4.5 |
| Carbonochloridic acid, methylester | 79-22-1 | U156 | 1,000 | 454 |
| Carbon oxide sulfide (COS) | 463-58-1 | | 100 | 45.4 |
| Carbon tetrachloride | 56-23-5 | U211 | 10 | 4.5 |
| Carbonyl sulfide | 463-58-1 | | 100 | 45.4 |
| Carbosulfan | 55285-14-8 | P189 | 1000 | 454 |
| Catechol | 120-80-9 | | 100 | 45.4 |
| CFC-11 | 75-69-4 | U121 | 5,000 | 2,270 |
| CFC-12 | 75-71-8 | U075 | 5,000 | 2,270 |
| Chloramben | 133-90-4 | | 100 | 45.4 |
| Chlorambucil | 305-03-3 | U035 | 10 | 4.5 |
| Chlordane | 57-74-9 | U036 | 1.0 | 0.454 |
| Chlordane (technical mixture and metabolites) | | | & | & |
| Chlorinated benzenes | | | & | & |
| Chlorinated ethanes | | | & | & |
| Chlorinated naphthalenes | | | & | & |
| Chlorinated phenols | | | & | & |
| Chlorine | 7782-50-5 | | 10 | 4.5 |
| Chlornaphazine | 494-03-1 | U026 | 100 | 45.4 |
| Chloroacetaldehyde | 107-20-0 | P023 | 1,000 | 454 |
| Chloroacetic acid | 79-11-8 | | 100 | 45.4 |
| 2-Chloroacetophenone | 532-27-4 | | 100 | 45.4 |
| Chloroalkyl ethers | | | & | & |
| p-Chloroaniline | 106-47-8 | P024 | 1,000 | 454 |
| Chlorobenzene | 108-90-7 | U037 | 100 | 45.4 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Chlorobenzilate | 510-15-6 | U038 | 10 | 4.5 |
| p-Chloro-m-cresol | 59-50-7 | U039 | 5,000 | 2,270 |
| 2,4-D chlorocrotyl ester | 2971-38-2 | | 100 | 45.4 |
| Chlorodibromomethane | 124-48-1 | | 100 | 45.4 |
| Chloroethane | 75-00-3 | | 100 | 45.4 |
| 2-Chloroethyl vinyl ether | 110-75-8 | U042 | 1,000 | 454 |
| Chloroform | 67-66-3 | U044 | 10 | 4.5 |
| Chloromethane | 74-87-3 | U045 | 100 | 45.4 |
| Chloromethyl ether | 542-88-1 | P016 | 10 | 4.5 |
| Chloromethyl methyl ether | 107-30-2 | U046 | 10 | 4.5 |
| 2-Chloronaphthalene | 91-58-7 | U047 | 5,000 | 2,270 |
| 2-Chlorophenol | 95-57-8 | U048 | 100 | 45.4 |
| Chlorophenols | | | & | & |
| 4-Chlorophenyl phenyl ether | 7005-72-3 | | 5,000 | 2,270 |
| Chloroprene | 126-99-8 | | 100 | 45.4 |
| 3-Chloropropionitrile | 542-76-7 | P027 | 1,000 | 454 |
| Chlorosulfonic acid | 7790-94-5 | | 1,000 | 454 |
| 4-Chloro-o-toluidine, hydrochloride | 3165-93-3 | U049 | 100 | 45.4 |
| Chlorpyrifos | 2921-88-2 | | 1.0 | 0.454 |
| Chromic acetate | 1066-30-4 | | 1,000 | 454 |
| Chromic acid | 7738-94-5 | | 10 | 4.5 |
| | 11115-74-5 | | 10 | 4.5 |
| Chromic sulfate | 10101-53-8 | | 1,000 | 454 |
| Chromium(2) | 7440-47-3 | | 5,000 | 2,270 |
| Chromium compounds | | | & | & |
| Chromous chloride | 10049-05-5 | | 1,000 | 454 |
| Chrysene | 218-01-9 | U050 | 100 | 45.4 |
| C.I. solvent yellow 34 | 492-80-8 | U014 | 100 | 45.4 |
| Cobalt compounds | | | & | & |
| Cobaltous bromide | 7789-43-7 | | 1,000 | 454 |
| Cobaltous formate | 544-18-3 | | 1,000 | 454 |
| Cobaltous sulfamate | 14017-41-5 | | 1,000 | 454 |
| Coke oven emissions | | | 1.0 | 0.454 |
| Copper(2) | 7440-50-8 | | 5,000 | 2,270 |
| Copper compounds | | | & | & |
| Copper cyanide | 544-92-3 | P029 | 10 | 4.5 |
| Coumaphos | 56-72-4 | | 10 | 4.5 |
| Creosote | | U051 | 1.0 | 0.454 |
| m-Cresol | 108-39-4 | U052 | 100 | 45.4 |
| o-Cresol | 95-48-7 | U052 | 100 | 45.4 |
| p-Cresol | 106-44-5 | U052 | 100 | 45.4 |
| Cresol (mixed isomers) | 1319-77-3 | U052 | 100 | 45.4 |
| Crotonaldehyde | 4170-30-3 | U053 | 100 | 45.4 |
| Crotonaldehyde, (E)- | 123-73-9 | U053 | 100 | 45.4 |
| Cumene | 98-82-8 | U055 | 5,000 | 2,270 |
| Cumene hydroperoxide | 80-15-9 | U096 | 10 | 4.5 |
| Cupric acetate | 142-71-2 | | 100 | 45.4 |
| Cupric acetoarsenite | 12002-03-8 | | 1.0 | 0.454 |
| Cupric chloride | 7447-39-4 | | 10 | 4.5 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[(1)] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Cupric nitrate | 3251-23-8 | | 100 | 45.4 |
| Cupric oxalate | 5893-66-3 | | 100 | 45.4 |
| Cupric sulfate | 7758-98-7 | | 10 | 4.5 |
| Cupric sulfate, ammoniated | 10380-29-7 | | 100 | 45.4 |
| Cupric tartrate | 815-82-7 | | 100 | 45.4 |
| Cyanide compounds | | | & | & |
| Cyanides (soluble salts and complexes), not otherwise specified | | P030 | 10 | 4.5 |
| Cyanogen | 460-19-5 | P031 | 100 | 45.4 |
| Cyanogen bromide | 506-68-3 | U246 | 1,000 | 454 |
| Cyanogen chloride | 506-77-4 | P033 | 10 | 4.5 |
| Cyclohexane | 110-82-7 | U056 | 1,000 | 454 |
| Cyclohexane, 1,2,3,4,5,6-hexachloro-,(1.alpha.,2.alpha., 3.beta.,4.alpha.,5.alpha.,6.beta.)- | 58-89-9 | U129 | 1.0 | 0.454 |
| Cyclohexanone | 108-94-1 | U057 | 5,000 | 2,270 |
| 2-Cyclohexyl-4,6-dinitrophenol | 131-89-5 | P034 | 100 | 45.4 |
| Cyclophosphamide | 50-18-0 | U058 | 10 | 4.5 |
| 2,4-D | 94-75-7 | U240 | 100 | 45.4 |
| 2,4-D acid | 94-75-7 | U240 | 100 | 45.4 |
| 2,4-D butyl ester | 94-80-4 | | 100 | 45.4 |
| 2,4-D esters | 94-11-1 | | 100 | 45.4 |
| | 94-79-1 | | 100 | 45.4 |
| | 94-80-4 | | 100 | 45.4 |
| | 1320-18-9 | | 100 | 45.4 |
| | 1928-38-7 | | 100 | 45.4 |
| | 1928-61-6 | | 100 | 45.4 |
| | 1929-73-3 | | 100 | 45.4 |
| | 2971-38-2 | | 100 | 45.4 |
| | 25168-26-7 | | 100 | 45.4 |
| | 53467-11-1 | | 100 | 45.4 |
| 2,4-D isopropyl ester | 94-11-1 | | 100 | 45.4 |
| 2,4-D propylene glycol butyl ether ester | 1320-18-9 | | 100 | 45.4 |
| 2,4-D, salts and esters | 94-75-7 | U240 | 100 | 45.4 |
| Daunomycin | 20830-81-3 | U059 | 10 | 4.5 |
| DBCP | 96-12-8 | U066 | 1.0 | 0.454 |
| DDD | 72-54-8 | U060 | 1.0 | 0.454 |
| DDE | 72-55-9 | | 1.0 | 0.454 |
| | 3547-04-4 | | 5,000 | 2,270 |
| DDT | 50-29-3 | U061 | 1.0 | 0.454 |
| DDT and metabolites | | | & | & |
| DEHP | 117-81-7 | U028 | 100 | 45.4 |
| Diallate | 2303-16-4 | U062 | 100 | 45.4 |
| Diaminotoluene | 496-72-0 | U221 | 10 | 4.5 |
| | 823-40-5 | U221 | 10 | 4.5 |
| 2,4-Diaminotoluene | 95-80-7 | | 10 | 4.5 |
| Diaminotoluene (mixed isomers) | 25376-45-8 | U221 | 10 | 4.5 |
| Diazinon | 333-41-5 | | 1.0 | 0.454 |
| Diazomethane | 334-88-3 | | 100 | 45.4 |
| Dibenz[a,h]anthracene | 53-70-3 | U063 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Dibenzofuran | 132-64-9 | | 100 | 45.4 |
| Dibenz[a,i]pyrene | 189-55-9 | U064 | 10 | 4.5 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | U066 | 1.0 | 0.454 |
| 1,2-Dibromoethane | 106-93-4 | U067 | 1.0 | 0.454 |
| Dibutyl phthalate | 84-74-2 | U069 | 10 | 4.5 |
| Dicamba | 1918-00-9 | | 1,000 | 454 |
| Dichlobenil | 1194-65-6 | | 100 | 45.4 |
| Dichlone | 117-80-6 | | 1.0 | 0.454 |
| o-Dichlorobenzene | 95-50-1 | U070 | 100 | 45.4 |
| Dichlorobenzene | 25321-22-6 | | 100 | 45.4 |
| 1,2-Dichlorobenzene | 95-50-1 | U070 | 100 | 45.4 |
| 1,3-Dichlorobenzene | 541-73-1 | U071 | 100 | 45.4 |
| 1,4-Dichlorobenzene | 106-46-7 | U072 | 100 | 45.4 |
| Dichlorobenzene (mixed isomers) | 25321-22-6 | | 100 | 45.4 |
| Dichlorobenzidine | | | & | & |
| 3,3'-Dichlorobenzidine | 91-94-1 | U073 | 1.0 | 0.454 |
| Dichlorobromomethane | 75-27-4 | | 5,000 | 2,270 |
| 1,4-Dichloro-2-butene | 764-41-0 | U074 | 1.0 | 0.454 |
| Dichlorodifluoromethane | 75-71-8 | U075 | 5,000 | 2,270 |
| 1,1-Dichloroethane | 75-34-3 | U076 | 1,000 | 454 |
| 1,2-Dichloroethane | 107-06-2 | U077 | 100 | 45.4 |
| 1,1-Dichloroethylene | 75-35-4 | U078 | 100 | 45.4 |
| 1,2-Dichloroethylene | 156-60-5 | U079 | 1,000 | 454 |
| Dichloroethyl ether | 111-44-4 | U025 | 10 | 4.5 |
| Dichloroisopropyl ether | 108-60-1 | U027 | 1,000 | 454 |
| Dichloromethane | 75-09-2 | U080 | 1,000 | 454 |
| 3,6-Dichloro-2-methoxybenzoic acid | 1918-00-9 | | 1,000 | 454 |
| Dichloromethyl ether | 542-88-1 | P016 | 10 | 4.5 |
| 2,6-Dichlorophenol | 87-65-0 | U082 | 100 | 45.4 |
| 2,4-Dichlorophenol | 120-83-2 | U081 | 100 | 45.4 |
| Dichlorophenylarsine | 696-28-6 | P036 | 1.0 | 0.454 |
| Dichloropropane | 26638-19-7 | | 1,000 | 454 |
| Dichloropropane - Dichloropropene (mixture) | 8003-19-8 | | 100 | 45.4 |
| 1,1-Dichloropropane | 78-99-9 | | 1,000 | 454 |
| 1,2-Dichloropropane | 78-87-5 | U083 | 1,000 | 454 |
| 1,3-Dichloropropane | 142-28-9 | | 1,000 | 454 |
| Dichloropropene | 26952-23-8 | | 100 | 45.4 |
| 1,3-Dichloropropene | 542-75-6 | U084 | 100 | 45.4 |
| 2,3-Dichloropropene | 78-88-6 | | 100 | 45.4 |
| 2,2-Dichloropropionic acid | 75-99-0 | | 5,000 | 2,270 |
| 1,3-Dichloropropylene | 542-75-6 | U084 | 100 | 45.4 |
| Dichlorvos | 62-73-7 | | 10 | 4.5 |
| Dicofol | 115-32-2 | | 10 | 4.5 |
| Dieldrin | 60-57-1 | P037 | 1.0 | 0.454 |
| Diepoxybutane | 1464-53-5 | U085 | 10 | 4.5 |
| Diethanolamine | 111-42-2 | | 100 | 45.4 |
| Diethylamine | 109-89-7 | | 100 | 45.4 |
| N,N-Diethylaniline | 91-66-7 | | 1,000 | 454 |
| Diethylarsine | 692-42-2 | P038 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Di(2-ethylhexyl) phthalate | 117-81-7 | U028 | 100 | 45.4 |
| O,O-Diethyl S-methyl dithiophosphate | 3288-58-2 | U087 | 5,000 | 2,270 |
| Diethyl-p-nitrophenyl phosphate | 311-45-5 | P041 | 100 | 45.4 |
| Diethyl phthalate | 84-66-2 | U088 | 1,000 | 454 |
| O,O-Diethyl O-pyrazinyl phosphorothioate | 297-97-2 | P040 | 100 | 45.4 |
| Diethylstilbestrol | 56-53-1 | U089 | 1.0 | 0.454 |
| Diethyl sulfate | 64-67-5 | | 10 | 4.5 |
| Dihydrosafrole | 94-58-6 | U090 | 10 | 4.5 |
| Diisopropylfluorophosphate | 55-91-4 | P043 | 100 | 45.4 |
| 1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-(1.alpha.,4.alpha.,4a.beta., 5.alpha.,8.alpha.,8a.beta.)- | 309-00-2 | P004 | 1.0 | 0.454 |
| Dimethoate | 60-51-5 | P044 | 10 | 4.5 |
| 3,3'-Dimethoxybenzidine | 119-90-4 | U091 | 100 | 45.4 |
| Dimethylamine | 124-40-3 | U092 | 1,000 | 454 |
| 4-Dimethylaminoazobenzene | 60-11-7 | U093 | 10 | 4.5 |
| Dimethylaminoazobenzene | 60-11-7 | U093 | 10 | 4.5 |
| N,N-Dimethylaniline | 121-69-7 | | 100 | 45.4 |
| 7,12-Dimethylbenz[a]anthracene | 57-97-6 | U094 | 1.0 | 0.454 |
| 3,3'-Dimethylbenzidine | 119-93-7 | U095 | 10 | 4.5 |
| 2,2-Dimethyl-1,3-benzodioxol-4-ol methylcarbamate | 22781-23-3 | U278 | 100 | 45.4 |
| Dimethylcarbamyl chloride | 79-44-7 | U097 | 1.0 | 0.454 |
| Dimethylformamide | 68-12-2 | | 100 | 45.4 |
| N,N-Dimethylformamide | 68-12-2 | | 100 | 45.4 |
| 1,1-Dimethyl hydrazine | 57-14-7 | U098 | 10 | 4.5 |
| Dimethyl hydrazine | 57-14-7 | U098 | 10 | 4.5 |
| 2,4-Dimethylphenol | 105-67-9 | U101 | 100 | 45.4 |
| Dimethyl phthalate | 131-11-3 | U102 | 5,000 | 2,270 |
| Dimethyl sulfate | 77-78-1 | U103 | 100 | 45.4 |
| Dimetilan | 644-64-4 | P191 | 1.0 | 0.454 |
| Dinitrobenzene (mixed isomers) | 25154-54-5 | | 100 | 45.4 |
| m-Dinitrobenzene | 99-65-0 | | 100 | 45.4 |
| o-Dinitrobenzene | 528-29-0 | | 100 | 45.4 |
| p-Dinitrobenzene | 100-25-4 | | 100 | 45.4 |
| Dinitrobutyl phenol | 88-85-7 | P020 | 1,000 | 454 |
| 4,6-Dinitro-o-cresol | 534-52-1 | P047 | 10 | 4.5 |
| Dinitrocresol | 534-52-1 | P047 | 10 | 4.5 |
| 4,6-Dinitro-o-cresol and salts | 534-52-1 | P047 | 10 | 4.5 |
| Dinitrophenol | 25550-58-7 | | 10 | 4.5 |
| 2,4-Dinitrophenol | 51-28-5 | P048 | 10 | 4.5 |
| 2,5-Dinitrophenol | 329-71-5 | | 10 | 4.5 |
| 2,6-Dinitrophenol | 573-56-8 | | 10 | 4.5 |
| Dinitrotoluene (mixed isomers) | 25321-14-6 | | 10 | 4.5 |
| 2,4-Dinitrotoluene | 121-14-2 | U105 | 10 | 4.5 |
| 2,6-Dinitrotoluene | 606-20-2 | U106 | 100 | 45.4 |
| 3,4-Dinitrotoluene | 610-39-9 | | 10 | 4.5 |
| Dinoseb | 88-85-7 | P020 | 1,000 | 454 |
| Di-n-octyl phthalate | 117-84-0 | U107 | 5,000 | 2,270 |
| n-Dioctylphthalate | 117-84-0 | U107 | 5,000 | 2,270 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| 1,4-Dioxane | 123-91-1 | U108 | 100 | 45.4 |
| 1,2-Diphenylhydrazine | 122-66-7 | U109 | 10 | 4.5 |
| Diphenylhydrazine | | | & | & |
| Diphosphoramide, octamethyl- | 152-16-9 | P085 | 100 | 45.4 |
| Dipropylamine | 142-84-7 | U110 | 5,000 | 2,270 |
| Di-n-propylnitrosamine | 621-64-7 | U111 | 10 | 4.5 |
| Diquat | 85-00-7 | | 1,000 | 454 |
| Diquat | 2764-72-9 | | 1,000 | 454 |
| Disulfoton | 298-04-4 | P039 | 1.0 | 0.454 |
| Dithiobiuret | 541-53-7 | P049 | 100 | 45.4 |
| 2,4-Dithiobiuret | 541-53-7 | P049 | 100 | 45.4 |
| Diuron | 330-54-1 | | 100 | 45.4 |
| Dodecylbenzenesulfonic acid | 27176-87-0 | | 1,000 | 454 |
| Endosulfan | 115-29-7 | P050 | 1.0 | 0.454 |
| alpha-Endosulfan | 959-98-8 | | 1.0 | 0.454 |
| beta-Endosulfan | 33213-65-9 | | 1.0 | 0.454 |
| Endosulfan and metabolites | | | & | & |
| Endosulfan sulfate | 1031-07-8 | | 1.0 | 0.454 |
| Endothall | 145-73-3 | P088 | 1,000 | 454 |
| Endrin | 72-20-8 | P051 | 1.0 | 0.454 |
| Endrin aldehyde | 7421-93-4 | | 1.0 | 0.454 |
| Endrin and metabolites | | | & | & |
| Epichlorohydrin | 106-89-8 | U041 | 100 | 45.4 |
| Epinephrine | 51-43-4 | P042 | 1,000 | 454 |
| Ethanamine | 75-04-7 | | 100 | 45.4 |
| Ethane, chloro- | 75-00-3 | | 100 | 45.4 |
| 1,2-Ethanediamine | 107-15-3 | | 5,000 | 2,270 |
| Ethanedinitrile | 460-19-5 | P031 | 100 | 45.4 |
| Ethane, 1,1'-oxybis- | 60-29-7 | U117 | 100 | 45.4 |
| Ethane, 1,1,1,2-tetrachloro- | 630-20-6 | U208 | 100 | 45.4 |
| Ethanimidothioic acid, 2-(dimethylamino)-N-hydroxy-2- oxo-, methyl ester | 30558-43-1 | U394 | 5,000 | 2,270 |
| Ethanimidothioic acid, N-[methylamino) carbonyl] | 16752-77-5 | P066 | 100 | 45.4 |
| Ethanol, 2-ethoxy- | 110-80-5 | U359 | 1,000 | 454 |
| Ethanol, 2,2'-oxybis-, dicarbamate | 5952-26-1 | U395 | 5,000 | 2,270 |
| Ethene, chloro- | 75-01-4 | U043 | 1.0 | 0.454 |
| Ethene, 1,1-dichloro- | 75-35-4 | U078 | 100 | 45.4 |
| Ethion | 563-12-2 | | 10 | 4.5 |
| 2-Ethoxyethanol | 110-80-5 | U359 | 1,000 | 454 |
| Ethyl acetate | 141-78-6 | U112 | 5,000 | 2,270 |
| Ethyl acrylate | 140-88-5 | U113 | 1,000 | 454 |
| Ethylbenzene | 100-41-4 | | 1,000 | 454 |
| Ethyl carbamate | 51-79-6 | U238 | 100 | 45.4 |
| Ethyl chloride | 75-00-3 | | 100 | 45.4 |
| Ethyl cyanide | 107-12-0 | P101 | 10 | 4.5 |
| Ethylenebisdithiocarbamic acid, salts & esters | 111-54-6 | U114 | 5,000 | 2,270 |
| Ethylenediamine | 107-15-3 | | 5,000 | 2,270 |
| Ethylenediamine-tetraacetic acid (EDTA) | 60-00-4 | | 5,000 | 2,270 |
| Ethylene dibromide | 106-93-4 | U067 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Ethylene dichloride | 107-06-2 | U077 | 100 | 45.4 |
| Ethylene glycol | 107-21-1 | | 5,000 | 2,270 |
| Ethyleneimine | 151-56-4 | P054 | 1.0 | 0.454 |
| Ethylene oxide | 75-21-8 | U115 | 10 | 4.5 |
| Ethylene thiourea | 96-45-7 | U116 | 10 | 4.5 |
| Ethyl ether | 60-29-7 | U117 | 100 | 45.4 |
| Ethylidene dichloride | 75-34-3 | U076 | 1,000 | 454 |
| Ethyl methacrylate | 97-63-2 | U118 | 1,000 | 454 |
| Ethyl methanesulfonate | 62-50-0 | U119 | 1.0 | 0.454 |
| Famphur | 52-85-7 | P097 | 1,000 | 454 |
| Ferric ammonium citrate | 1185-57-5 | | 1,000 | 454 |
| Ferric ammonium oxalate | 2944-67-4 | | 1,000 | 454 |
| | 55488-87-4 | | 1,000 | 454 |
| Ferric chloride | 7705-08-0 | | 1,000 | 454 |
| Ferric fluoride | 7783-50-8 | | 100 | 45.4 |
| Ferric nitrate | 10421-48-4 | | 1,000 | 454 |
| Ferric sulfate | 10028-22-5 | | 1,000 | 454 |
| Ferrous ammonium sulfate | 10045-89-3 | | 1,000 | 454 |
| Ferrous chloride | 7758-94-3 | | 100 | 45.4 |
| Ferrous sulfate | 7720-78-7 | | 1,000 | 454 |
| | 7782-63-0 | | 1,000 | 454 |
| Fine mineral fibers | | | & | & |
| Fluoranthene | 206-44-0 | U120 | 100 | 45.4 |
| Fluorene | 86-73-7 | | 5,000 | 2,270 |
| Fluorine | 7782-41-4 | P056 | 10 | 4.5 |
| Fluoroacetamide | 640-19-7 | P057 | 100 | 45.4 |
| Fluoroacetic acid, sodium salt | 62-74-8 | P058 | 10 | 4.5 |
| Formaldehyde | 50-00-0 | U122 | 100 | 45.4 |
| Formaldehyde (solution) | 50-00-0 | U122 | 100 | 45.4 |
| Formetanate hydrochloride | 23422-53-9 | P198 | 100 | 45.4 |
| Formic acid | 64-18-6 | U123 | 5,000 | 2,270 |
| Formparanate | 17702-57-7 | P197 | 100 | 45.4 |
| Fumaric acid | 110-17-8 | | 5,000 | 2,270 |
| Furan | 110-00-9 | U124 | 100 | 45.4 |
| Furan, tetrahydro- | 109-99-9 | U213 | 1,000 | 454 |
| Furfural | 98-01-1 | U125 | 5,000 | 2,270 |
| Glycidylaldehyde | 765-34-4 | U126 | 10 | 4.5 |
| Glycol ethers | | | & | & |
| Guanidine, N-methyl-N'-nitro-N-nitroso- | 70-25-7 | U163 | 10 | 4.5 |
| Guthion | 86-50-0 | | 1.0 | 0.454 |
| Haloethers | | | & | & |
| Halomethanes | | | & | & |
| Heptachlor | 76-44-8 | P059 | 1.0 | 0.454 |
| Heptachlor and metabolites | | | & | & |
| Heptachlor epoxide | 1024-57-3 | | 1.0 | 0.454 |
| 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene | 76-44-8 | P059 | 1.0 | 0.454 |
| Hexachlorobenzene | 118-74-1 | U127 | 10 | 4.5 |
| Hexachloro-1,3-butadiene | 87-68-3 | U128 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Hexachlorobutadiene | 87-68-3 | U128 | 1.0 | 0.454 |
| Hexachlorocyclohexane (all isomers) | 608-73-1 | | & | & |
| alpha-Hexachlorocyclohexane | 319-84-6 | | 10 | 4.5 |
| Hexachlorocyclohexane (gamma isomer) | 58-89-9 | U129 | 1.0 | 0.454 |
| Hexachlorocyclopentadiene | 77-47-4 | U130 | 10 | 4.5 |
| Hexachloroethane | 67-72-1 | U131 | 100 | 45.4 |
| Hexachlorophene | 70-30-4 | U132 | 100 | 45.4 |
| Hexachloropropene | 1888-71-7 | U243 | 1,000 | 454 |
| Hexaethyl tetraphosphate | 757-58-4 | P062 | 100 | 45.4 |
| Hexamethylene-1,6-diisocyanate | 822-06-0 | | 100 | 45.4 |
| Hexamethylphosphoramide | 680-31-9 | | 1.0 | 0.454 |
| Hexane | 110-54-3 | | 5,000 | 2,270 |
| n-Hexane | 110-54-3 | | 5,000 | 2,270 |
| Hydrazine | 302-01-2 | U133 | 1.0 | 0.454 |
| Hydrazine, 1,2-diethyl- | 1615-80-1 | U086 | 10 | 4.5 |
| Hydrazine, 1,1-dimethyl- | 57-14-7 | U098 | 10 | 4.5 |
| Hydrazine, 1,2-dimethyl- | 540-73-8 | U099 | 1.0 | 0.454 |
| Hydrazine, 1,2-diphenyl- | 122-66-7 | U109 | 10 | 4.5 |
| Hydrazine, methyl- | 60-34-4 | P068 | 10 | 4.5 |
| Hydrazobenzene | 122-66-7 | U109 | 10 | 4.5 |
| Hydrochloric acid | 7647-01-0 | | 5,000 | 2,270 |
| Hydrochloric acid (concentration of 37% or greater) | 7647-01-0 | | 5,000 | 2,270 |
| Hydrochloric acid (aerosol forms only) | 7647-01-0 | | 5,000 | 2,270 |
| Hydrocyanic acid | 74-90-8 | P063 | 10 | 4.5 |
| Hydrofluoric acid | 7664-39-3 | U134 | 100 | 45.4 |
| Hydrofluoric acid (concentration of 50% or greater) | 7664-39-3 | U134 | 100 | 45.4 |
| Hydrogen chloride (anhydrous) | 7647-01-0 | | 5,000 | 2,270 |
| Hydrogen chloride (gas only) | 7647-01-0 | | 5,000 | 2,270 |
| Hydrogen cyanide | 74-90-8 | P063 | 10 | 4.5 |
| Hydrogen fluoride | 7664-39-3 | U134 | 100 | 45.4 |
| Hydrogen fluoride (anhydrous) | 7664-39-3 | U134 | 100 | 45.4 |
| Hydrogen sulfide | 7783-06-4 | U135 | 100 | 45.4 |
| Hydroperoxide, 1-methyl-1-phenylethyl- | 80-15-9 | U096 | 10 | 4.5 |
| Hydroquinone | 123-31-9 | | 100 | 45.4 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | U137 | 100 | 45.4 |
| Isobutyl alcohol | 78-83-1 | U140 | 5,000 | 2,270 |
| Isodrin | 465-73-6 | P060 | 1.0 | 0.454 |
| Isofluorphate | 55-91-4 | P043 | 100 | 45.4 |
| 1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]- | 133-06-2 | | 10 | 4.5 |
| Isophorone | 78-59-1 | | 5,000 | 2,270 |
| Isoprene | 78-79-5 | | 100 | 45.4 |
| Isopropanolamine dodecylbenzene sulfonate | 42504-46-1 | | 1,000 | 454 |
| Isopropylmethylpyrazolyl dimethylcarbamate | 119-38-0 | P192 | 100 | 45.4 |
| Isosafrole | 120-58-1 | U141 | 100 | 45.4 |
| Kepone | 143-50-0 | U142 | 1.0 | 0.454 |
| Lasiocarpine | 303-34-4 | U143 | 10 | 4.5 |
| Lead(2) | 7439-92-1 | | 10 | 4.5 |
| Lead acetate | 301-04-2 | U144 | 10 | 4.5 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Lead arsenate | 7645-25-2 | | 1.0 | 0.454 |
| | 7784-40-9 | | 1.0 | 0.454 |
| | 10102-48-4 | | 1.0 | 0.454 |
| Lead chloride | 7758-95-4 | | 10 | 4.5 |
| Lead compounds | | | & | & |
| Lead fluoborate | 13814-96-5 | | 10 | 4.5 |
| Lead fluoride | 7783-46-2 | | 10 | 4.5 |
| Lead iodide | 10101-63-0 | | 10 | 4.5 |
| Lead nitrate | 10099-74-8 | | 10 | 4.5 |
| Lead phosphate | 7446-27-7 | U145 | 10 | 4.5 |
| Lead stearate | 1072-35-1 | | 10 | 4.5 |
| | 7428-48-0 | | 10 | 4.5 |
| | 52652-59-2 | | 10 | 4.5 |
| | 56189-09-4 | | 10 | 4.5 |
| Lead subacetate | 1335-32-6 | U146 | 10 | 4.5 |
| Lead sulfate | 7446-14-2 | | 10 | 4.5 |
| | 15739-80-7 | | 10 | 4.5 |
| Lead sulfide | 1314-87-0 | | 10 | 4.5 |
| Lead thiocyanate | 592-87-0 | | 10 | 4.5 |
| Lindane | 58-89-9 | U129 | 1.0 | 0.454 |
| Lithium chromate | 14307-35-8 | | 10 | 4.5 |
| Malathion | 121-75-5 | | 100 | 45.4 |
| Maleic acid | 110-16-7 | | 5,000 | 2,270 |
| Maleic anhydride | 108-31-6 | U147 | 5,000 | 2,270 |
| Maleic hydrazide | 123-33-1 | U148 | 5,000 | 2,270 |
| Malononitrile | 109-77-3 | U149 | 1,000 | 454 |
| Manganese, bis(dimethylcarbamodithioato-S,S')- | 15339-36-3 | P196 | 10 | 4.5 |
| Manganese compounds | | | & | & |
| MBOCA | 101-14-4 | U158 | 10 | 4.5 |
| MDI | 101-68-8 | | 5,000 | 2,270 |
| Melphalan | 148-82-3 | U150 | 1.0 | 0.454 |
| Mercaptodimethur | 2032-65-7 | P199 | 10 | 4.5 |
| Mercuric cyanide | 592-04-1 | | 1.0 | 0.454 |
| Mercuric nitrate | 10045-94-0 | | 10 | 4.5 |
| Mercuric sulfate | 7783-35-9 | | 10 | 4.5 |
| Mercuric thiocyanate | 592-85-8 | | 10 | 4.5 |
| Mercurous nitrate | 7782-86-7 | | 10 | 4.5 |
| Mercurous nitrate | 10415-75-5 | | 10 | 4.5 |
| Mercury | 7439-97-6 | U151 | 1.0 | 0.454 |
| Mercury compounds | | | & | & |
| Mercury fulminate | 628-86-4 | P065 | 10 | 4.5 |
| Methacrylonitrile | 126-98-7 | U152 | 1,000 | 454 |
| Methanamine | 74-89-5 | | 100 | 45.4 |
| Methanamine, N,N-dimethyl- | 75-50-3 | | 100 | 45.4 |
| Methanamine, N-methyl- | 124-40-3 | U092 | 1,000 | 454 |
| Methanamine, N-methyl-N-nitroso- | 62-75-9 | P082 | 10 | 4.5 |
| Methane, chloro- | 74-87-3 | U045 | 100 | 45.4 |
| Methane, chloromethoxy- | 107-30-2 | U046 | 10 | 4.5 |
| Methane, isocyanato- | 624-83-9 | P064 | 10 | 4.5 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Methane, oxybis[chloro- | 542-88-1 | P016 | 10 | 4.5 |
| Methanesulfenyl chloride, trichloro- | 594-42-3 | | 100 | 45.4 |
| Methane, tetranitro- | 509-14-8 | P112 | 10 | 4.5 |
| Methanethiol | 74-93-1 | U153 | 100 | 45.4 |
| Methane, trichloro- | 67-66-3 | U044 | 10 | 4.5 |
| 4,7-Methanoindan, 1,2,3,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro- | 57-74-9 | U036 | 1.0 | 0.454 |
| Methanol | 67-56-1 | U154 | 5,000 | 2,270 |
| Methapyrilene | 91-80-5 | U155 | 5,000 | 2,270 |
| Methiocarb | 2032-65-7 | P199 | 10 | 4.5 |
| Methomyl | 16752-77-5 | P066 | 100 | 45.4 |
| Methoxychlor | 72-43-5 | U247 | 1.0 | 0.454 |
| Methyl bromide | 74-83-9 | U029 | 1,000 | 454 |
| Methyl chloride | 74-87-3 | U045 | 100 | 45.4 |
| Methyl chlorocarbonate | 79-22-1 | U156 | 1,000 | 454 |
| Methyl chloroform | 71-55-6 | U226 | 1,000 | 454 |
| Methyl chloroformate | 79-22-1 | U156 | 1,000 | 454 |
| 3-Methylcholanthrene | 56-49-5 | U157 | 10 | 4.5 |
| 4,4'-Methylenebis(2-chloroaniline) | 101-14-4 | U158 | 10 | 4.5 |
| Methylenebis(phenylisocyanate) | 101-68-8 | | 5,000 | 2,270 |
| Methylene bromide | 74-95-3 | U068 | 1,000 | 454 |
| Methylene chloride | 75-09-2 | U080 | 1,000 | 454 |
| 4,4'-Methylenedianiline | 101-77-9 | | 10 | 4.5 |
| Methyl ethyl ketone | 78-93-3 | U159 | 5,000 | 2,270 |
| Methyl ethyl ketone peroxide | 1338-23-4 | U160 | 10 | 4.5 |
| Methyl hydrazine | 60-34-4 | P068 | 10 | 4.5 |
| Methyl iodide | 74-88-4 | U138 | 100 | 45.4 |
| Methyl isobutyl ketone | 108-10-1 | U161 | 5,000 | 2,270 |
| Methyl isocyanate | 624-83-9 | P064 | 10 | 4.5 |
| 2-Methyllactonitrile | 75-86-5 | P069 | 10 | 4.5 |
| Methyl mercaptan | 74-93-1 | U153 | 100 | 45.4 |
| Methyl methacrylate | 80-62-6 | U162 | 1,000 | 454 |
| Methyl parathion | 298-00-0 | P071 | 100 | 45.4 |
| 2-Methylpyridine | 109-06-8 | U191 | 5,000 | 2,270 |
| Methyl tert-butyl ether | 1634-04-4 | | 1,000 | 454 |
| Methylthiouracil | 56-04-2 | U164 | 10 | 4.5 |
| Metolcarb | 1129-41-5 | P190 | 1,000 | 454 |
| Mevinphos | 7786-34-7 | | 10 | 4.5 |
| Mexacarbate | 315-18-4 | P128 | 1,000 | 454 |
| Mitomycin C | 50-07-7 | U010 | 10 | 4.5 |
| Monoethylamine | 75-04-7 | | 100 | 45.4 |
| Monomethylamine | 74-89-5 | | 100 | 45.4 |
| Muscimol | 2763-96-4 | P007 | 1,000 | 454 |
| Naled | 300-76-5 | | 10 | 4.5 |
| Naphthalene | 91-20-3 | U165 | 100 | 45.4 |
| 1-Naphthalenol, methylcarbamate | 63-25-2 | U279 | 100 | 45.4 |
| Naphthenic acid | 1338-24-5 | | 100 | 45.4 |
| 1,4-Naphthoquinone | 130-15-4 | U166 | 5,000 | 2,270 |
| alpha-Naphthylamine | 134-32-7 | U167 | 100 | 45.4 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| beta-Naphthylamine | 91-59-8 | U168 | 10 | 4.5 |
| Nickel[2] | 7440-02-0 | | 100 | 45.4 |
| Nickel ammonium sulfate | 15699-18-0 | | 100 | 45.4 |
| Nickel carbonyl | 13463-39-3 | P073 | 10 | 4.5 |
| Nickel chloride | 7718-54-9 | | 100 | 45.4 |
| Nickel chloride | 37211-05-5 | | 100 | 45.4 |
| Nickel compounds | | | & | & |
| Nickel cyanide | 557-19-7 | P074 | 10 | 4.5 |
| Nickel hydroxide | 12054-48-7 | | 10 | 4.5 |
| Nickel nitrate | 14216-75-2 | | 100 | 45.4 |
| Nickel sulfate | 7786-81-4 | | 100 | 45.4 |
| Nicotine | 54-11-5 | P075 | 100 | 45.4 |
| Nicotine and salts | 54-11-5 | P075 | 100 | 45.4 |
| Nicotine sulfate | 65-30-5 | | 100 | 45.4 |
| Nitric acid | 7697-37-2 | | 1,000 | 454 |
| Nitric acid (conc 80% or greater) | 7697-37-2 | | 1,000 | 454 |
| Nitric oxide | 10102-43-9 | P076 | 10 @ | 4.5 @ |
| p-Nitroaniline | 100-01-6 | P077 | 5,000 | 2,270 |
| Nitrobenzene | 98-95-3 | U169 | 1,000 | 454 |
| 4-Nitrobiphenyl | 92-93-3 | | 10 | 4.5 |
| Nitrogen dioxide | 10102-44-0 | P078 | 10 @ | 4.5 @ |
| Nitrogen dioxide | 10544-72-6 | | 10 @ | 4.5 @ |
| Nitrogen oxide (NO) | 10102-43-9 | P076 | 10 @ | 4.5 @ |
| Nitroglycerin | 55-63-0 | P081 | 10 | 4.5 |
| Nitrophenol (mixed isomers) | 25154-55-6 | | 100 | 45.4 |
| 2-Nitrophenol | 88-75-5 | | 100 | 45.4 |
| 4-Nitrophenol | 100-02-7 | U170 | 100 | 45.4 |
| m-Nitrophenol | 554-84-7 | | 100 | 45.4 |
| p-Nitrophenol | 100-02-7 | U170 | 100 | 45.4 |
| Nitrophenols | | | & | & |
| 2-Nitropropane | 79-46-9 | U171 | 10 | 4.5 |
| Nitrosamines | | | & | & |
| N-Nitrosodi-n-butylamine | 924-16-3 | U172 | 10 | 4.5 |
| N-Nitrosodiethanolamine | 1116-54-7 | U173 | 1.0 | 0.454 |
| N-Nitrosodiethylamine | 55-18-5 | U174 | 1.0 | 0.454 |
| N-Nitrosodimethylamine | 62-75-9 | P082 | 10 | 4.5 |
| Nitrosodimethylamine | 62-75-9 | P082 | 10 | 4.5 |
| N-Nitrosodiphenylamine | 86-30-6 | | 100 | 45.4 |
| N-Nitrosodi-n-propylamine | 621-64-7 | U111 | 10 | 4.5 |
| N-Nitroso-N-ethylurea | 759-73-9 | U176 | 1.0 | 0.454 |
| N-Nitroso-N-methylurea | 684-93-5 | U177 | 1.0 | 0.454 |
| N-Nitroso-N-methylurethane | 615-53-2 | U178 | 1.0 | 0.454 |
| N-Nitrosomethylvinylamine | 4549-40-0 | P084 | 10 | 4.5 |
| N-Nitrosomorpholine | 59-89-2 | | 1.0 | 0.454 |
| N-Nitrosopiperidine | 100-75-4 | U179 | 10 | 4.5 |
| N-Nitrosopyrrolidine | 930-55-2 | U180 | 1.0 | 0.454 |
| Nitrotoluene | 1321-12-6 | | 1,000 | 454 |
| m-Nitrotoluene | 99-08-1 | | 1,000 | 454 |
| o-Nitrotoluene | 88-72-2 | | 1,000 | 454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| p-Nitrotoluene | 99-99-0 | | 1,000 | 454 |
| 5-Nitro-o-toluidine | 99-55-8 | U181 | 100 | 45.4 |
| Oleum (fuming sulfuric acid) | 8014-95-7 | | 1,000 | 454 |
| Organorhodium complex (PMN-82-147) | | | | |
| Osmium oxide $OsO_4$ (T-4)- | 20816-12-0 | P087 | 1,000 | 454 |
| Osmium tetroxide | 20816-12-0 | P087 | 1,000 | 454 |
| Oxamyl | 23135-22-0 | P194 | 100 | 45.4 |
| Oxirane | 75-21-8 | U115 | 10 | 4.5 |
| Oxirane, (chloromethyl)- | 106-89-8 | U041 | 100 | 45.4 |
| Oxirane, methyl- | 75-56-9 | | 100 | 45.4 |
| Paraformaldehyde | 30525-89-4 | | 1,000 | 454 |
| Paraldehyde | 123-63-7 | U182 | 1,000 | 454 |
| Parathion | 56-38-2 | P089 | 10 | 4.5 |
| Parathion-methyl | 298-00-0 | P071 | 100 | 45.4 |
| Paris green | 12002-03-8 | | 1.0 | 0.454 |
| PCBs | 1336-36-3 | | 1.0 | 0.454 |
| PCNB | 82-68-8 | U185 | 100 | 45.4 |
| PCP | 87-86-5 | | 10 | 4.5 |
| Pentachlorobenzene | 608-93-5 | U183 | 10 | 4.5 |
| Pentachloroethane | 76-01-7 | U184 | 10 | 4.5 |
| Pentachloronitrobenzene | 82-68-8 | U185 | 100 | 45.4 |
| Pentachlorophenol | 87-86-5 | | 10 | 4.5 |
| 1,3-Pentadiene | 504-60-9 | U186 | 100 | 45.4 |
| Perchloroethylene | 127-18-4 | U210 | 100 | 45.4 |
| Perchloromethyl mercaptan | 594-42-3 | | 100 | 45.4 |
| Phenacetin | 62-44-2 | U187 | 100 | 45.4 |
| Phenanthrene | 85-01-8 | | 5,000 | 2,270 |
| Phenol | 108-95-2 | U188 | 1,000 | 454 |
| Phenol, 2-(1-methylethoxy)-, methylcarbamate | 114-26-1 | U411 | 100 | 45.4 |
| Phenol, 3-(1-methylethyl)-, methylcarbamate | 64-00-6 | P202 | 10 | 4.5 |
| Phenyl dichloroarsine | 696-28-6 | P036 | 1.0 | 0.454 |
| p-Phenylenediamine | 106-50-3 | | 5,000 | 2,270 |
| Phenylmercuric acetate | 62-38-4 | P092 | 100 | 45.4 |
| Phenylmercury acetate | 62-38-4 | P092 | 100 | 45.4 |
| Phenylthiourea | 103-85-5 | P093 | 100 | 45.4 |
| Phorate | 298-02-2 | P094 | 10 | 4.5 |
| Phosgene | 75-44-5 | P095 | 10 | 4.5 |
| Phosphine | 7803-51-2 | P096 | 100 | 45.4 |
| Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-, dimethyl ester | 52-68-6 | | 100 | 45.4 |
| Phosphoric acid | 7664-38-2 | | 5,000 | 2,270 |
| Phosphoric acid, 2-dichloroethenyl dimethyl ester | 62-73-7 | | 10 | 4.5 |
| Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester | 56-38-2 | P089 | 10 | 4.5 |
| Phosphorous trichloride | 7719-12-2 | | 1,000 | 454 |
| Phosphorus (yellow or white) | 7723-14-0 | | 1.0 | 0.454 |
| Phosphorus | 7723-14-0 | | 1.0 | 0.454 |
| Phosphorus oxychloride | 10025-87-3 | | 1,000 | 454 |
| Phosphorus trichloride | 7719-12-2 | | 1,000 | 454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Phosphoryl chloride | 10025-87-3 | | 1,000 | 454 |
| Phthalate esters | | | & | & |
| Phthalic anhydride | 85-44-9 | U190 | 5,000 | 2,270 |
| Physostigmine | 57-47-6 | P204 | 100 | 45.4 |
| Physostigmine, salicylate (1:1) | 57-64-7 | P188 | 100 | 45.4 |
| 2-Picoline | 109-06-8 | U191 | 5,000 | 2,270 |
| PCBs | 1336-36-3 | | 1.0 | 0.454 |
| Polycyclic organic matter | | | & | & |
| Polynuclear aromatic hydrocarbons | | | & | & |
| Potassium arsenate | 7784-41-0 | | 1.0 | 0.454 |
| Potassium arsenite | 10124-50-2 | | 1.0 | 0.454 |
| Potassium bichromate | 7778-50-9 | | 10 | 4.5 |
| Potassium chromate | 7789-00-6 | | 10 | 4.5 |
| Potassium cyanide | 151-50-8 | P098 | 10 | 4.5 |
| Potassium hydroxide | 1310-58-3 | | 1,000 | 454 |
| Potassium permanganate | 7722-64-7 | | 100 | 45.4 |
| Potassium silver cyanide | 506-61-6 | P099 | 1.0 | 0.454 |
| Promecarb | 2631-37-0 | P201 | 1,000 | 454 |
| Pronamide | 23950-58-5 | U192 | 5,000 | 2,270 |
| Propane 1,2-dichloro- | 78-87-5 | U083 | 1,000 | 454 |
| Propanenitrile | 107-12-0 | P101 | 10 | 4.5 |
| Propane sultone | 1120-71-4 | U193 | 10 | 4.5 |
| 1,3-Propane sultone | 1120-71-4 | U193 | 10 | 4.5 |
| Propargite | 2312-35-8 | | 10 | 4.5 |
| Propargyl alcohol | 107-19-7 | P102 | 1,000 | 454 |
| 2-Propenal | 107-02-8 | P003 | 1.0 | 0.454 |
| 2-Propenenitrile | 107-13-1 | U009 | 100 | 45.4 |
| 2-Propenenitrile, 2-methyl- | 126-98-7 | U152 | 1,000 | 454 |
| 2-Propen-1-ol | 107-18-6 | P005 | 100 | 45.4 |
| Propham | 122-42-9 | U373 | 1000 | 454 |
| beta-Propiolactone | 57-57-8 | | 10 | 4.5 |
| Propionaldehyde | 123-38-6 | | 1,000 | 454 |
| Propionic acid | 79-09-4 | | 5,000 | 2,270 |
| Propionic anhydride | 123-62-6 | | 5,000 | 2,270 |
| Propionitrile | 107-12-0 | P101 | 10 | 4.5 |
| Propionitrile, 3-chloro- | 542-76-7 | P027 | 1,000 | 454 |
| Propoxur | 114-26-1 | U411 | 100 | 45.4 |
| n-Propylamine | 107-10-8 | U194 | 5,000 | 2,270 |
| Propyleneimine | 75-55-8 | P067 | 1.0 | 0.454 |
| Propylene oxide | 75-56-9 | | 100 | 45.4 |
| Pyrene | 129-00-0 | | 5,000 | 2,270 |
| Pyrethrins | 121-21-1 | | 1.0 | 0.454 |
| | 121-29-9 | | 1.0 | 0.454 |
| | 8003-34-7 | | 1.0 | 0.454 |
| Pyridine | 110-86-1 | U196 | 1,000 | 454 |
| Pyridine, 4-amino- | 504-24-5 | P008 | 1,000 | 454 |
| Pyridine, 3-(1-methyl-2-pyrrolidinyl)-,(S)- | 54-11-5 | P075 | 100 | 45.4 |
| Quinoline | 91-22-5 | | 5,000 | 2,270 |
| Quinone | 106-51-4 | U197 | 10 | 4.5 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Quintozene | 82-68-8 | U185 | 100 | 45.4 |
| Reserpine | 50-55-5 | U200 | 5,000 | 2,270 |
| Resorcinol | 108-46-3 | U201 | 5,000 | 2,270 |
| Saccharin (manufacturing) | 81-07-2 | U202 | 100 | 45.4 |
| Saccharin and salts | 81-07-2 | U202 | 100 | 45.4 |
| Safrole | 94-59-7 | U203 | 100 | 45.4 |
| Selenious acid | 7783-00-8 | U204 | 10 | 4.5 |
| Selenious acid, dithallium(1+) salt | 12039-52-0 | P114 | 1,000 | 454 |
| Selenium(2) | 7782-49-2 | | 100 | 45.4 |
| Selenium compounds | | | & | & |
| Selenium dioxide | 7446-08-4 | | 10 | 4.5 |
| Selenium sulfide | 7488-56-4 | U205 | 10 | 4.5 |
| Selenourea | 630-10-4 | P103 | 1,000 | 454 |
| Silver(2) | 7440-22-4 | | 1,000 | 454 |
| Silver compounds | | | & | & |
| Silver cyanide | 506-64-9 | P104 | 1.0 | 0.454 |
| Silver nitrate | 7761-88-8 | | 1.0 | 0.454 |
| Silvex (2,4,5-TP) | 93-72-1 | | 100 | 45.4 |
| Sodium | 7440-23-5 | | 10 | 4.5 |
| Sodium arsenate | 7631-89-2 | | 1.0 | 0.454 |
| | 7784-46-5 | | 1.0 | 0.454 |
| Sodium azide ($Na[N_3]$) | 26628-22-8 | P105 | 1,000 | 454 |
| Sodium bichromate | 10588-01-9 | | 10 | 4.5 |
| Sodium bifluoride | 1333-83-1 | | 100 | 45.4 |
| Sodium bisulfite | 7631-90-5 | | 5,000 | 2,270 |
| Sodium chromate | 7775-11-3 | | 10 | 4.5 |
| Sodium cyanide (Na[CN]) | 143-33-9 | P106 | 10 | 4.5 |
| Sodium dodecylbenzenesulfonate | 25155-30-0 | | 1,000 | 454 |
| Sodium fluoride | 7681-49-4 | | 1,000 | 454 |
| Sodium fluoroacetate | 62-74-8 | P058 | 10 | 4.5 |
| Sodium hydrosulfide | 16721-80-5 | | 5,000 | 2,270 |
| Sodium hydroxide | 1310-73-2 | | 1,000 | 454 |
| Sodium hypochlorite | 7681-52-9 | | 100 | 45.4 |
| | 10022-70-5 | | 100 | 45.4 |
| Sodium methylate | 124-41-4 | | 1,000 | 454 |
| Sodium nitrite | 7632-00-0 | | 100 | 45.4 |
| Sodium phosphate, dibasic | 7558-79-4 | | 5,000 | 2,270 |
| | 10039-32-4 | | 5,000 | 2,270 |
| | 10140-65-5 | | 5,000 | 2,270 |
| Sodium phosphate, tribasic | 7601-54-9 | | 5,000 | 2,270 |
| | 10101-89-0 | | 5,000 | 2,270 |
| | 10361-89-4 | | 5,000 | 2,270 |
| Sodium selenite | 7782-82-3 | | 100 | 45.4 |
| Sodium selenite | 10102-18-8 | | 100 | 45.4 |
| Streptozotocin | 18883-66-4 | U206 | 1.0 | 0.454 |
| Strontium chromate | 7789-06-2 | | 10 | 4.5 |
| Strychnine | 57-24-9 | P108 | 10 | 4.5 |
| Strychnine and salts | 57-24-9 | P108 | 10 | 4.5 |
| Strychnine, sulfate | 60-41-3 | | 10 | 4.5 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Styrene | 100-42-5 | | 1,000 | 454 |
| Styrene oxide | 96-09-3 | | 100 | 45.4 |
| Sulfotep | 3689-24-5 | P109 | 100 | 45.4 |
| Sulfuric acid (aerosol forms only) | 7664-93-9 | | 1,000 | 454 |
| Sulfuric acid | 7664-93-9 | | 1,000 | 454 |
| Sulfuric acid (fuming) | 8014-95-7 | | 1,000 | 454 |
| Sulfuric acid, mixture with sulfur trioxide | 8014-95-7 | | 1,000 | 454 |
| Sulfur monochloride | 12771-08-3 | | 1,000 | 454 |
| | 10025-67-9 | | 1,000 | 454 |
| Sulfur phosphide | 1314-80-3 | U189 | 100 | 45.4 |
| 2,4,5-T acid | 93-76-5 | | 1,000 | 454 |
| 2,4,5-T amines | 1319-72-8 | | 5,000 | 2,270 |
| | 2008-46-0 | | 5,000 | 2,270 |
| | 3813-14-7 | | 5,000 | 2,270 |
| | 6369-96-6 | | 5,000 | 2,270 |
| | 6369-97-7 | | 5,000 | 2,270 |
| 2,4,5-T esters | 93-79-8 | | 1,000 | 454 |
| | 1928-47-8 | | 1,000 | 454 |
| | 2545-59-7 | | 1,000 | 454 |
| | 25168-15-4 | | 1,000 | 454 |
| | 61792-07-2 | | 1,000 | 454 |
| 2,4,5-T salts | 13560-99-1 | | 1,000 | 454 |
| TEPP | 107-49-3 | P111 | 10 | 4.5 |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | U207 | 5,000 | 2,270 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | 1746-01-6 | | 1.0 | 0.454 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | U209 | 100 | 45.4 |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | U208 | 100 | 45.4 |
| Tetrachloroethylene | 127-18-4 | U210 | 100 | 45.4 |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | | 10 | 4.5 |
| Tetraethyl dithiopyrophosphate | 3689-24-5 | P109 | 100 | 45.4 |
| Tetraethyl lead | 78-00-2 | P110 | 10 | 4.5 |
| Tetraethyl pyrophosphate | 107-49-3 | P111 | 10 | 4.5 |
| Tetranitromethane | 509-14-8 | P112 | 10 | 4.5 |
| Thallic oxide | 1314-32-5 | P113 | 100 | 45.4 |
| Thallium(2) | 7440-28-0 | | 1,000 | 454 |
| Thallium(I) acetate | 563-68-8 | U214 | 100 | 45.4 |
| Thallium(I) carbonate | 6533-73-9 | U215 | 100 | 45.4 |
| Thallium chloride | 7791-12-0 | U216 | 100 | 45.4 |
| Thallium compounds | | | & | & |
| Thallium(I) nitrate | 10102-45-1 | U217 | 100 | 45.4 |
| Thallium(I) sulfate | 7446-18-6 | P115 | 100 | 45.4 |
| Thallium sulfate | 10031-59-1 | | 100 | 45.4 |
| Thallous carbonate | 6533-73-9 | U215 | 100 | 45.4 |
| Thallous chloride | 7791-12-0 | U216 | 100 | 45.4 |
| Thallous sulfate | 7446-18-6 | P115 | 100 | 45.4 |
| Thioacetamide | 62-55-5 | U218 | 10 | 4.5 |
| Thiodicarb | 59669-26-0 | U410 | 100 | 45.4 |
| Thiofanox | 39196-18-4 | P045 | 100 | 45.4 |
| Thiomethanol | 74-93-1 | U153 | 100 | 45.4 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Thionazin | 297-97-2 | P040 | 100 | 45.4 |
| Thiophanate-methyl | 23564-05-8 | U409 | 10 | 4.5 |
| Thiophenol | 108-98-5 | P014 | 100 | 45.4 |
| Thiosemicarbazide | 79-19-6 | P116 | 100 | 45.4 |
| Thiourea | 62-56-6 | U219 | 10 | 4.5 |
| Thiourea, (2-chlorophenyl)- | 5344-82-1 | P026 | 100 | 45.4 |
| Thiourea, 1-naphthalenyl- | 86-88-4 | P072 | 100 | 45.4 |
| Thiram | 137-26-8 | U244 | 10 | 4.5 |
| Titanium chloride ($TiCl_4$) (T-4)- | 7550-45-0 | | 1,000 | 454 |
| Titanium tetrachloride | 7550-45-0 | | 1,000 | 454 |
| o-Tolidine | 119-93-7 | U095 | 10 | 4.5 |
| Toluene | 108-88-3 | U220 | 1,000 | 454 |
| Toluenediamine | 25376-45-8 | U221 | 10 | 4.5 |
| Toluene-2,4-diisocyanate | 584-84-9 | | 100 | 45.4 |
| Toluene-2,6-diisocyanate | 91-08-7 | | 100 | 45.4 |
| Toluenediisocyanate (mixed isomers) | 26471-62-5 | U223 | 100 | 45.4 |
| Toluene diisocyanate (unspecified isomer) | 26471-62-5 | U223 | 100 | 45.4 |
| o-Toluidine | 95-53-4 | U328 | 100 | 45.4 |
| p-Toluidine | 106-49-0 | U353 | 100 | 45.4 |
| o-Toluidine hydrochloride | 636-21-5 | U222 | 100 | 45.4 |
| Toxaphene | 8001-35-2 | P123 | 1.0 | 0.454 |
| 2,4,5-TP esters | 32534-95-5 | | 100 | 45.4 |
| Triallate | 2303-17-5 | U389 | 100 | 45.4 |
| Tribromomethane | 75-25-2 | U225 | 100 | 45.4 |
| Trichlorfon | 52-68-6 | | 100 | 45.4 |
| 1,2,4-Trichlorobenzene | 120-82-1 | | 100 | 45.4 |
| 1,1,1-Trichloroethane | 71-55-6 | U226 | 1,000 | 454 |
| 1,1,2-Trichloroethane | 79-00-5 | U227 | 100 | 45.4 |
| Trichloroethylene | 79-01-6 | U228 | 100 | 45.4 |
| Trichlorofluoromethane | 75-69-4 | U121 | 5,000 | 2,270 |
| Trichloromethanesulfenyl chloride | 594-42-3 | | 100 | 45.4 |
| Trichloromonofluoromethane | 75-69-4 | U121 | 5,000 | 2,270 |
| Trichlorophenol | 25167-82-2 | | 10 | 4.5 |
| 2,3,4-Trichlorophenol | 15950-66-0 | | 10 | 4.5 |
| 2,3,5-Trichlorophenol | 933-78-8 | | 10 | 4.5 |
| 2,3,6-Trichlorophenol | 933-75-5 | | 10 | 4.5 |
| 2,4,5-Trichlorophenol | 95-95-4 | | 10 | 4.5 |
| 2,4,6-Trichlorophenol | 88-06-2 | | 10 | 4.5 |
| 3,4,5-Trichlorophenol | 609-19-8 | | 10 | 4.5 |
| Triethanolamine dodecylbenzene sulfonate | 27323-41-7 | | 1,000 | 454 |
| Triethylamine | 121-44-8 | U404 | 5,000 | 2,270 |
| Trifluralin | 1582-09-8 | | 10 | 4.5 |
| Trimethylamine | 75-50-3 | | 100 | 45.4 |
| 2,2,4-Trimethylpentane | 540-84-1 | | 1,000 | 454 |
| 1,3,5-Trinitrobenzene | 99-35-4 | U234 | 10 | 4.5 |
| Tris(2,3-dibromopropyl) phosphate | 126-72-7 | U235 | 10 | 4.5 |
| Trypan blue | 72-57-1 | U236 | 10 | 4.5 |
| Uracil mustard | 66-75-1 | U237 | 10 | 4.5 |
| Uranyl acetate | 541-09-3 | | 100 | 45.4 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Uranyl nitrate | 10102-06-4 | | 100 | 45.4 |
| | 36478-76-9 | | 100 | 45.4 |
| Urethane | 51-79-6 | U238 | 100 | 45.4 |
| Vanadium pentoxide | 1314-62-1 | P120 | 1,000 | 454 |
| Vanadyl sulfate | 27774-13-6 | | 1,000 | 454 |
| Vinyl acetate | 108-05-4 | | 5,000 | 2,270 |
| Vinyl acetate monomer | 108-05-4 | | 5,000 | 2,270 |
| Vinyl bromide | 593-60-2 | | 100 | 45.4 |
| Vinyl chloride | 75-01-4 | U043 | 1.0 | 0.454 |
| Vinylidene chloride | 75-35-4 | U078 | 100 | 45.4 |
| Warfarin | 81-81-2 | P001 | 100 | 45.4 |
| Warfarin and salts, concentration > 0.3% | 81-81-2 | P001 | 100 | 45.4 |
| Warfarin sodium | 129-06-6 | | 100 | 45.4 |
| m-Xylene | 108-38-3 | U239 | 1,000 | 454 |
| o-Xylene | 95-47-6 | U239 | 1,000 | 454 |
| p-Xylene | 106-42-3 | U239 | 100 | 45.4 |
| Xylene (mixed isomers) | 1330-20-7 | U239 | 100 | 45.4 |
| Xylenol | 1300-71-6 | | 1,000 | 454 |
| Zinc (fume or dust) | 7440-66-6 | | 1,000 | 454 |
| Zinc[2] | 7440-66-6 | | 1,000 | 454 |
| Zinc acetate | 557-34-6 | | 1,000 | 454 |
| Zinc ammonium chloride | 14639-97-5 | | 1,000 | 454 |
| | 14639-98-6 | | 1,000 | 454 |
| | 52628-25-8 | | 1,000 | 454 |
| Zinc borate | 1332-07-6 | | 1,000 | 454 |
| Zinc bromide | 7699-45-8 | | 1,000 | 454 |
| Zinc carbonate | 3486-35-9 | | 1,000 | 454 |
| Zinc chloride | 7646-85-7 | | 1,000 | 454 |
| Zinc compounds | | | & | & |
| Zinc cyanide | 557-21-1 | P121 | 10 | 4.5 |
| Zinc fluoride | 7783-49-5 | | 1,000 | 454 |
| Zinc formate | 557-41-5 | | 1,000 | 454 |
| Zinc hydrosulfite | 7779-86-4 | | 1,000 | 454 |
| Zinc nitrate | 7779-88-6 | | 1,000 | 454 |
| Zinc phenolsulfonate | 127-82-2 | | 5,000 | 2,270 |
| Zinc phosphide | 1314-84-7 | P122 | 100 | 45.4 |
| Zinc phosphide (concentration ≤ 10%) | 1314-84-7 | U249 | 100 | 45.4 |
| Zinc phosphide (concentration > 10%) | 1314-84-7 | P122 | 100 | 45.4 |
| Zinc silicofluoride | 16871-71-9 | | 5,000 | 2,270 |
| Zinc sulfate | 7733-02-0 | | 1,000 | 454 |
| Ziram | 137-30-4 | P205 | 10 | 4.5 |
| Zirconium nitrate | 13746-89-9 | | 5,000 | 2,270 |
| Zirconium potassium fluoride | 16923-95-8 | | 1,000 | 454 |
| Zirconium sulfate | 14644-61-2 | | 5,000 | 2,270 |
| Zirconium tetrachloride | 10026-11-6 | | 5,000 | 2,270 |
| UNLISTED CHARACTERISTIC HAZARDOUS WASTE | | | | |
| Unlisted hazardous waste characteristic of ignitability | | D001 | 100 | 45.4 |
| Unlisted hazardous waste characteristic of corrosivity | | D002 | 100 | 45.4 |
| Unlisted hazardous waste characteristic of reactivity | | D003 | 100 | 45.4 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| UNLISTED HAZARDOUS WASTE CHARACTERISTIC OF TOXICITY | | | | |
| Arsenic | | D004 | 1.0 | 0.454 |
| Barium | | D005 | 1,000 | 454 |
| Cadmium | | D006 | 10 | 4.54 |
| Chromium | | D007 | 10 | 4.54 |
| Lead | | D008 | 10 | 4.54 |
| Mercury | | D009 | 1.0 | 0.454 |
| Selenium | | D010 | 10 | 4.54 |
| Silver | | D011 | 1.0 | 0.454 |
| Endrin | | D012 | 1.0 | 0.454 |
| Lindane | | D013 | 1.0 | 0.454 |
| Methoxychlor | | D014 | 1.0 | 0.454 |
| Toxaphene | | D015 | 1.0 | 0.454 |
| 2,4-D | | D016 | 100 | 45.4 |
| 2,4,5-TP | | D017 | 100 | 45.4 |
| Benzene | | D018 | 10 | 4.54 |
| Carbon tetrachloride | | D019 | 10 | 4.54 |
| Chlordane | | D020 | 1.0 | 0.454 |
| Chlorobenzene | | D021 | 100 | 45.4 |
| Chloroform | | D022 | 10 | 4.54 |
| o-Cresol | | D023 | 100 | 45.4 |
| m-Cresol | | D024 | 100 | 45.4 |
| p-Cresol | | D025 | 100 | 45.4 |
| Cresol | | D026 | 100 | 45.4 |
| 1,4-Dichlorobenzene | | D027 | 100 | 45.4 |
| 1,2-Dichloroethane | | D028 | 100 | 45.4 |
| 1,1-Dichloroethylene | | D029 | 100 | 45.4 |
| 2,4-Dinitrotoluene | | D030 | 10 | 4.54 |
| Heptachlor (and epoxide) | | D031 | 1.0 | 0.454 |
| Hexachlorobenzene | | D032 | 10 | 4.54 |
| Hexachlorobutadiene | | D033 | 1.0 | 0.454 |
| Hexachloroethane | | D034 | 100 | 45.4 |
| Methyl ethyl ketone | | D035 | 5,000 | 2,270 |
| Nitrobenzene | | D036 | 1,000 | 454 |
| Pentachlorophenol | | D037 | 10 | 4.54 |
| Pyridine | | D038 | 1,000 | 454 |
| Tetrachloroethylene | | D039 | 100 | 45.4 |
| Trichloroethylene | | D040 | 100 | 45.4 |
| 2,4,5-Trichlorophenol | | D041 | 10 | 4.54 |
| 2,4,6-Trichlorophenol | | D042 | 10 | 4.54 |
| Vinyl chloride | | D043 | 1.0 | 0.454 |
| NONSPECIFIC SOURCE HAZARDOUS WASTE(3) | | | | |
| Spent halogenated solvents used in degreasing: | | F001 | 10 | 4.54 |
| (a) Tetrachloroethylene | 127-18-4 | U210 | 100 | 45.4 |
| (b) Trichloroethylene | 79-0-16 | U228 | 100 | 45.4 |
| (c) Methylene chloride | 75-09-2 | U080 | 1,000 | 454 |
| (d) 1,1,1-Trichloroethane | 71-55-6 | U226 | 1,000 | 454 |
| (e) Carbon tetrachloride | 56-23-5 | U211 | 10 | 4.54 |
| (f) Chlorinated fluorocarbons | | | 5,000 | 2,270 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Spent halogenated solvents: | | F002 | 10 | 4.54 |
| (a) Tetrachloroethylene | 127-18-4 | U210 | 100 | 45.4 |
| (b) Methylene chloride | 75-09-2 | U080 | 1,000 | 454 |
| (c) Trichloroethylene | 79-01-6 | U228 | 100 | 45.4 |
| (d) 1,1,1-Trichloroethane | 71-55-6 | U226 | 1,000 | 454 |
| (e) Chlorobenzene | 108-90-7 | U037 | 100 | 45.4 |
| (f) 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | | 5,000 | 2,270 |
| (g) o-Dichlorobenzene | 95-50-1 | U070 | 100 | 45.4 |
| (h) Trichlorofluoromethane | 75-69-4 | U121 | 5,000 | 2,270 |
| (i) 1,1,2-Trichloroethane | 79-00-5 | U227 | 100 | 45.4 |
| Spent non-halogenated solvents and still bottoms from recovery: | | F003 | 100 | 45.4 |
| (a) Xylene | 1330-20-7 | U239 | 1,000 | 454 |
| (b) Acetone | 67-64-1 | U002 | 5,000 | 2,270 |
| (c) Ethyl acetate | 141-78-6 | U112 | 5,000 | 2,270 |
| (d) Ethylbenzene | 100-41-4 | | 1,000 | 454 |
| (e) Ethyl ether | 60-29-7 | U117 | 100 | 45.4 |
| (f) Methyl isobutyl ketone | 108-10-1 | U161 | 5,000 | 2,270 |
| (g) n-Butyl alcohol | 71-36-3 | U031 | 5,000 | 2,270 |
| (h) Cyclohexanone | 108-94-1 | U031 | 5,000 | 2,270 |
| (i) Methanol | 67-56-1 | U154 | 5,000 | 2,270 |
| Spent non-halogenated solvents and still bottoms from recovery: | | F004 | 100 | 45.4 |
| (a) Cresols/cresylic acid | 1319-77-3 | U052 | 100 | 45.4 |
| (b) Nitrobenzene | 98-95-3 | U169 | 1,000 | 454 |
| Spent non-halogenated solvents and still bottoms from recovery: | | F005 | 100 | 45.4 |
| (a) Toluene | 108-88-3 | U220 | 1,000 | 454 |
| (b) Methyl ethyl ketone | 78-93-3 | U159 | 5,000 | 2,270 |
| (c) Carbon disulfide | 75-15-0 | P022 | 100 | 45.4 |
| (d) Isobutanol | 78-83-1 | U140 | 5,000 | 2,270 |
| (e) Pyridine | 110-86-1 | U196 | 1,000 | 454 |
| Wastewater treatment sludges from electroplating operations (with some exceptions) | | F006 | 10 | 4.54 |
| Spent cyanide plating bath solutions from electroplating | | F007 | 10 | 4.54 |
| Plating bath residues from electroplating where cyanides are used | | F008 | 10 | 4.54 |
| Spent stripping/cleaning bath solutions from electroplating where cyanides are used | | F009 | 10 | 4.54 |
| Quenching bath residues from metal heat treating where cyanides are used | | F010 | 10 | 4.54 |
| Spent cyanide solution from salt bath pot cleaning from metal heat treating | | F011 | 10 | 4.54 |
| Quenching wastewater sludges from metal heat treating where cyanides are used | | F012 | 10 | 4.54 |
| Wastewater treatment sludges from chemical conversion aluminum coating | | F019 | 10 | 4.54 |
| Wastes from production or use of tri/tetrachlorophenol or derivative intermediates | | F020 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Waste from production or use of pentachlorophenol or intermediates for derivatives | | F021 | 1.0 | 0.454 |
| Waste from use of tetra/penta/hexachlorobenzenes under alkaline conditions | | F022 | 1.0 | 0.454 |
| Waste from material production on equipment previously used for tri\tetrachlorophenol | | F023 | 1.0 | 0.454 |
| Waste from production of chlorinated aliphatic hydrocarbons (C1-C5) | | F024 | 1.0 | 0.454 |
| Lights ends, filters from production of chlorinated aliphatic hydrocarbons (C1-C5) | | F025 | 1.0 | 0.454 |
| Waste from equipment previously used to production tetra/penta/hexachlorobenzenes | | F026 | 1.0 | 0.454 |
| Discarded formulations containing tri/tetra/pentachlorophenols or derivatives | | F027 | 1.0 | 0.454 |
| Residues from incineration of soil contaminated with F020, F021, F022, F023, F026, F027 | | F028 | 1.0 | 0.454 |
| Wastewaters, process residuals from wood preserving using chlorophenolic solutions. | | F032 | 1.0 | 0.454 |
| Wastewaters, process residuals from wood preserving using creosote formulations | | F034 | 1.0 | 0.454 |
| Wastewaters, process residuals from wood preserving using arsenic or chromium | | F035 | 1.0 | 0.454 |
| Petroleum refinery primary oil/water/solids separation sludge | | F037 | 1.0 | 0.454 |
| Petroleum refinery secondary (emulsified) oil/water/solids separation sludge | | F038 | 1.0 | 0.454 |
| Multisource leachate | | F039 | 1.0 | 0.454 |
| SOURCE-SPECIFIC HAZARDOUS WASTE | | | | |
| Wastewater treatment sludge from creosote/pentachlorophenol wood preserving | | K001 | 1.0 | 0.454 |
| Wastewater treatment sludge from production of chrome yellow and orange pigments | | K002 | 10 | 4.54 |
| Wastewater treatment sludge from production of molybdate orange pigments | | K003 | 10 | 4.54 |
| Wastewater treatment sludge from production of zinc yellow pigments | | K004 | 10 | 4.54 |
| Wastewater treatment sludge from production of chrome green pigments | | K005 | 10 | 4.54 |
| Wastewater treatment sludge from production of chrome oxide green pigments | | K006 | 10 | 4.54 |
| Wastewater treatment sludge from production of iron blue pigments | | K007 | 10 | 4.54 |
| Oven residue from production of chrome oxide green pigments | | K008 | 10 | 4.54 |
| Distillation bottoms from production of acetaldehyde from ethylene | | K009 | 10 | 4.54 |
| Distillation side cuts from production of acetaldehyde from ethylene | | K010 | 10 | 4.54 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Bottom stream from wastewater stripper in acrylonitrile production | | K011 | 10 | 4.54 |
| Bottom stream from acetonitrile column in acrylonitrile production | | K013 | 10 | 4.54 |
| Bottoms from acetonitrile purification column in acrylonitrile production | | K014 | 5,000 | 2,270 |
| Still bottoms from the distillation of benzyl chloride | | K015 | 10 | 4.54 |
| Heavy ends or distillation residues from production of carbon tetrachloride | | K016 | 1.0 | 0.454 |
| Heavy ends from the purification column in epichlorohydrin production | | K017 | 10 | 4.54 |
| Heavy ends from the fractionation column in ethyl chloride production | | K018 | 1.0 | 0.454 |
| Heavy ends from the distillation of ethylene dichloride during its production | | K019 | 1.0 | 0.454 |
| Heavy ends from the distillation of vinyl chloride during production of the monomer | | K020 | 1.0 | 0.454 |
| Aqueous spent antimony catalyst waste from fluoromethanes production | | K021 | 10 | 4.54 |
| Distillation bottom tars from production of phenol/acetone from cumene | | K022 | 1.0 | 0.454 |
| Distillation light ends from production of phthalic anhydride from naphthalene | | K023 | 5,000 | 2,270 |
| Distillation bottoms from production of phthalic anhydride from naphthalene | | K024 | 5,000 | 2,270 |
| Distillation bottoms from production of nitrobenzene by nitration of benzene | | K025 | 10 | 4.54 |
| Stripping still tails from the production of methyl ethyl pyridines | | K026 | 1,000 | 454 |
| Centrifuge/distillation residues from toluene diisocyanate production | | K027 | 10 | 4.54 |
| Spent catalyst from hydrochlorinator reactor in production of 1,1,1-trichloroethane | | K028 | 1.0 | 0.454 |
| Waste from product steam stripper in production of 1,1,1-trichloroethane | | K029 | 1.0 | 0.454 |
| Column bottoms/heavy ends from production of trichloroethylene and perchloroethylene | | K030 | 1.0 | 0.454 |
| By-product salts generated in the production of monosodium methanearsonate and cacodylic acid | | K031 | 1.0 | 0.454 |
| Wastewater treatment sludge from the production of chlordane | | K032 | 10 | 4.54 |
| Wastewater/scrubwater from chlorination of cyclopentadiene in chlordane production | | K033 | 10 | 4.54 |
| Filter solids from filtration of hexachlorocyclopentadiene in chlordane production | | K034 | 10 | 4.54 |
| Wastewater treatment sludges from the production of creosote | | K035 | 1.0 | 0.454 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Still bottoms from toluene reclamation distillation in disulfoton production | | K036 | 1.0 | 0.454 |
| Wastewater treatment sludges from the production of disulfoton | | K037 | 1.0 | 0.454 |
| Wastewater from the washing and stripping of phorate production | | K038 | 10 | 4.54 |
| Filter cake from filtration of diethylphosphorodithioic acid in phorate production | | K039 | 10 | 4.54 |
| Wastewater treatment sludge from the production of phorate | | K040 | 10 | 4.54 |
| Wastewater treatment sludge from the production of toxaphene | | K041 | 1.0 | 0.454 |
| Heavy ends/residues from distillation of tetrachlorobenzene in 2,4,5-T production | | K042 | 10 | 4.54 |
| 2,6-Dichlorophenol waste from the production of 2,4-D | | K043 | 10 | 4.54 |
| Wastewater treatment sludge from manufacturing and processing of explosives | | K044 | 10 | 4.54 |
| Spent carbon from treatment of wastewater containing explosives | | K045 | 10 | 4.54 |
| Wastewater sludge from manufacturing, formulating, loading of lead-based initiating compound | | K046 | 10 | 4.54 |
| Pink/red water from trinitrotolune operations | | K047 | 10 | 4.54 |
| Dissolved air flotation float from the petroleum refining industry | | K048 | 10 | 4.54 |
| Slop oil emulsion solids from the petroleum refining industry | | K049 | 10 | 4.54 |
| Heat exchanger bundle cleaning sludge from petroleum refining industry | | K050 | 10 | 4.54 |
| API separator sludge from the petroleum refining industry | | K051 | 10 | 4.54 |
| Tank bottoms (leaded) from the petroleum refining industry | | K052 | 10 | 4.54 |
| Ammonia still lime sludge from coking operations | | K060 | 1.0 | 0.454 |
| Emission control dust/sludge from primary production of steel in electric furnaces | | K061 | 10 | 4.54 |
| Spent pickle liquor generated by steel finishing (SIC codes 331 and 332) | | K062 | 10 | 4.54 |
| Acid plant blowdown slurry/sludge from blowdown slurry from primary copper production | | K064 | 10 | 4.54 |
| Surface impoundment solids at primary lead smelting facilities | | K065 | 10 | 4.54 |
| Sludge from treatment of wastewater/acid plant blowdown from primary zinc production | | K066 | 10 | 4.54 |
| Emission control dust/sludge from secondary lead smelting | | K069 | 10 | 4.54 |
| Brine purification muds from mercury cell process in chlorine production | | K071 | 1.0 | 0.454 |
| Chlorinated hydrocarbon waste from diaphragm cell process in chlorine production | | K073 | 10 | 4.54 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[1] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Distillation bottoms from aniline extraction | | K083 | 100 | 45.4 |
| Wastewater sludges from production of veterinary pharmaceuticals from arsenic compounds | | K084 | 1.0 | 0.454 |
| Distillation or fractionation column bottoms in production of chlorobenzenes | | K085 | 10 | 4.54 |
| Wastes/sludges from production of inks from chromium and lead-containing substances | | K086 | 10 | 4.54 |
| Decanter tank tar sludge from coking operations | | K087 | 100 | 45.4 |
| Spent potliners from primary aluminum reduction | | K088 | 10 | 4.54 |
| Emission control dust/sludge from ferrochromiumsilicon production | | K090 | 10 | 4.54 |
| Emission control dust/sludge from ferrochromium production | | K091 | 10 | 4.54 |
| Distillation light ends from production of phthalic anhydride by ortho-xylene | | K093 | 5,000 | 2,270 |
| Distillation bottoms in production of phthalic anhydride by ortho-xylene | | K094 | 5,000 | 2,270 |
| Distillation bottoms in production of 1,1,1-trichloroethane | | K095 | 100 | 45.4 |
| Heavy ends from distillation column in production of 1,1,1-trichloroethane | | K096 | 100 | 45.4 |
| Vacuum stripper discharge from the chlordane chlorinator in production of chlordane | | K097 | 1.0 | 0.454 |
| Untreated process wastewater from the production of toxaphene | | K098 | 1.0 | 0.454 |
| Untreated wastewater from the production of 2,4-D | | K099 | 10 | 4.54 |
| Waste leaching solution from emission control dust/sludge in secondary lead smelting | | K100 | 10 | 4.54 |
| Distillation tar residue from aniline in production of veterinary pharmaceuticals from arsenic compd. | | K101 | 1.0 | 0.454 |
| Residue from activated carbon in production of veterinary pharmaceuticals from arsenic compounds | | K102 | 1.0 | 0.454 |
| Process residues from aniline extraction from the production of aniline | | K103 | 100 | 45.4 |
| Combined wastewater streams generated from production of nitrobenzene/aniline | | K104 | 10 | 4.54 |
| Aqueous stream from washing in production of chlorobenzenes | | K105 | 10 | 4.54 |
| Wastewater treatment sludge from mercury cell process in chlorine production | | K106 | 1.0 | 0.454 |
| Column bottoms from separation in production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides | | K107 | 10 | 4.54 |
| Condensed column overheads and vent gas from production of UDMH from -COOH hydrazides | | K108 | 10 | 4.54 |
| Spent filter cartridges from purification of UDMH production from carboxylic acid hydrazides | | K109 | 10 | 4.54 |
| Condensed column overheads from separation in UDMH production from -COOH hydrazides | | K110 | 10 | 4.54 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ[(1)] | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Product washwaters from production of dinitrotoluene via nitration of toluene | | K111 | 10 | 4.54 |
| Reaction by-product water from drying in toluenediamine production from dinitrotoluene | | K112 | 10 | 4.54 |
| Condensed liquid light ends from purification of toluenediamine during its production | | K113 | 10 | 4.54 |
| Vicinals from purification of toluenediamine during its production from dinitrotoluene | | K114 | 10 | 4.54 |
| Heavy ends from toluenediamine purification during production from dinitrotoluene | | K115 | 10 | 4.54 |
| Organic condensate from solvent recovery system in production of toluene diisocyanate | | K116 | 10 | 4.54 |
| Wastewater from vent gas scrubber in ethylene bromide production by ethene bromination | | K117 | 1.0 | 0.454 |
| Spent absorbent solids in purification of ethylene dibromide in its production | | K118 | 1.0 | 0.454 |
| Process wastewater from the production of ethylenebisdithiocarbamic acid and | | K123 | 10 | 4.54 |
| Reactor vent scrubber water from production of ethylenebisdithiocarbamic acid and salts | | K124 | 10 | 4.54 |
| Filtration/other solids from production of ethylenebisdithiocarbamic acid and | | K125 | 10 | 4.54 |
| Dust/sweepings from the production of ethylenebisdithiocarbamic acid and | | K126 | 10 | 4.54 |
| Wastewater and spent sulfuric acid from the production of methyl bromide | | K131 | 100 | 45.4 |
| Spent absorbent and wastewater solids from the production of methyl bromide | | K132 | 1,000 | 454 |
| Still bottoms from ethylene dibromide purification in production by ethene bromination | | K136 | 1.0 | 0.454 |
| Process residues from coal tar recovery in coking | | K141 | 1.0 | 0.454 |
| Tar storage tank residues from coke production from coal or recovery of coke by-products | | K142 | 1.0 | 0.454 |
| Process residues from recovery of light oil in coking | | K143 | 1.0 | 0.454 |
| Wastewater residues from light oil refining in coking | | K144 | 1.0 | 0.454 |
| Residues from naphthalene collection and recovery from coke by-products | | K145 | 1.0 | 0.454 |
| Tar storage tank residues from coal tar refining in coking | | K147 | 1.0 | 0.454 |
| Residues from coal tar distillation, including still bottoms, in coking | | K148 | 1.0 | 0.454 |
| Distillation bottoms from the production of chlorinated toluenes/benzoyl chlorides | | K149 | 10 | 4.54 |
| Organic residuals from chlorine gas and hydrogen chloride recovery from chlorinated toluene | | K150 | 10 | 4.54 |
| Wastewater treatment sludge from production of chlorotoluenes/benzoyl chlorides | | K151 | 10 | 4.54 |
| Organic waste from production of carbamates and carbamoyl oximes | | K156 | 10 | 4.54 |

## Table 16.3: List of Hazardous Wastes and Hazardous Substances, Continued

| HAZARDOUS WASTE / HAZARDOUS SUBSTANCE | CAS NO. | HW NO. | RQ(1) | |
|---|---|---|---|---|
| | | | (Pounds) | (kg) |
| Wastewaters from production of carbamates and carbamoyl oximes (not sludges) | | K157 | 10 | 4.54 |
| Bag house dusts and filter/separation solids from the production of carbamates and carbamoyl oximes | | K158 | 10 | 4.54 |
| Organics from treatment of thiocarbamate waste | | K159 | 10 | 4.54 |
| Purification solids, bag house dust and floor sweepings from the production of dithiocarbamate acids and their salts | | K161 | 1.0 | 0.454 |
| Crude oil storage tank sediment from refining operations | | K169 | 10 | 4.54 |
| Clarified slurry oil tank sediment of in-line filter/separation solids | | K170 | 1.0 | 0.454 |
| Spent hydrotreating catalyst | | K171 | 1.0 | 0.454 |
| Spent hydrorefining catalyst | | K172 | 1.0 | 0.454 |
| Wastewater treatment sludges from the production of ethylene dichloride or vinyl chloride monomer, (including sludges that result from commingled ethylene dichloride or vinyl chloride monomer wastewater and other wastewater), unless the sludges meet certain disposal conditions (Refer to 40 CFR §261.32, Hazardous wastes from specific sources). | | K174 | 1.0 | 0.454 |
| Wastewater treatment sludges from the production vinyl chloride monomer using mercuric chloride catalyst in an acetylene-based process (Refer to 40 CFR §261.32, Hazardous wastes from specific sources). | | K175 | 1.0 | 0.454 |
| Baghouse filters from the production of antimony oxide, including filters from the production of intermediates (e.g., antimony metal or crude antimony oxide) | | K176 | 1.0 | 0.454 |
| Slag from the production of antimony oxide that is speculatively accumulated or disposed, including slag from the production of intermediates (e.g., antimony metal or crude antimony oxide) | | K177 | 5,000 | 2,270 |
| Non-wastewaters generated from the production of certain dyes, pigments, and food, drug & cosmetics colorants, exceeding constituent mass loading levels, subject to disposal exceptions in 40 CFR §261.32, Hazardous wastes from specific sources. | | K181 | 1.0 | 0.454 |

& = Indicates that no RQ is assigned to this generic or broad class, although the class is a hazardous substance.

@ = Releases in amounts less than 453.5 kg [1,000 pounds] per 24 hours of nitrogen oxide or nitrogen dioxide to the air that are the result of combustion and combustion related activities are exempt from the notification requirements.

Notes:

1. RQ (Refer to JEGS Chapter 13)
2. For metals, no reporting of releases of the solid form is required if the mean diameter of the pieces of the solid metal released is greater than 100 micrometers [0.004 inches]. The RQs shown apply to smaller particles.
3. Detailed descriptions of nonspecific source hazardous wastes are contained in Table 16.5.

### Table 16.4: Hazard Codes

| TYPE OF WASTE | HAZARD CODE |
|---|---|
| Ignitable Waste | (I) |
| Corrosive Waste | (C) |
| Reactive Waste | (R) |
| Toxicity Characteristic Waste | (E) |
| Acute Hazardous Waste | (H) |
| Toxic Waste | (T) |

### Table 16.5: Listed Hazardous Wastes from Nonspecific Sources

| HW NO. | HAZARDOUS WASTE | HAZARD CODE[1] |
|---|---|---|
| F001 | The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. | (T) |
| F002 | The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. | (T) |
| F003 | The following spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. | (I) |
| F004 | The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. | (T) |
| F005 | The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of 10 percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. | (I,T) |
| F006 | Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum. | (T) |
| F007 | Spent cyanide plating bath solutions from electroplating operations. | (R,T) |
| F008 | Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process. | (R,T) |

## Table 16.5: Listed Hazardous Wastes from Nonspecific Sources, Continued

| HW NO. | HAZARDOUS WASTE | HAZARD CODE[(1)] |
|---|---|---|
| F009 | Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process. | (R,T) |
| F010 | Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process. | (R,T) |
| F011 | Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations. | (R,T) |
| F012 | Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process. | (T) |
| F019 | Wastewater treatment sludges from the chemical conversion coating of aluminum, except from zirconium phosphating in aluminum can washing when such phosphating is an exclusion conversion coating process. | (T) |
| F020 | Waste (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives (this listing does not include waste from the production of hexachlorophene from highly purified 2,4,5- trichlorophenol). | (H) |
| F021 | Waste (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives. | (H) |
| F022 | Waste (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions. | (H) |
| F023 | Waste (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- and tetrachlorophenols (this listing does not include waste from equipment used only for the production or use of hexachlorophene from highly purified 2,4,5- trichlorophenol). | (H) |
| F025 | Condensed light ends, spent filters and filter aids, and spent desiccant waste from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to five, with varying amounts and positions of chlorine substitution. | (T) |
| F026 | Waste (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzene under alkaline conditions. | (H) |
| F027 | Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols (this listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5- trichlorophenol as the sole component). | (H) |
| F028 | Residues resulting from the incineration or thermal treatment of soil contaminated with USEPA HW No.s F020, F021, F022, F023, F026, and F027. | (T) |

## Table 16.5: Listed Hazardous Wastes from Nonspecific Sources, Continued

| HW NO. | HAZARDOUS WASTE | HAZARD CODE[1] |
|---|---|---|
| F032 | Wastewater (except that which has not come into contact with process contaminants), process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that currently use or have previously used chlorophenolic formulations (except potentially cross-contaminated waste that are otherwise currently regulated as hazardous waste (i.e., F034 or F035), and where the generator has cleaned or replaced all process equipment that may have come into contact with chlorophenolic formulations or constituents thereof, and does not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote or pentachlorophenol. | (T) |
| F034 | Wastewaters (except those that have not come into contact with process contaminants), process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. | (T) |
| F035 | Wastewater (except those that have not come into contact with process contaminants), process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that use inorganic preservatives containing arsenic or chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote or pentachlorophenol. | (T) |
| F037 | Petroleum refinery primary oil/water/solids separation sludge: Any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewater and oily cooling wastewater from petroleum refineries. Such sludges include, but are not limited to, those generated in: oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather flow. Sludge generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling water segregated for treatment from other process or oily cooling water, sludges generated in activated sludge, trickling filter, rotating biological contactor, or high-rate aeration biological treatment units (including sludges generated in one or more additional units after wastewater has been treated in aggressive biological treatment units) and K051 waste are not included in this listing. | (T) |
| F039 | Leachate (liquids that have percolated through land disposed waste) resulting from the disposal of more than one restricted waste listed in Tables 16.3 or 16.5 (leachate resulting from the disposal of one or more of the following hazardous wastes and no other hazardous waste retains its USEPA HW No.s: F020, F021, F022, F026, F027, and/or F028). | (T) |

Note:

1. Hazard Codes: Ignitable Waste (I), Corrosive Waste (C), Reactive Waste (R), Toxicity Characteristic Waste (E), Acute Hazardous waste (H), Toxic Waste (T). (I,T) should be used to specify mixtures containing ignitable and toxic constituents.

# APPENDIX 16B: JAPANESE HAZARDOUS WASTE STANDARDS

## Table 16.6: Class I Specified Chemical Substances

| HAZARDOUS SUBSTANCE | CAS NO. | EPA HW NO. |
|---|---|---|
| Aldrin(1) | 309-00-2 | P004 |
| alpha-Benzenehexachloride (BHC)(1) | 319-84-6 | |
| beta-Benzenehexachloride (BHC)(1) | 319-85-7 | |
| Camphechlor(1) | 8001-35-2 | P123 |
| Chlordane(1) | 57-74-9 | U036 |
| Chlorinated naphthalenes(1) | | |
| Decabromodiphenyl oxide | 1163-19-5 | |
| Dichlorodiphenyltrichloroethane (DDT)(1) | 50-29-3 | U061 |
| Dicofol(1) | 115-32-2 | |
| Dieldrin(1) | 60-57-2 | P037 |
| Endosulfan(1) | 115-29-7 | P050 |
| alpha-Endosulfan(1) | 959-98-8 | |
| beta-Endosulfan(1) | 33213-65-9 | |
| Endrin(1) | 72-20-8 | P051 |
| Heptachlor(1) | 76-44-8 | P059 |
| Hexabromocyclododecanes | | |
| Hexachlorobenzene(1) | 118-74-1 | U127 |
| Hexachloro-1,3-butadiene(1) | 87-68-3 | U128 |
| Kepone(1) | 143-50-0 | U142 |
| Lindane(1) | 58-89-9 | U129 |
| Pentachlorobenzene(1) | 608-93-5 | U183 |
| Pentachlorophenol (PCP)(1) | 87-86-5 | |
| Pentachlorophenol (PCP), its salts or esters | | |
| Perfluorohexane sulfonic acid (PFHxS) and its salts | | |
| Perfluorooctane sulfonic acid (PFOS) and its salts | | |
| Perfluorooctane sulfonyl fluoride (PFOSF) | 307-35-7 | |
| Perfluorooctanoic acid (PFOA) and its salts | | |
| Polychlorinated biphenyls (PCBs)(1) | 1336-36-3 | |
| Polychlorinated straight chain paraffins (limited to those having carbon numbers from 10 to 13 and whose content of chlorine exceeds 48% of total weight) | | |
| Toxaphene(1) | 8001-35-2 | P123 |

Sources: Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc., Act No. 117, 16 October 1973, revised 13 December 2023; Order for Enforcement of the Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc., Cabinet Order No. 202 of 1974, revised 1 December 2023.

Note:

1. Also listed in Table 16.3.

## Table 16.7: Classifications of Specially Controlled Municipal Solid Waste (SCMW) and Specially Controlled Industrial Waste (SCIW) for Disposal

| CLASSIFICATION | | | WASTE ITEM | JEGS HW NO. |
|---|---|---|---|---|
| Specially Controlled Municipal Solid Waste (SCMW) | Components containing PCBs | | PCBs contained in parts of air conditioners, televisions, and microwaves | |
| | Dust | | Dust collected by a dust collection facility at a waste disposal facility | |
| | Dioxin contained material | | Dust, cinder dust, and sludge, ≥ 3.0 ng/g of dioxin from a dioxin-regulated waste incineration facility | |
| | Infectious general waste | | Infectious general waste suspected of containing infectious pathogens from a medical institution | |
| | Waste consisting of mercury | | Waste consisting of mercury recovered from waste mercury-added products (municipal solid waste) | |
| Specially Controlled Industrial Waste (SCIW) | Waste oil | | Volatile oils, gasoline, kerosene type, and diesel type fuels (except nonflammable tar pitch) with a flashpoint < 70°C (158°F) | J001 |
| | Waste acid | | pH ≤ 2.0 | J002 |
| | Waste alkali | | pH ≥ 12.5 | J002 |
| | Infectious industrial waste | | Infectious industrial waste suspected of containing infectious pathogens from a medical institution | |
| | Specified Hazardous Industrial Waste (SHIW) | Waste PCB | Waste PCB and waste PCB-contaminated oil | |
| | | PCB contaminated substances | PCB-contaminated sludge, paper trash, waste woods, fibers, plastics, metals, waste ceramic, debris | |
| | | Treated material for PCB | Waste PCB oil and PCB-contaminated substances that have been treated to reduce PCB concentrations | |
| | | Slag | Slag containing heavy metals above regulatory levels provided in Table 16.8 | |
| | | Waste asbestos | Waste asbestos that are suspected to scatter in building materials subject for demolition or facilities that generate asbestos dust | J029 |
| | | Dust, Cinder dust | Dust and cinder dust containing heavy metals and dioxin which are above regulatory levels provided in Table 16.8 | |
| | | Waste oil | Waste oil (solvent) containing chlorinated organic compounds which exceed the criteria in Table 16.8 | |
| | | Waste sludge, Acid, Alkali | Waste sludge, waste acid and waste alkali containing heavy metals, chlorinated organic compounds, PCBs, pesticides, selenium and dioxins which are above regulatory levels in Table 16.8 | |
| | | Waste consisting of mercury or mercury compounds | Waste consisting of mercury or mercury compounds generated in specific sources and substances or objects consisting of mercury or mercury compounds (excluding municipal solid waste) or industrial waste from mercury-added products | |
| Source: Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 16 June 2017. | | | | |

## Table 16.8: Specially Controlled Industrial Waste (SCIW) Disposal Criteria

| WASTE TYPE AT TIME OF GENERATION | | | CINDER DUST, DUST, SLAG | | | WASTE OIL (SOLVENT ONLY) | | WASTE SLUDGE, ACID, ALKALI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Waste type at time of disposal | | | Cinder Dust, Dust, Slag | Waste Treated Material (waste acid, waste alkali) | Waste Treated Material (except waste acid, waste alkali) | Waste Treated Material (waste acid, waste alkali) | Waste Treated Material (except waste alkali, waste acid) | Waste Sludge | Waste Treated Material (except waste alkali, waste acid) | Waste Acid, Waste Alkali | Waste Treated Material (waste alkali, waste acid) |
| JEGS HW NO. | CONTAMINANT | CAS NO. | CONCENTRATION LEVEL (mg/L) | | | | | | | | |
| J004 | Mercury (alkyl compounds) | | < LOQ | < LOQ | < LOQ | | | < LOQ | < LOQ | < LOQ | < LOQ |
| J005 | Mercury | 7439-97-6 | 0.005 | 0.05 | 0.005 | | | 0.005 | 0.005 | 0.05 | 0.05 |
| J006 | Cadmium | 7440-43-9 | 0.09 | 0.3 | 0.09 | | | 0.09 | 0.09 | 0.3 | 0.3 |
| J007 | Lead | 7439-92-1 | 0.3 | 1.0 | 0.3 | | | 0.3 | 0.3 | 1.0 | 1.0 |
| J008 | Organic phosphorus(1) | | | | | | | 1.0 | 1.0 | 1.0 | 1.0 |
| J009 | Chromium (hexavalent) | 18540-29-9 | 1.5 | 5.0 | 1.5 | | | 1.5 | 1.5 | 5.0 | 5.0 |
| J010 | Arsenic | 7440-38-2 | 0.3 | 1.0 | 0.3 | | | 0.3 | 0.3 | 1.0 | 1.0 |
| J011 | Cyanide (total) | | | | | | | 1.0 | 1.0 | 1.0 | 1.0 |
| J012 | PCBs | 1336-36-3 | | | | Waste Oil: 0.5 mg/kg | | 0.003 | 0.003 | 0.03 | 0.03 |
| J013 | Trichloroethylene | 79-01-6 | | | | 1.0 | 0.1 | 0.1 | 0.1 | 1.0 | 1.0 |
| J014 | Tetrachloroethylene | 127-18-4 | | | | 1.0 | 0.1 | 0.1 | 0.1 | 1.0 | 1.0 |
| J015 | Dichloromethane | 75-09-2 | | | | 2.0 | 0.2 | 0.2 | 0.2 | 2.0 | 2.0 |
| J016 | Carbon tetrachloride | 56-23-5 | | | | 0.2 | 0.02 | 0.02 | 0.02 | 0.2 | 0.2 |
| J017 | 1,2-Dichloroethane | 107-06-2 | | | | 0.4 | 0.04 | 0.04 | 0.04 | 0.4 | 0.4 |
| J018 | 1,1-Dichloroethylene | 75-35-4 | | | | 10.0 | 1.0 | 1.0 | 1.0 | 10.0 | 10.0 |
| J019 | cis-1,2-Dichloroethylene | 156-59-2 | | | | 4.0 | 0.4 | 0.4 | 0.4 | 4.0 | 4.0 |
| J020 | 1,1,1-Trichloroethane | 71-55-6 | | | | 30.0 | 3.0 | 3.0 | 3.0 | 30.0 | 30.0 |
| J021 | 1,1,2-Trichloroethane | 79-00-5 | | | | 0.6 | 0.06 | 0.06 | 0.06 | 0.6 | 0.6 |

## Table 16.8: Specially Controlled Industrial Waste (SCIW) Disposal Criteria, Continued

| WASTE TYPE AT TIME OF GENERATION | | | CINDER DUST, DUST, SLAG | | | WASTE OIL (SOLVENT ONLY) | | WASTE SLUDGE, ACID, ALKALI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Waste type at time of disposal | | | Cinder Dust, Dust, Slag | Waste Treated Material (waste acid, waste alkali) | Waste Treated Material (except waste acid, waste alkali) | Waste Treated Material (waste acid, waste alkali) | Waste Treated Material (except waste alkali, waste acid) | Waste Sludge | Waste Treated Material (except waste alkali, waste acid) | Waste Acid, Waste Alkali | Waste Treated Material (waste alkali, waste acid) |
| JEGS HW NO. | CONTAMINANT | CAS NO. | CONCENTRATION LEVEL (mg/L) | | | | | | | | |
| J022 | 1,3-Dichloropropene | 542-75-6 | | | | 0.2 | 0.02 | 0.02 | 0.02 | 0.2 | 0.2 |
| J023 | Thiuram | 137-26-8 | | | | | | 0.06 | 0.06 | 0.6 | 0.6 |
| J024 | Simazine | 122-34-9 | | | | | | 0.03 | 0.03 | 0.3 | 0.3 |
| J025 | Thiobencarb | 28249-77-6 | | | | | | 0.2 | 0.2 | 2.0 | 2.0 |
| J026 | Benzene | 71-43-2 | | | | 1.0 | 0.1 | 0.1 | 0.1 | 1.0 | 1.0 |
| J027 | Selenium | 7782-49-2 | 0.3 | 1.0 | 0.3 | | | 0.3 | 0.3 | 1.0 | 1.0 |
| J028 | Dioxins(2) | | 3.0 ng/g(3) | 100 pg/L(3) | 3.0 ng/g(3) | | | 3.0 ng/g | 3.0 ng/g | 100 pg/L | 100 pg/L |
| J030 | 1,4-Dioxane | 123-91-1 | 0.5(4) | 5.0(4) | 0.5(4) | 5.0 | 0.5 | 0.5 | 0.5 | 5.0 | 5.0 |

Sources: Act on Waste Management and Public Cleansing, Act No. 137 of 1970, revised 16 June 2017; Order of Ministry to Provide for Criteria for Determination Pertaining to Industrial Waste Including Metals, Ordinance No. 5 of the Prime Minister's Office of 1973, revised 9 June 2017; Ordinance for the Enforcement of the Act on Waste Management and Public Cleansing, Ministry of Health and Welfare Cabinet Order No. 35 of 1971, revised 22 February 2018.

< LOQ = below the limit of quantitation
mg/L = milligrams per liter
ng/g = nanograms per gram
pg/L = picograms per liter

Notes:

1. Includes parathion, methyl parathion, methyl demeton, and EPN only.
2. Toxic equivalence (TEQ) conversion.
3. Except for slag and its treated material.
4. Applies to dust and its treated material.

# APPENDIX 16C: HAZARDOUS WASTE LABELING

16.C.1 Hazardous Waste Storage. As required by Paragraphs 16.4.2 and 16.6.2.4, installations must properly label hazardous waste storage containers. The hazardous waste labels shown in Figure 16.1 (Mainland Japan) and Figure 16.2 (Okinawa) meet these labeling requirements. Installations may use other labels as long as they adequately indicate the contents, characteristics, and hazards of the waste.

16.C.2 Hazardous Waste Disposal. As required by Paragraph 16.9.3.4, installations must label hazardous waste intended for disposal. Installations using DLA Disposition Services to dispose of their hazardous waste must label the waste using the hazardous waste labels shown in Figure 16.1 (Mainland Japan) and Figure 16.2 (Okinawa). Installations not using DLA Disposition Services to dispose of their hazardous waste must also label the waste appropriately. The label must contain as a minimum the information regarding the hazardous waste as shown in Figures 16.1 and 16.2, along with the appropriate point of contact in the event the waste is discovered by a third party.

16.C.3 Terminology

16.C.3.1 Proper Shipping Name. A description of a particular article or substance in all shipping documents and notifications and, where appropriate, on packaging.

16.C.3.2 Item Name. Name if the item has a national stock number (NSN) assigned to it.

16.C.3.3 Hazard Class. U.S. Department of Transportation (DOT) category of hazard assigned to a hazardous material. A material may meet the criteria for more than one hazard class, but is assigned to only one hazard class.

16.C.3.3.1 Class 1: Explosives.

16.C.3.3.2 Class 2: Gases.

16.C.3.3.3 Class 3: Flammable and combustible liquids.

16.C.3.3.4 Class 4: Flammable solids, substances liable to spontaneous combustion, and substances which, on contact with water, emit flammable gases.

16.C.3.3.5 Class 5: Oxidizing substances and organic peroxides.

16.C.3.3.6 Class 6: Toxic substances and infectious substances.

16.C.3.3.7 Class 7: Radioactive materials.

16.C.3.3.8 Class 8: Corrosive substances.

16.C.3.3.9 Class 9: Miscellaneous dangerous goods/hazardous materials and articles.

16.C.3.4 UN No. A 4-digit number defined by the United Nations (UN) for hazardous material transportation.

16.C.3.5 Packing Group. A grouping according to the degree of danger presented by hazardous materials. Packing Group I indicates great danger; Packing Group II, medium danger; Packing Group III, minor danger.

16.C.3.6 Waste Code. A code assigned to each hazardous waste consisting of the letter associated with the waste, followed by three numbers. The JEGS includes both waste codes defined in the Overseas Environmental Baseline Guidance Document ("D" codes) and waste codes defined in the JEGS ("J" codes). For disposal in Japan, the following codes are assigned for waste codes:

16.C.3.6.1 F is for hazardous waste from non-specific sources.

16.C.3.6.2 K is for hazardous waste from specific sources.

16.C.3.6.3 U is for toxic (non-acute) hazardous waste.

16.C.3.6.4 D001 is for solid waste exhibiting the characteristic of ignitability.

16.C.3.6.5 D002 is for solid waste exhibiting the characteristic of corrosivity.

16.C.3.6.6 D003 is for solid waste exhibiting the characteristic of reactivity.

16.C.3.6.7 D004 to D043 are for solid waste exhibiting a specific characteristic of toxicity, as shown in Table 16.1.

16.C.3.6.8 J001 and J002 are for specially controlled industrial waste as shown in Table 16.7.

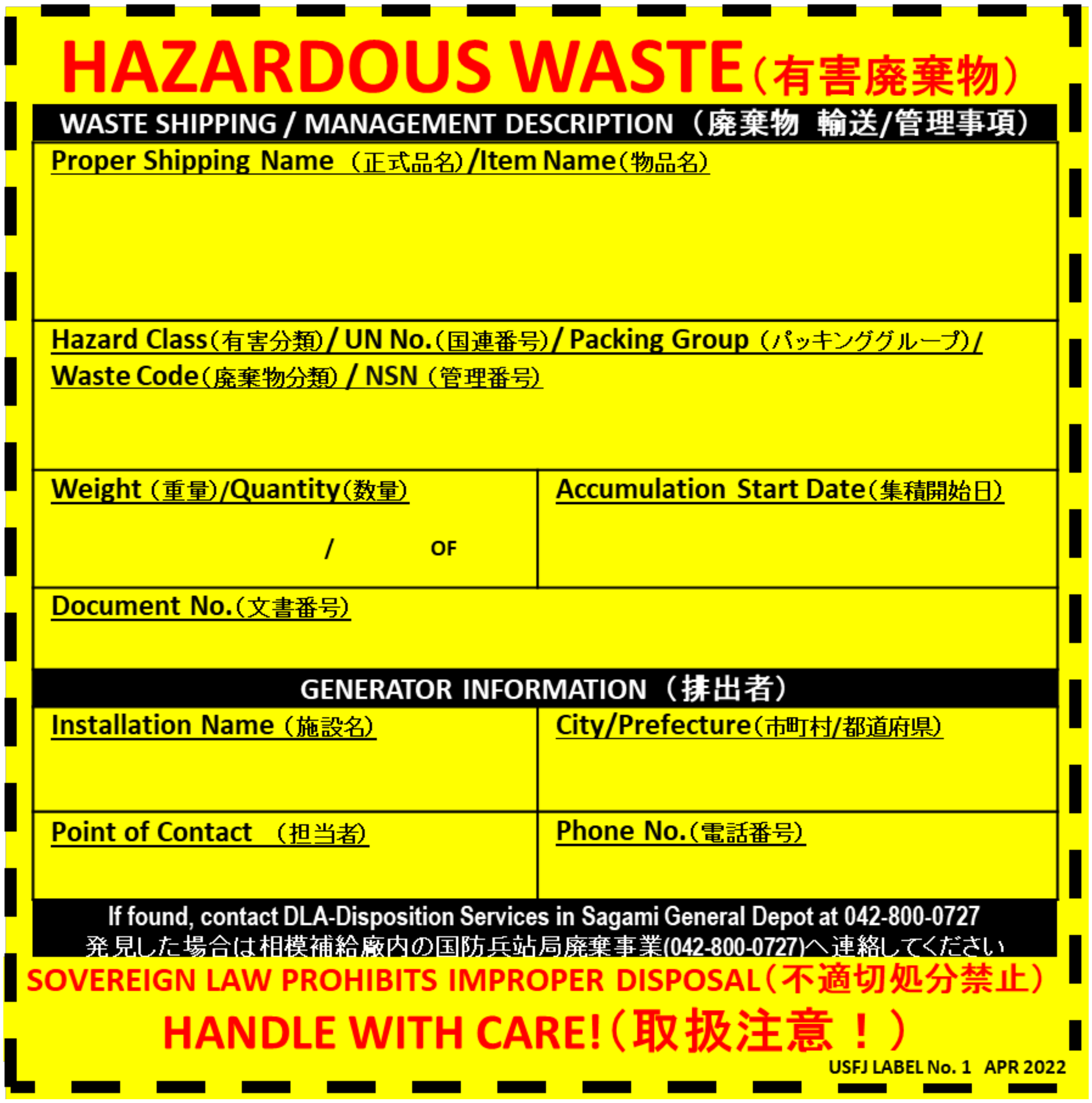
16.C.3.6.7 J004 to J028 are for specially controlled industrial waste exhibiting a specific characteristic of toxicity, as shown in Table 16.8.

16.C.3.6.8 J029 is for asbestos waste.

16.C.3.6.9 J030 is for solid waste containing 1,4-Dioxane.

16.C.3.7 NSN. National stock number, if the item has a NSN assigned and is an unused product. The NSN is a 13-digit number that identifies a stock item consisting of the 4-digit United States federal supply classification code, plus the 9-digit national item identification number. NSN are arranged as follows: 9999-00-999-9999.

**Figure 16.1: Hazardous Waste Label (Mainland Japan)**



HAZARDOUS WASTE（有害廃棄物）

WASTE SHIPPING / MANAGEMENT DESCRIPTION（廃棄物 輸送/管理事項）

Proper Shipping Name（正式品名）/Item Name（物品名）

Hazard Class（有害分類）/ UN No.（国連番号）/ Packing Group（パッキンググループ）/ Waste Code（廃棄物分類）/ NSN（管理番号）

Weight（重量）/Quantity（数量）

/ OF

Accumulation Start Date（集積開始日）

Document No.（文書番号）

GENERATOR INFORMATION（排出者）

Installation Name（施設名）

City/Prefecture（市町村/都道府県）

Point of Contact（担当者）

Phone No.（電話番号）

If found, contact DLA-Disposition Services in Sagami General Depot at 042-800-0727

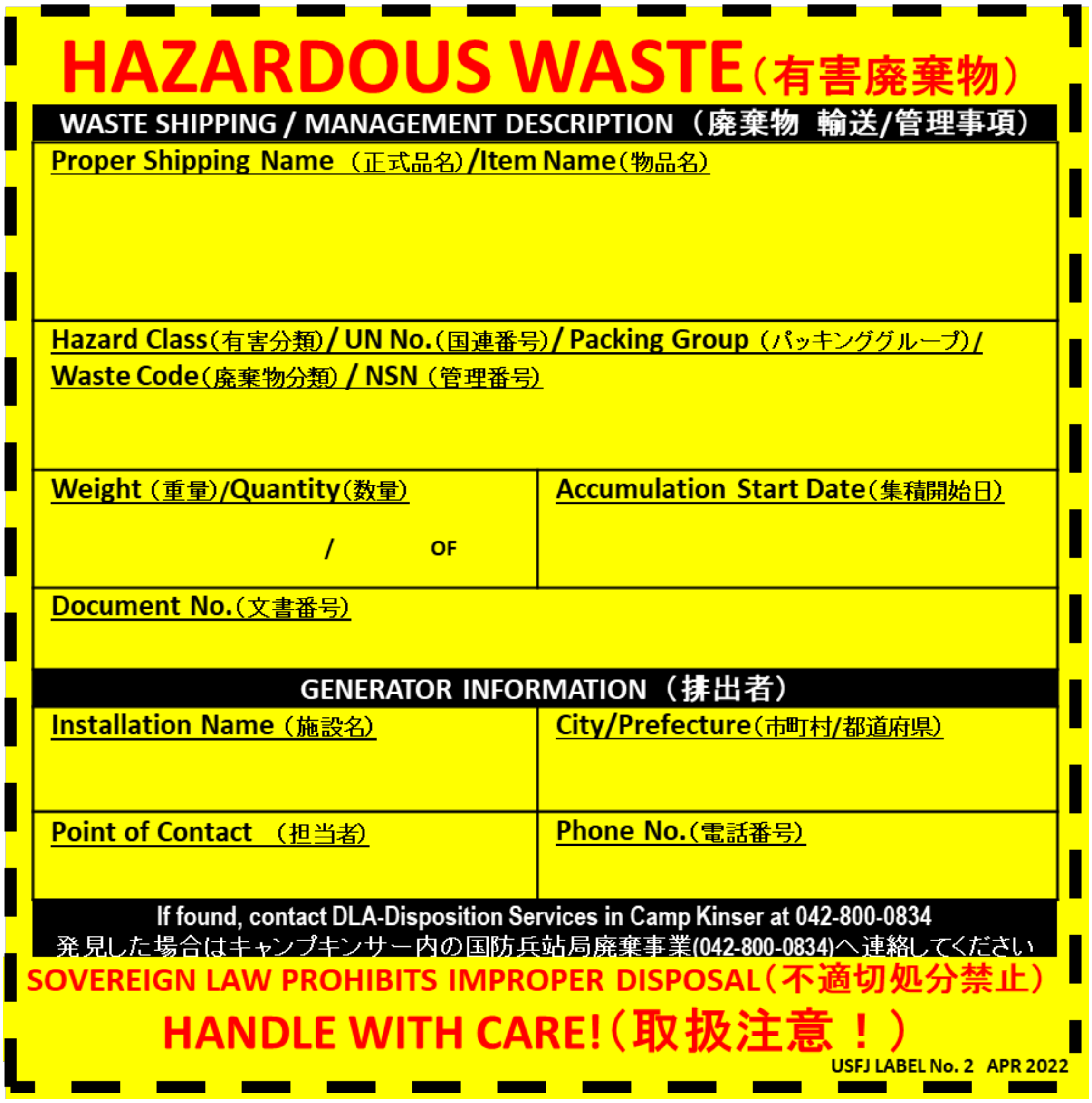
発見した場合は相模補給廠内の国防兵站局廃棄事業(042-800-0727)へ連絡してください

SOVEREIGN LAW PROHIBITS IMPROPER DISPOSAL（不適切処分禁止）

HANDLE WITH CARE!（取扱注意！）

USFJ LABEL No. 1 APR 2022

**Figure 16.2: Hazardous Waste Label (Okinawa)**



**HAZARDOUS WASTE（有害廃棄物）**

**WASTE SHIPPING / MANAGEMENT DESCRIPTION（廃棄物 輸送/管理事項）**

**Proper Shipping Name（正式品名）/Item Name（物品名）**

**Hazard Class（有害分類）/ UN No.（国連番号）/ Packing Group（パッキンググループ）/ Waste Code（廃棄物分類） / NSN（管理番号）**

**Weight（重量）/Quantity（数量）**

/ OF

**Accumulation Start Date（集積開始日）**

**Document No.（文書番号）**

**GENERATOR INFORMATION（排出者）**

**Installation Name（施設名）**

**City/Prefecture（市町村/都道府県）**

**Point of Contact（担当者）**

**Phone No.（電話番号）**

If found, contact DLA-Disposition Services in Camp Kinser at 042-800-0834

発見した場合はキャンプキンサー内の国防兵站局廃棄事業(042-800-0834)へ連絡してください

**SOVEREIGN LAW PROHIBITS IMPROPER DISPOSAL（不適切処分禁止）**

**HANDLE WITH CARE!（取扱注意！）**

USFJ LABEL No. 2 APR 2022

# CHAPTER 17: MEDICAL WASTE

## 17.1 INTRODUCTION

This chapter contains standards on the safe handling, storage, treatment, and disposal of medical waste generated by medical, dental, research and development, and veterinary facilities. Medical waste includes waste generated in the diagnosis, treatment, or immunization of human beings or animals or in the production or testing of biologicals (i.e., medical products, such as a vaccine, made from biological sources) subject to certain exclusions. It also includes mixtures of medical waste and hazardous waste. Waste that would otherwise be solid waste or radiological waste are not covered in this chapter. Standards for solid waste are provided in JEGS Chapter 15. Standards for radiological waste are covered in DoDI 4715.27, DoD Low-Level Radioactive Waste (LLRW) Program.

## 17.2 TRAINING

Installations must:

17.2.1 Ensure that all employees are adequately trained to perform their duties.

17.2.2 Train employees who come in direct contact with patients, or who generate, segregate, package, store, transport, treat, or dispose of infectious medical waste, in the safe handling and management of infectious medical waste.

## 17.3 GENERATION

Installations must:

17.3.1 Separate infectious medical waste, if practical, from other solid waste at the point of origin. Place all infectious medical waste in final storage containers lined with plastic bags that comply with Paragraph 17.3.3 before being transported off-site for disposal and destruction.

17.3.1.1 Handle mixtures of infectious medical waste and hazardous waste as an infectious hazardous waste.[137]

17.3.1.1.1 These mixtures are the responsibility of the generating DoD Service Component, with priority given to the hazard that presents the greatest risk.

17.3.1.1.2 DLA Disposition Services has no responsibility for this type of hazardous waste until it is rendered noninfectious, as determined by the appropriate DoD medical authority. Prior to transfer to DLA Disposition Services, the Turn-In Document (DD Form 1348-1A, Issue Release/Receipt) must include certification from the appropriate DoD medical authority stating the waste is no longer infectious.

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[137] DoDM 4160.21 (Volume 4), Defense Materiel Disposition: Instructions for Hazardous Property and Other Special Processing Materiel, Enclosure 3 Paragraph 96.

17.3.1.2 Handle mixtures of other solid waste and infectious medical waste as infectious medical waste.

17.3.1.3 Segregate and manage mixtures of infectious medical waste and radioactive waste in accordance with DoD Service Component guidance.

17.3.2 Segregate from routine infectious medical waste any medical waste from animal or human treatment containing a Category A infectious substance and manage in accordance with regulations of Japan and the International Air Transport Association.

17.3.3 Segregate, transport, and store infectious medical waste in red bags or receptacles that are a minimum of 3.0-mil [0.0762-millimeter] thick and have durability, puncture resistance, and burst strength as to prevent rupture or leaks during ordinary use.

17.3.4 Clearly mark all bags or receptacles used to segregate, transport, or store infectious medical waste with:

17.3.4.1 The universal biohazard symbol.

17.3.4.2 The word "BIOHAZARD" in English and Japanese.

17.3.4.3 Markings or a label that identify the generator, date of generation, and contents.

17.3.5 Segregate and store sharps in upright and stable heavy-duty plastic containers with tight-fitting, puncture-resistant, leak-resistant lids. Discard sharps in rigid receptacles. Do not clip, cut, bend, or recap needles before disposal. Close sharps containers and remove them when they are three-fourths full.

17.3.6 Place all anatomical pathology waste (e.g., large body parts) in containers lined with plastic bags in accordance with Paragraph 17.3.3.

17.3.7 Ensure all receptacles can be closed and are kept closed, except when the container is actively being used.

## 17.4 HANDLING WITHIN THE FACILITY

Installations must:

17.4.1 Transport infectious medical waste to minimize human exposure. Do not place in chutes or dumbwaiters.

17.4.2 Avoid compacting infectious medical waste unless first converted to noninfectious medical waste by the treatment described in Paragraph 17.6. Do not compact containers holding sharps.

17.4.3 Ensure all personnel handling infectious medical waste and medical waste containers wear appropriate protective apparel or equipment such as gloves, coveralls, masks, and goggles, and receive appropriate training on the use of protective equipment and risk reduction associated with exposure to infectious agents, pathogens, and physical hazards.

## 17.5 STORAGE

Installations must:

17.5.1 Manage infectious waste when stored on-site.

17.5.1.1 Store infectious medical waste in a manner that prevents decay, spoilage, or becoming putrid. Refrigeration is required for pathology waste.

17.5.1.2 Infectious medical waste must not be placed in hallways.

17.5.1.3 Infectious medical waste with multiple hazards (e.g., infectious hazardous waste or infectious radioactive waste) must be segregated from the general infectious waste stream when additional or alternate treatment and disposal is required.

17.5.2 Ensure storage sites:

17.5.2.1 Are specifically designated for such use.

17.5.2.2 Are constructed to prevent entry of insects, rodents, and other pests.

17.5.2.3 Prevent access by unauthorized personnel.

17.5.2.4 Are marked on the outside with the universal biohazard symbol and the word "BIOHAZARD" in English and Japanese.

17.5.3 Post signage that:

17.5.3.1 Identifies any special requirements for entering the site, and the name and telephone number of the person responsible for the storage site.

17.5.3.2 Is fluorescent orange-red in color, or predominately so, with lettering and symbols in contrasting color, and easily visible to workers.

17.5.4 Remove waste from:

17.5.4.1 Interim storage sites (e.g., soiled utility rooms) daily.

17.5.4.2 The final storage site at least every seven calendar days unless refrigerated. If refrigerated, the infectious medical waste may remain in the final storage site for 30 calendar days. Infectious medical waste is typically refrigerated at temperatures between 0-4.0°C [32.0-39.2°F].

## 17.6 TREATMENT AND DISPOSAL

Installations must:

17.6.1 Treat and dispose of blood, blood products, and other liquid infectious waste as follows:

17.6.1.1 Decant bulk blood and blood products into a sewer system connection (e.g., sinks, drains), unless pre-treatment is required.

17.6.1.1.1 If pre-treatment is required, use the methods outlined in Table 17.1 before discharge to the sewer system. Continue to manage the emptied containers as infectious medical waste.

17.6.1.1.2 If pre-treatment is not feasible to allow for sewer system disposal, seal the liquid waste in leak-proof containers and incinerate.

17.6.1.2 Either decant suction canister waste from operating rooms into a clinical sink (if pre-treatment is available) or sealed in leak-proof containers and incinerate.

17.6.2 Before disposal, treat infectious medical waste in accordance with Table 17.1 and:

17.6.2.1 Ensure sterilizers maintain their temperature at 121°C [250°F] for at least 30 minutes at 103.4 kilopascal [15 pounds per square inch].

17.6.2.2 Check the effectiveness of sterilizers at least weekly using *Bacillus stearo thermophilus* spore strips or an equivalent biological performance test.

17.6.2.3 Design and operate incinerators used to treat infectious medical waste to maintain a minimum temperature and retention time sufficient to destroy all infectious agents and pathogens and meet the applicable air emission standards in JEGS Paragraph 4.4.

17.6.2.4 Assess ash or residue from the incineration of infectious medical waste for classification as hazardous waste in accordance with JEGS Paragraph 16.3.

17.6.2.4.1 Manage ash that is determined to be hazardous waste in accordance with JEGS Chapter 16.

17.6.2.4.2 Dispose of all other residue in a landfill that complies with the standards in JEGS Chapter 15.

17.6.2.5 Conduct chemical disinfection using procedures and compounds approved by the appropriate DoD medical authority for use on any pathogen or infectious agent suspected to be present in the waste.

## 17.7 OFF-SITE DISPOSAL OF MEDICAL WASTE

17.7.1 Infectious medical waste is classified as either a specially controlled municipal solid waste (SCMW) or specially controlled industrial waste (SCIW) depending on the source of generation (JEGS Table 16.7).[138] Disposal of such waste off-site in Japan may require special handling depending on local prefectural and municipality guidelines.

17.7.2 For the disposal of non-contaminated animal carcasses, consider and appropriately address Japanese requirements that may vary from the standards in this chapter.

17.7.3 Place bags and receptacles containing infectious medical waste in rigid or semi-rigid, leak-proof containers before being transported off-site.

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[138] GOJ Order for Enforcement of the Waste Management and Public Cleansing Act, Articles 1, 2-4.

17.7.4 Package and document the transport of infectious medical waste off-site for disposal in accordance with transportation regulations of Japan and the International Air Transport Association. At a minimum, the transporter must be appropriately credentialed by the appropriate governmental authority to transport the waste and must provide a receipt for transport to the disposal facility.

17.7.5 Installations utilizing off-site disposal facilities must ensure that the transportation and disposal facility contractor(s) are properly licensed by the appropriate governmental authorities for the infectious medical waste being disposed.[139] Installations are not required to inspect these facilities. Installations must ensure the disposal contractor maintains a current license with the appropriate governmental licensing authority.

17.7.6 Generators of infectious medical waste are prohibited from contracting with a licensed transporter that requires the transporter to then subcontract with a licensed disposal facility.[140] The installation must either contract with a single contractor who is licensed to both transport and dispose the waste, or contract separately with a licensed transporter and a licensed disposal facility.

## 17.8 CONTINGENCY PLANNING

Installations must:

17.8.1 Develop and update as necessary medical waste contingency plans for treatment and/or disposal of infectious medical waste in case the primary means become either inoperable or inaccessible.

17.8.2 Include alternate storage sites or alternate means of treatment and disposal in the contingency plans.

## 17.9 SPILLS

Installations must:

17.9.1 Clean up spills of infectious medical waste as soon as possible.

17.9.2 Comply with personal protection equipment requirements in Paragraph 17.4.3.

17.9.3 Remove blood, body fluid, and other infectious fluid spills with an absorbent material that must then be managed as infectious medical waste.

17.9.4 Wash surfaces contacted by infectious medical waste with soap and water and chemically decontaminate the surfaces in accordance with Paragraph 17.6.2.5.

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[139] GOJ Act on Waste Management and Public Cleansing, Articles 7, 14.

[140] GOJ Act on Waste Management and Public Cleansing, Article 14.

## 17.10 RECORDKEEPING

Installations must keep records of the following information concerning infectious medical waste for at least three years after the date of disposal:

17.10.1 Type of waste.

17.10.2 Amount of waste (volume or weight).

17.10.3 Treatment method, including date of treatment.

17.10.4 Disposition, including:

17.10.4.1 Date of disposition.

17.10.4.2 If the waste was transferred to Japanese facilities.

17.10.4.3 Receipts acknowledging Paragraphs 17.10.1 through 17.10.3 for each transfer.

**Table 17.1: Treatment and Disposal Methods for Infectious Medical Waste**

| TYPE OF MEDICAL WASTE | METHOD OF TREATMENT | METHOD OF DISPOSAL |
|---|---|---|
| Microbiological | Steam sterilization(1) | MSWLF(2) |
| | Chemical disinfection | MSWLF |
| | Incineration | MSWLF |
| Pathology | Incineration(3) | MSWLF |
| | Cremation(3) | Burial |
| | Chemical sterilization(4) | DWTP(5) |
| | Steam sterilization(4) | DWTP |
| Bulk blood and suction canister waste | Steam sterilization(6)<br>Chemical disinfection | DWTP |
| | Incineration(6) | MSWLF |
| Sharps in sharps containers | Steam sterilization | MSWLF |
| | Incineration | MSWLF |

Notes:

1. Preferred method for cultures and stocks because they can be treated at point of generation.
2. Refer to JEGS Chapter 15 for solid waste landfill standards.
3. Treat anatomical pathology waste (e.g., large body parts) either by incineration or cremation before disposal. Refer to JEGS Chapter 4 for incinerator standards.
4. This only applies to placentas, small organs, and small body parts that may be steam sterilized or chemically sterilized, ground, and discharged to a domestic wastewater treatment plant.
5. Refer to JEGS Chapter 9 for wastewater standards.
6. Treat bulk blood or suction canister waste known to be infectious by incineration or steam sterilization before disposal.