TIP No. 033-0724

Waste Characterization of Clinical Laboratory Effluents

1. **PURPOSE.** This document provides waste characterization determination considerations for liquid waste effluents discharged from clinical laboratory equipment in military medical treatment facilities (MTFs) and research facilities.

2. REFERENCES. See Appendix A for a list of reference information.

3. BACKGROUND. Clinical laboratory equipment and processes generate liquid waste effluents that must either be collected in containers for waste treatment or discharged down the drain to the sewer system. The liquid waste effluents may be hazardous waste due to ignitability, corrosivity, reactivity, toxicity, or may be deemed prohibited from discharge down the drain due to safety hazards or regulatory prohibitions. Waste generators must understand the applicable regulations and wastewater treatment standards to properly characterize liquid waste effluents and determine their respective waste management requirements.

A. Requirement to Characterize (Hazardous Waste Determination)

According to Title 40, Code of Federal Regulations (CFR), Section 262.11(c), a solid waste generator must determine if each solid waste generated is a hazardous waste (HW), as defined in 40 CFR Sections 261.21 – .24 and 261.31 – .33. Solid waste includes solids, liquids, and gases. To do so, the generator uses analytical test methods specified in Resource Conservation and Recovery Act (RCRA) regulations and/or applies user knowledge of the materials/processes used to identify each specific hazard characteristic. For RCRA purposes, waste characterization occurs at the point of generation to determine if the effluent is a HW or if it is excluded from RCRA regulation. If the effluent is a HW, additional considerations are required to evaluate exemptions for possible permissible discharges in lieu of HW management.

B. Discharge Treatment Plant Classification

Defense Health Agency (DHA) MTFs and medical research laboratories discharge and dispose of numerous effluents generated by automated laboratory analyzers. Based on the physical and chemical properties of these effluents, effluents are either discharged to the sanitary sewer system or collected and turned in for disposal as HW or non-hazardous waste. Discharges to the sanitary sewer system flow to either Publicly Owned Treatment Works (POTW) (owned and operated by States or municipalities) or to treatment works owned and operated by private companies or to Federally Owned Treatment Works (FOTW) owned by the U.S. Government and operated either by the government or by contractors under privatization agreements. Under certain circumstances, it is permissible to discharge effluents that meet the criteria for classification as HW to the sewer. Facility personnel are responsible for knowing the characteristics of the effluents they intend to discharge to the sanitary sewer, knowing what type of standards apply (POTW or FOTW), understanding the qualifying effluent criteria, and informing Installation Directorate of Public Works (DPW)/Installation Environmental Office personnel of their intent to discharge effluents under an exemption from RCRA regulation referred to as the Domestic Sewage Exclusion (DSE).

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4. DOMESTIC SEWAGE EXCLUSION (DSE) AND APPLICABLE STANDARDS. Disposal and discharge of effluents generated by laboratory equipment and processes are governed by either the Clean Water Act (CWA) or RCRA. While numerous effluents can be managed by either CWA or RCRA, the regulations are written such that only one set governs the management of any effluent. Coordinate with the Installation DPW/Environmental office to find out what type of wastewater treatment plant treats wastewaters discharged from the MTF (POTW or FOTW) and what standards apply to the MTF waste effluent. Two discharge exclusions, based on wastewater treatment plant classification are detailed below.

A. POTW Discharge Exclusion. In RCRA, 40 CFR 261.4, referred to as the DSE, the regulation stipulates that effluents discharged to a POTW are not "solid waste" and are regulated under the CWA (40 CFR 403), and therefore, fall outside of the requirements of RCRA provided the "conditions" detailed under this exclusion are met. The "conditions of the exclusion" consist of CWA general discharge prohibitions, pretreatment standards, and operational guidelines specific to what and the manner with which effluents are discharged to the POTW. In the event any of these conditions cannot be met, management of the effluent would revert to RCRA regulations for HW.

B. FOTW Discharge Exclusion. Under RCRA, the distinction between discharges to POTWs and FOTWs is important. The DSE in RCRA applies only to POTWs. However, a similar exclusion for discharges of HW to FOTWs exists in Section 108 of the Federal Facilities Compliance Act (FFCA). Under this exclusion, it is permissible to discharge effluents provided they are subject to and meet the pretreatment standards, OR they meet the RCRA Land Disposal Restriction (LDR) level specified in 40 CFR Part 268.40. Effluents discharged to an FOTW that meet the criteria for these exclusions are not a regulatory solid or HW under Subtitle C of RCRA. If an MTF discharges to an FOTW, the RCRA LDR requirements must be assessed.

5. SAMPLING/MONITORING. MTF personnel must evaluate liquid effluent from each laboratory analyzer/process to comply with RCRA requirements to 1) characterize all wastes generated at the MTF (40 CFR 261.11) and 2) to determine whether an effluent has the potential to impact CWA discharge conditions. The sampling/monitoring point to collect representative samples of the waste effluents is contingent upon the regulatory driver in question (CWA or RCRA) and is referred to as the discharge compliance point in this document. The CWA and RCRA discharge compliance points for sampling and monitoring effluent constituents will be different locations as detailed below.

A. CWA Discharge Compliance Point

Under the CWA, the installation wastewater permit specifies the discharge point location(s) where the effluent monitoring occurs for compliance purposes. The CWA discharge point from the MTF is the point where compliance with the general, specific, and local pretreatment requirements must occur. This may be where the MTF sewer lines connect to the installation system, a location within the sewer line located down gradient from the MTF, or an established monitoring point on the installation defined in the permit. Multiple points can exist. Either situation will allow the discharge of effluents that exceed a pretreatment requirement or exclusion at the point of discharge from the laboratory analyzer/process provided the effluent

sampled at the discharge point is compliant. Effluents that would otherwise be considered a HW can be discharged to the sanitary sewer according to the DSE in 40 CFR 261.4(a)(1) when: 1) the effluent at the discharge point is compliant with CWA requirements; 2) the POTW was contacted in advance and approved the discharge; 3) the POTW would normally treat for the waste characteristic that is present; and 4) no HW pharmaceuticals are discharged. Monitoring for adherence to the discharge standards occurs at the CWA discharge point(s) and involves flow or time-weighted composite sampling methods and confined space entry. CWA discharge monitoring is an installation responsibility unless detailed in Installation/DHA service agreements.

B. RCRA Discharge Compliance Point. RCRA waste characterization sampling occurs at the point of generation (where effluent is discharged from the laboratory analyzer/process) to determine whether the effluent is a HW. The data generated at this point in the process represents the worst-case scenario since incidental dilution would occur once introduced to the sanitary sewer lines in the MTF. Point of generation sampling/characterization data provides user knowledge to facilitate waste management decisions and documentation. If the effluent exhibits HW characteristics at the generation point, a review of CWA prohibited discharges and pretreatment requirements must be conducted to ensure the DSE conditions are met. Additional sampling might be required at the CWA discharge point to determine whether applicable pretreatment standards or LDR standards (for FOTWs) are achieved at the CWA discharge point. If all discharge conditions are achieved (see Section 6) and Installation authorities are notified, the waste can be discharged to the sewer system, if not, the waste must be collected at the point of generation and managed as a HW.

6. CWA WASTEWATER (WW) DISCHARGE REQUIREMENTS (CONDITIONS). Once a waste is characterized (effluent properties are known), the generator must compare the effluent properties to the CWA discharge standards to determine if it can be discharged. The Environmental Protection Agency (EPA) regulates the discharge and treatment of WW under the CWA through the National Pollutant Discharge Elimination System (NPDES) and a component of the NPDES called the National Pretreatment Program (NPP). The NPP applies and enforces three types of discharge standards: 1) prohibited discharge standards (general and specific), 2) categorical pretreatment standards, and 3) local limits. The prohibited discharge standards apply to all discharges regardless of the size or type of operation (publicly owned, federally owned, or privately owned treatment works). Additional pretreatment standards are enacted to protect the sewage treatment plants by adjusting discharges to safe levels when necessary.

A. Prohibited Discharges. Prohibited discharges include both general and specific prohibitions. Although the prohibition regulations are directed at POTWs, the NPDES Permit Program (40 CFR 122.1(b) and 122.41(a)) and the FFCA (Title 42, U.S. Code, Chapter 82, Subchapter III, Section 6939e) require compliance of POTWs, privatized treatment works, and FOTWs with these CWA discharge standards.

(1) General Prohibitions. General prohibitions defined in 40 CFR 403.5(a) forbid the discharge to a POTW of any pollutant that causes pass-through or interference. Pass-through

means a discharge that causes a violation of any requirement of the POTW's NPDES permit. Interference refers to a discharge that inhibits or disrupts the POTW, its treatment process or operations, or its sludge processes and that leads to a violation of the NPDES permits or any other applicable Federal, State, or local regulation.

Pollutant of Concern. The CWA considers a pollutant of concern (POC) to be any pollutant that can adversely impact POTW operations and jeopardize human health when discharged in sufficient quantities. POCs include pollutants that are contributing to or known to cause operational problems even if the pollutants are not currently causing NPDES permit violations. The EPA identified 15 potential POCs among the pollutants often found in POTW sludge and effluent: ammonia, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, molybdenum, nickel, selenium, silver, total suspended solids, zinc, and 5-day Biochemical Oxygen Demand. The EPA recommends that each POTW, at a minimum, screen for the presence of the 15 POCs using data on industrial user (IU) discharges and collected from samples of POTW influent, effluent, and sludge.

(2) Specific Prohibitions. Specific prohibitions defined in 40 CFR 403.5(b)(1) – (b)(8) forbid the following eight categories of pollutant discharges (Table 1) to POTWs:

Table 1. Eight Categories of Prohibited Pollutant Discharges

1	Pollutants that create fire or explosion hazards
2	Pollutants that will cause structural damage due to corrosion
3	Pollutants that will cause obstructions in the flow of discharges to the POTW
4	Pollutants released at excessive rates of flow or concentrations
5	Excessive heat in amounts that inhibit biological activity
6	Certain oils that cause pass through or interference
7	Pollutants that result in the presence of toxic gases, vapors, or fumes
8	Trucked or hauled pollutants, except at discharge points designated by the POTW

B. Categorical Standards – Hospital Category (40 CFR 460.12). The CWA specifies functional hospital point source discharge limits for large hospitals. According to this regulation, the pH of discharges must be in the range of 6.0 to 9.0 after use of best available pretreatment technology. This standard only applies to hospitals with 1,000 or more inpatient beds. If a hospital does not meet the capacity requirement, this regulation does not apply other than to serve as an industry best management practice.

C. Local Limits. Sewage treatment plants develop local limits to enforce the specific and general prohibitions including all identified POCs, as well as any applicable State and local regulations. When assessing waste effluent discharge requirements, local limits will be assessed at the CWA compliance discharge points included in the Installation WW discharge permit.

D. Pretreatment Standards. Pretreatment standards are applicable at the point of discharge to the POTW (CWA compliance discharge point). Pretreatment standards may be detailed within a WW discharge permit, state regulations, local ordinances, and/or installation

policy. Conditions that must be met after pretreatment typically include limitations on the concentration of specific analytes, a given range of pH, suspended solids, and oxygen demand. Provided the requirements are met at the CWA discharge point, it is still permissible to discharge effluents from laboratory analyzers that would not otherwise meet the pretreatment standards at the point of generation.

(1) Incidental Dilution. Incidental dilution is permitted via the mixing of effluent with the contents of the sewer lines as it is transported through the building. Incidental dilution occurs as effluents discharged within the building mix with other wastewaters discharged in the building including discharges from patient rooms, kitchen activities, central sterilization activities, sinks and toilets, showers, cart washing activities, etc.

(2) Intentional Dilution. According to the CWA and RCRA, effluents discharged to the sanitary sewer that would otherwise be HW, cannot be intentionally diluted either by mixing directly with another liquid or through flushing of the system with tap water, except when elementary neutralization is conducted according to 40 CFR 260.10, 261.22 and 270.1(c)(2)(v) on a corrosive waste (see *Elementary Neutralization*). It is permissible to dilute and pretreat effluents that are characterized as non-hazardous per RCRA.

(3) Elementary Neutralization. Wastes that are only HW due to corrosivity may be neutralized onsite to a pH of 6.0 to 9.0 in an elementary neutralization unit. An elementary neutralization unit is defined in 40 CFR 260.10 as a device which: 1) is used to neutralize wastes that are hazardous only because they exhibit the corrosivity characteristic defined in 40 CFR 261.22 or they are listed solely for their corrosivity properties; and 2) the unit meets the definition of a tank, tank system, container, transport vehicle, or vessel as defined in 40 CFR 260.10. Owners and operators of elementary neutralization units are excluded from the RCRA permit program according to 40 CFR 270.1(c)(2)(v) but record retention detailing treatment quantities, treatment dates, and pH measurements prior to and after neutralization is necessary.

(4) Neutralization Tanks. Neutralization tanks are pretreatment devices designed to control the pH fluctuations of WW discharges outside of the normal range caused by laboratory effluents, cleaning solutions, and disinfection procedures used in MTF building(s). A properly functioning neutralization tank will effectively mitigate pH spikes and bring the pH of the WW back into the permissible pH range as specified within the WW discharge permit, CWA, or other governing requirements (usually 6.0–9.0). Some MTFs are designed with neutralization tanks to manage WW in the entire building, some have tanks in series to address WW from specific areas such as the laboratory. Consult the local MTF Facility Engineers or Maintenance Sections to assess neutralization capabilities.

7. LABORATORY EFFLUENTS PROHIBITED FROM SEWER DISCHARGE

Effluents meeting any of the discharge prohibitions in Section 6 above are prohibited from discharge. Examples of laboratory effluents prohibited from discharge are provided below. Circumstances exist where the concentration of the chemicals/contaminants in the effluent may qualify for exceptions as discussed in paragraph 7B.

A. Effluents Forbidden from Sewer Disposal. The following effluents are known examples of those forbidden from sewer disposal:

- Aldehydes
- Brominated Solvents
- Chlorinated Solvents
- Cyanide Waste
- Raw/Bulk/Pure/Neat Chemicals
- Water Insoluble Solvents (benzene, gasoline, toluene, xylene)
- Radiological Waste

B. Discharge Prohibition Considerations

(1) Aqueous Effluents Containing Alcohols. Water soluble solvents such as alcohols and glycols capable of creating fire and explosion hazards in the building plumbing systems are prohibited from discharge per the CWA. However, the EPA considers alcohol solutions with greater than 50% water content as incapable of sustaining combustion even when exhibiting low flash points due to the alcohol content. The term 'alcohol' in 40 CFR 260.21 refers to any alcohol or combination of alcohols containing the functional hydroxyl (-OH) group. The presence of a non-alcoholic component does not prohibit the waste stream from qualifying for the alcohol exclusion if the waste is aqueous (50% or greater water content) and does not contain another regulated solvent prohibited from discharge. Effluents that meet the aqueous alcohol exclusion may be discharged to the sanitary sewer under the DSE if their chemical constituents do not pose a combustion hazard (flashpoint less than 100 degrees Fahrenheit (° F)).

(2) Sodium Azide. Sodium azide is a common preservative found in stock laboratory solutions. When discharging concentrated solutions containing sodium azide to the sanitary sewer, a potential exists for the sodium azide to react with copper piping and lead solder to form heavy metal azide salts that are reactive and shock sensitive. For explosive conditions to form, sodium azide concentrations of required strength must be in contact with the lead/copper piping for enough time to allow it to dry and crystallize. In hospitals and laboratories, very dilute amounts of sodium azide are used as a biocide in bulk reagents and stock solutions to prohibit bacterial growth. The dilute concentrations (less than 1.0 percent) of sodium azide are contained in numerous reagents used in laboratory analyzers. These dilute sodium azide solutions are discharged to sink or floor drains and continually flushed with other discharges, preventing the dry conditions required to form the explosive lead and copper azides. Additionally, personnel may legally flush the system with water when discharging solutions containing sodium azide as a protective measure, because the concentration of sodium azide in the process waste stream does not meet HW criteria. If sodium azide solutions of greater than 1 percent are used, facility personnel should evaluate the type of plumbing in use (polyvinyl chloride or copper) to determine whether additional engineering and/or management controls are required.

(3) Corrosive Effluents. Effluents with pH values outside of the neutral pH range of 6.0 to 9.0 could cause corrosion to the WW system structure without pretreatment. These waste streams can damage the building plumbing system and create internal leaks over time if the

plumbing is not designed for acidic or alkaline WW discharges. Performing elementary neutralization of a corrosive solution according to 40 CFR Part 260.10, 261.22, and 270.1(c)(2)(v) **is permissible** if the effluent does not meet any other HW criteria.

C. Do Not Discharge Until Characterized and Approved. The following effluents should not be discharged until properly evaluated, characterized, and approved:

- Laboratory effluents with sodium azide concentrations of greater than 1.0%
- Laboratory effluents that exhibit flashpoints of <140° F and do not satisfy the requirements of the aqueous alcohol-content exclusion (Title 40 CFR Part 261.24(a)(1), greater than 50% water content and less than 24% alcohol).
- Laboratory effluents that are corrosive (i.e., pH less than 6 or greater than 9).
- Laboratory effluents with excessive coloration (i.e., concentrated solutions of stains can exceed RCRA metals content limits).

8. RECOMMENDED RECORD RETENTION. Retain the following types of records to document waste discharge considerations, decisions, and actions:

- Waste effluent characterizations or profiles for all effluents, including those for non-hazardous and non-regulated effluents.
- POTW or FOTW standards and conditions applicable to your waste effluents.
- If your MTF has a neutralization tank used to regulate the pH of effluents discharged from the facility:
  - Sampling records of tank discharge to demonstrate neutralization are effective.
  - Records of tank maintenance including media change and clean-out.
- Coordination with Installation DPW - Environmental Office and the DHA MTF Environmental Health Office records.
- Sampling records demonstrating compliance with RCRA and CWA standards.

9. WASTE CHARACTERIZATION AND DISCHARGE EVALUATION PROCESS SUMMARIZED

Before discharging a laboratory effluent down the drain, a generator must characterize the effluent using one of two methods: 1) by reviewing the SDS and Manufacturer provided operational information for liquid inputs and effluents generated during equipment operation; or 2) by collecting a representative sample(s) of the effluent. Based on information obtained during the waste characterization process, there are multiple possible scenarios for the waste effluent evaluation and management as displayed in the Appendix B flowchart. In general, the waste will be either non-hazardous or HW per RCRA at the generation point. The waste will also either be

eligible for discharge per the CWA DSE or it will require pretreatment, monitoring, and notifications. A HW evaluation at the point of discharge does not automatically require HW collection. An additional assessment of the CWA requirements must be conducted to complete the evaluation and determine proper waste effluent management from automated laboratory analyzers.

APPENDIX A

References

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Applicable State, County and Local Principality Discharge Agreements

Appendix B

Flow Diagram for Effluents Discharged to the Sanitary Sewer