



RCRA Organic Air Emission Standards (ROAES) Overview – Applicability, Pitfalls, and Compliance Strategies

40 CFR Parts 261/264/265

Subparts AA, BB, and CC

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Helping our clients
protect the environment,
improve worker health and safety,
ensure the safety of food and drugs,
plan sustainable facilities, and
achieve other positive outcomes.

Learning Objectives

- Discuss Federal RCRA Organic Air Emission Standards (ROAES) including applicability, exclusions and exemptions, and recordkeeping requirements.
- Identify important considerations in developing Leak Detection and Repair (LDAR) programs that comply with ROAES.
- Identify common areas of concern observed by regulators during ROAES inspections.
- Locate resources developed by EPA related to ROAES.

Why is controlling organic emissions from hazardous waste management important?

- Uncontained organic air emissions from **Treatment, Storage and Disposal Facilities (TSDFs)** and **Large Quantity Generators (LQGs)** of hazardous waste contribute significantly to **ambient ozone formation, crop damage, increased cancer rates, and other health risks**.
- Releases to the air from process vents, equipment, tanks, containers, and surface impoundments can result in onsite worker exposure, and under certain conditions, nearby community exposure to hazardous waste volatile organic compound (VOC) emissions. There may also be an increased fire or explosion risk from the releases to air.

From 2017-2022 EPA completed over **760** inspections and off-site compliance evaluations of RCRA facilities, under the **National Enforcement and Compliance Initiative** for *Reducing Hazardous Air Emissions from Hazardous Waste Facilities*, to ensure compliance with the organic air emission standards.



RCRA ORGANIC AIR EMISSION STANDARDS

What are the Federal ROAES Regulations?

- Relevant regulations are included in Chapter 40 of the Code of Federal Regulations (CFR) in Parts 261, 264, and 265. Part 270 also includes several ROAES regulations and permitting requirements.
- Each Subpart in Parts 261, 264, and 265 applies to different types of process units or equipment.
 - Subpart AA: Process Vents
 - Subpart BB: Equipment Leaks
 - Subpart CC: Tanks, Surface Impoundments, Containers, and Miscellaneous Units
- Each Subpart addresses applicability, definitions, standards, testing or inspection methods, and recordkeeping requirements.
- Compliance with ROAES is demonstrated through detailed Leak Detection and Repair (LDAR) Programs and monitoring records.
- **State-specific requirements may be more stringent.**
- **Even if your state has not adopted the ROAES, the Federal requirements are applicable in every state.**



APPLICABILITY AND EXEMPTIONS

What types of facilities and/or units are subject?

- **TSDFs** subject to 40 CFR Part 270
 - Permitted
 - Interim status
- **LQGs** with less-than-90-day accumulation tanks and containers.
- **Recycling units** at hazardous waste management facilities otherwise subject to permitting standards.
- Tanks & Containers managing hazardous secondary material (HSM) under remanufacturer exclusions (40 CFR Part 261).
- According to 40 CFR section 264.601, certain **Subpart X miscellaneous units may also be subject** to Subpart AA, BB, and CC requirements, as appropriate, to control volatile organic emissions from the unit.

What types of units or equipment are subject?

Subpart AA

Process vent



Process vents associated with certain operations

Subpart BB



Pumps, compressors, pressure relief devices, sampling connections, open-ended valves/lines, valves, flanges, and other connectors

Subpart CC



Tanks, containers, surface impoundments, and miscellaneous units

What types of hazardous wastes are subject?

Subpart	Types of Units or Equipment	Waste Stream Organic Content
AA	Process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations (includes associated tanks)	Manage hazardous wastes with organic concentrations of at least 10 parts per million by weight (ppmw)
BB	Pumps, compressors, pressure relief devices, sampling connections, open-ended valves/lines, valves, flanges and other connectors	Contains or contacts hazardous waste with organic concentrations of at least 10 percent by weight
CC	Tanks, containers, surface impoundments, and miscellaneous units	Any hazardous waste entering the unit with an average volatile organic concentration <u>at the point of waste origination</u> greater than or equal to 500 ppmw

If a facility has an air permit, does ROAES still apply to the HWMU and recycling units?

As described in 62 Federal Register 64636, where CAA and RCRA requirements would both apply to the same units or equipment, the ROAES allow for some compliance considerations. You should examine the interplay between CAA and RCRA closely.

Subparts AA and CC

- The ROAES exempt all process vents subject to AA and hazardous waste management units subject to CC that the facility owner or operator certifies as being equipped with and operating air emission controls in accordance with an applicable CAA regulation codified under **40 CFR parts 60, 61, or 63**.
- CAA requirements must be equivalent to or more stringent than the applicable ROAES subpart.
- The units that are being claimed for exemption should be included in the CAA permit.
- **If at any time, the CAA no longer applies, the facility must notify and operate under ROAES.**

Subpart BB

- **Subpart BB regulations still apply to all applicable equipment!**
- The facility owner or operator may elect to determine compliance *by documentation in accordance with an applicable CAA regulation* codified under **40 CFR parts 60, 61, or 63**. This is ***not*** an exemption, just a different method of documentation.
- CAA documentation requirements must be equivalent to or more stringent than the applicable ROAES subpart.

Review Subparts AA, BB, and CC for specific requirements relevant to interplay with CAA compliance.

Additional guidance provided in document *EPA530-R-19-006*, included in the resources at the end of this training.

Applicability of the RCRA Organic Air Emission Standards to Recycling Units

- Although units engaged in legitimate recycling of hazardous waste can be conditionally exempt from permitting under RCRA, 40 CFR section 261.6(d) subjects certain recycling units to the Subpart AA and BB standards. Thus, **recycling units at facilities that are subject to RCRA permitting for storage, or are operating in interim status**, must also comply with the applicable Subpart AA and BB regulations.
- Subpart CC does not apply to recycling units because the emission mechanisms for hazardous waste storage tanks differ significantly from the emission mechanisms of the distillation-type units used for recycling and certain treatment operations e.g., air strippers and thin-film evaporators), which are regulated under Subpart AA (See 61 Fed. Reg. 59,935, Nov. 25, 1996).

Exemptions: Units that are **NOT** subject to the Standards

- RCRA Empty Containers: 40 CFR 261.7
- Satellite Accumulation Areas (SAAs): 40 CFR 262.15
- Farmers disposing of wastes and pesticides: 40 CFR 264.1(g)(4) and 265.1(c)(8)
- Totally enclosed treatment units: 40 CFR 264.1(g)(5) and 265.1(c)(9)
- Wastewater Treatment Units (WWTUs): 40 CFR 264.1(g)(6) and 265.1(c)(10)
- Elementary neutralization units: 40 CFR 264.1(g)(6) and 265.1(c)(10)
- Emergency or spill management units: 40 CFR 264.1(g)(8) and 265.1(c)(11)
- Transporters storing manifested HW at transfer facilities: 40 CFR 264.1(g)(9) and 265.1(c)(12)
- Containers w/absorbent material: 40 CFR 264.1(g)(10) and 265.1(c)(13)
- Universal waste handlers and transporters: 40 CFR 264.1(g)(11) and 265.1(c)(14)

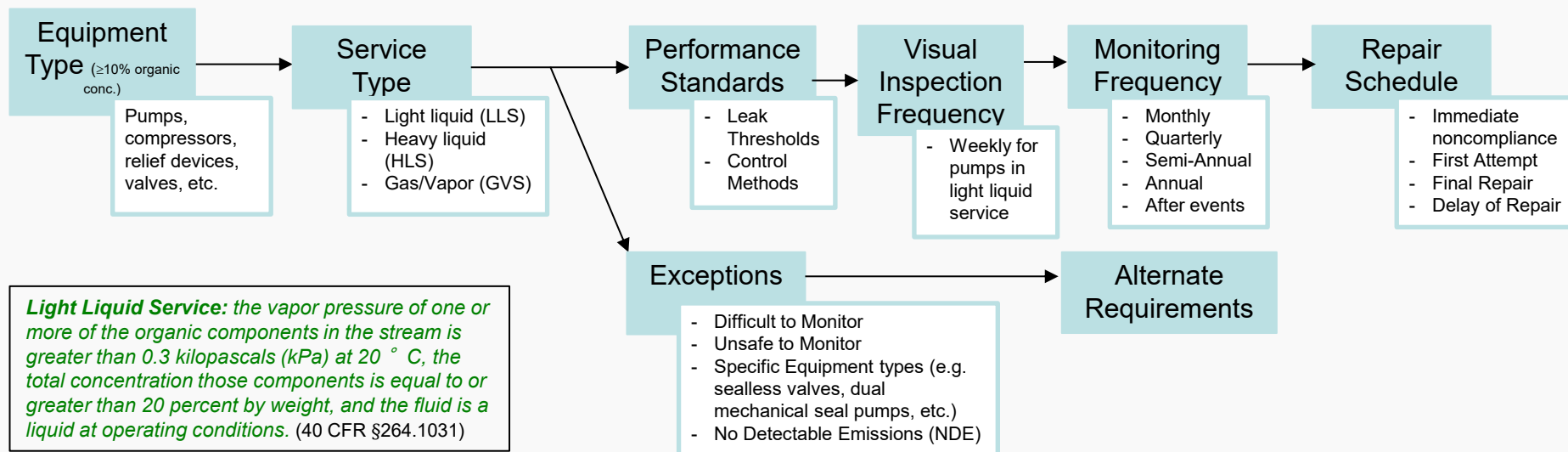
Additional exemptions exist, but those included in this presentation are the most common



COMPLIANCE REQUIREMENTS

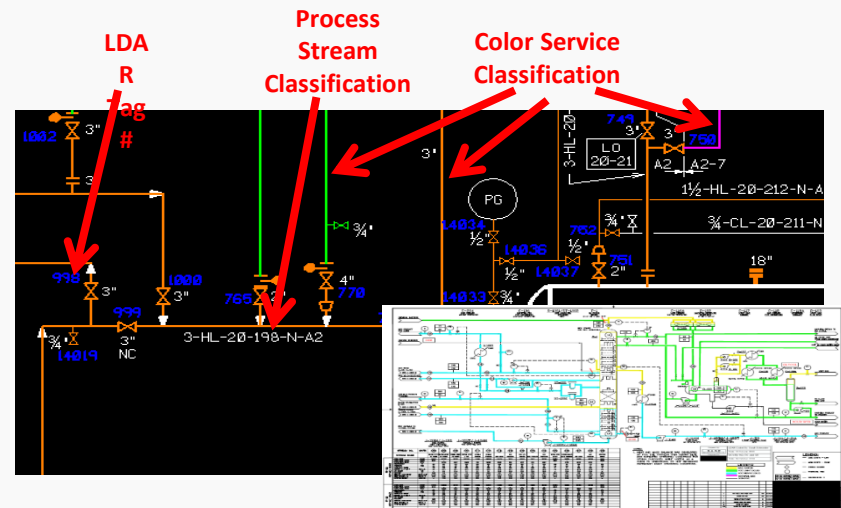
Subpart BB: Equipment Leaks

- Recall: Subpart BB is associated with equipment leaks from pumps, compressors, pressure relief devices, sampling connections, open-ended valves/lines, valves, and flanges and connectors.



Subpart BB: Tagging

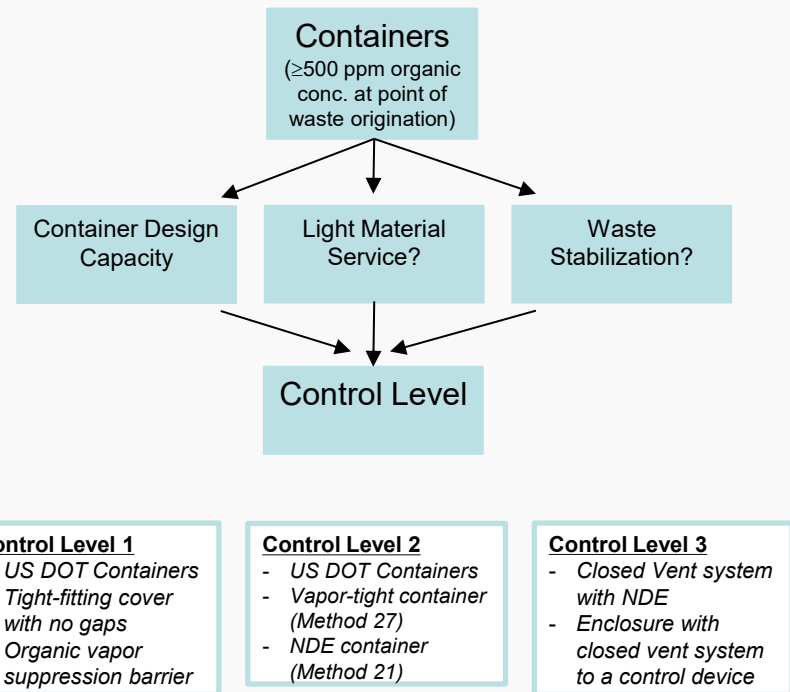
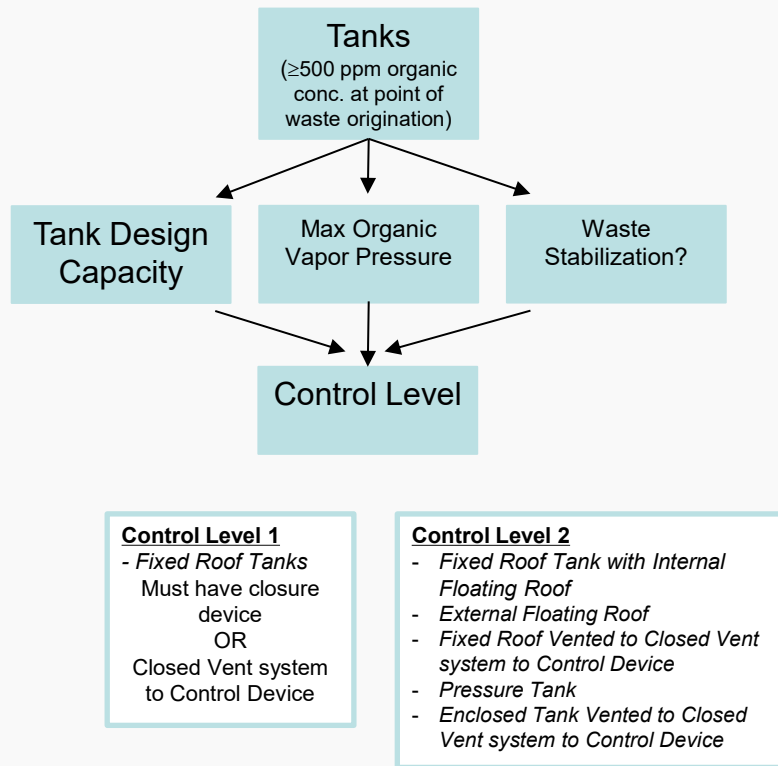
- 40 CFR 264.1050(d)/265.1050(c): *Each piece of equipment to which this subpart applies shall be marked in such a manner that it can be distinguished readily from other pieces of equipment.*



Subpart BB Exemption: “Less than 300-Hour” Rule [40 CFR 265.1050(e)]

- Equipment that **contains or contacts** hazardous waste with organic concentration of at least 10% by weight for **less than 300 hours per calendar year**.
- Keep in mind...
 - Applicable equipment is only exempt from certain requirements
 - **The equipment is not excluded from Subpart BB identification/markering, recordkeeping, and reporting** (refer to 40 CFR sections 264.1050(d) through 264.1050(f), or 40 CFR sections 265.1050(c) through 265.1050(e)).
 - Ensure hazardous waste lines are sufficiently cleared after use. A best practice is to clean or flush the piece of equipment with solvent and dry it with an air or nitrogen purge or other non-hazardous waste material (like water) capable of removing the liquid and gas.
 - Properly document compliance with this exemption (e.g., maintain operating logs – date/time, duration, and cleaning method – or calculate use rates for associated equipment to show compliance pursuant to the recordkeeping requirement found in 40 CFR 264/265.1064(k)).

Subpart CC: Tanks and Containers

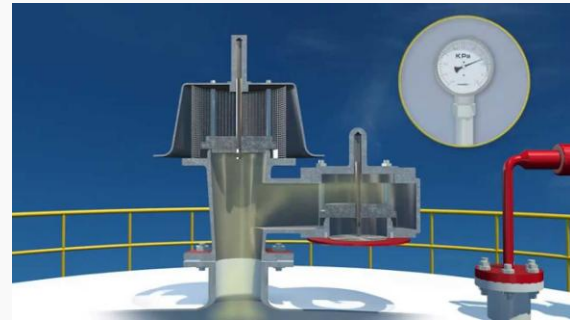


Light Material Service: 40 CFR §265.1081

Subpart CC: Tanks - Considerations



For Level 1 fixed-roof tanks: *“The fixed roof and its closure devices shall be designed to form a continuous barrier over the entire surface area of the hazardous waste in the tank.”*
... Closure devices such as flanges, manway covers, or valves should be completely closed in accordance with design (e.g., all bolts should be in use and tightened).



Venting from a PRD (e.g., a conservation vent) on a tank is allowed only for the purpose of maintaining tank internal pressure in accordance with design specifications or to avoid an unsafe condition. **PRDs should remain closed under ambient conditions – a rule of thumb is that PRD set point (gauge pressure) should be at least the maximum vapor pressure of the liquid being managed in the tank. Set points below this level may allow for open venting.**

- Other Considerations

- If a closed vent system connected to a control device is used to comply with Level 2 tank controls, the regulations will direct you back to Subpart AA standards (40 CFR 264/265.1033).
- Tanks must be regularly inspected daily (Subpart J) as well as initially, followed by annually (Subpart CC).
- Comply by following the specific requirements for the selected control method [40 CFR 264.1084(c)-(i)/265.1085(c)-(i)].

Subpart CC: Containers – Considerations



Roll-off containers may be difficult to seal. Tarps may be used to close a roll off and comply by keeping it: 1) visibly closed if a Level 1 control OR 2) sealed from detectable emissions if a Level 2 control.



Vacuum trucks, tanker trucks, and railcars are also considered “containers” under Subpart CC. These containers should have valid USDOT certification if used on public roads, or, if not on public roads, demonstrate that it is vapor-tight (Method 27) or operates with no detectable emissions (Method 21) if Level 2 controls are required. There are special provisions in Subpart CC that allow for venting during filling or vacuum operations.

- Other considerations
 - Transfer into or out of Level 2 and Level 3 containers must “*minimize exposure of the hazardous waste to the atmosphere*” (e.g., **NO** splash loading of Level 2 or 3 containers).
 - U.S. Department of Transportation (USDOT) containers used to meet Level 1 or Level 2 control standards must comply with the applicable USDOT regulations (e.g., reused containers must comply with USDOT reconditioning and reuse provisions) to be considered Subpart CC compliant.

Recordkeeping

- Maintain records relevant to monitoring and repair for **at least 3 years**
 - Records might include monitoring logs, repair logs and leak history, delays of repair, startup/shutdown events.
 - Monitoring and inspection forms for each monitoring event should include the actual highest monitor measurement for each piece of equipment, calibration data, designate if the equipment is in service, and identify the monitor or inspector and their training for the monitor and method.
- Maintain supporting records for equipment/unit applicability and any exemptions being claimed or alternative requirements.
 - May include logs, calculations, monitoring plans, waste determinations, analytical data, performance tests, engineering design documentation, and other supporting documentation.
 - Records are required to be maintained when managing equipment/units under the applicable CAA requirements and there is no exemption for complying with Subpart BB under CAA.
- To comply, check the full list of recordkeeping requirements at: 40 CFR 264.1036/265.1035 (Subpart AA), 40 CFR 264/265.1064 (Subpart BB), and 40 CFR 264.1089/265.1090 (Subpart CC).

Reporting

- **Permitted facilities** must comply with reporting requirements in 40 CFR 264.1036/1065/1090 (under Subparts AA, BB, and CC).
- Submit a **semi-annual report** to the Regional Administrator if...
 - A control device associated with Subparts AA, BB, or CC exceeded design specifications for longer than 24 hours.
 - The report must indicate the duration of each exceedance and any corrective measures taken to remedy the situation.
 - A valve, pump, or compressor leak is not repaired in the required time period.
 - Report must also include dates of hazardous waste management unit shutdowns.
- Submit a written report to the Regional Administrator **within 15 calendar days** if...
 - You become aware that hazardous waste that meets Subpart CC applicability (≥ 500 ppm VOCs by weight at point of waste origination and untreated) was placed in any waste management unit exempt from Subpart CC under 40 CFR 264.1082(c).
 - You become aware that hazardous waste that meets Subpart CC applicability was placed in a tank that did not meet the control standards under 40 CFR 264.1084(b).



LEAK DETECTION AND REPAIR PROGRAMS

Key to Compliance – A Documented LDAR Program

The requirements for Subparts AA/BB/CC are complex and differ based on a variety of factors that may include:

- Type of equipment
- Equipment size
- Physical properties of the hazardous waste stream
- Location/Ability to access
- Leak History
- Control level

Having a well-documented LDAR program is central to complying.

LDAR Components



Identifying components required to be monitored or exempted



Leak definitions (regulation-specific)



Monitoring components or control options



Repairing components



Recordkeeping

Key to Compliance – A Documented LDAR Program

Best practice elements of a written LDAR Program:

- Physically tag each regulated equipment component with a unique ID number and write the component ID number on piping and instrumentation diagrams.
- Audit the LDAR program to help ensure that the correct equipment is being monitored, Method 21 procedures are being followed properly, and the required records are being kept.
- Maintain records of the highest concentration measured for each piece of equipment during each monitoring event, including when the concentration is below the leak threshold.
- Implement a process for evaluating whether new or replacement equipment is needed, including tracking emission trends for existing equipment.
- Monitor components daily and over several days to ensure a leak has been successfully repaired.
- Electronically monitor and store LDAR data including regular QA/QC audits.



Source: Leak Detection and Repair, A Best Practices Guide (EPA-305-D-07-001)

Method 21 Calibration

- Adequate calibration for ROAES monitoring requires adherence to **BOTH** Method 21 and the RCRA regulations for calibration.
- VOC monitoring instrument must be calibrated **before use on each day** it is in use. Successful calibration requires the instrument reading is within 10% of the calibration gas value.
 - Document calibration results and maintain records alongside monitoring results.
- Use calibration standard gases specified in the RCRA regulations:
 - (i) Zero air (less than 10 ppm of hydrocarbon in air) .
 - (ii) A mixture of **methane or n-hexane** and air at a concentration of approximately, but less than, 10,000 ppm methane or n-hexane.
- Method 21 also includes requirement for a calibration gas of “a known standard in air at a concentration approximately equal to the applicable leak definition specified in the regulation”
→ a calibration gas of approximately 500 ppm should be used for calibration if this threshold is applied (“no detectable emissions”).
- Common area of concern: Most manufacturers recommend isobutylene gas for PID calibration, but **the ROAES requirements only allow for methane or n-hexane**.
 - PIDs cannot detect methane, and n-hexane calibration gas is not available at concentrations greater than 50% of the LEL (5,000 ppm).
 - If calibration can’t be completed using the gases required by the ROAES regulations, consult with state and regional agencies about alternative calibration.

Flame Ionization Detectors (FID)

- Portable FIDs use a hydrogen-air flame to combust the sample in a carrier gas and measures the generation of liberated ions. The magnitude of the current measured from the liberated ions is directly proportional to the concentration of organic species in the measured gas stream.
- Can measure many organic compounds, especially hydrocarbons, at very low and high concentrations.
- Requires re-ignition if exposed to oxygen-deficient atmosphere.
- Do not respond well to organic compounds that contain nitrogen, sulfur, or halogen atoms and FIDs cannot detect inorganic compounds, such as ammonia.

Note: 4-gas meters are **not** an acceptable device for Method 21 monitoring



LDAR Monitoring (contd.)

- Method 21 monitoring technique is considered.
 - Leak interface monitoring techniques are specified for each component.
 - Time spent monitoring each component should be adequate for Method 21 device response time or measuring the maximum reading, whichever is longer.
 - Record the highest measurement at each leak interface.
- Equipment designated as UTM or DTM should be justified by supporting documentation.
 - Monitoring plans are still required.
 - Probe extensions are available for monitoring equipment! Instrument calibration must be performed with extension on to show they still meet response time requirements, and the entire component interface must still be monitored.
- Leaks or areas of concern may allow time for repair, or may be an immediate noncompliance.
 - Open-ended lines are an immediate noncompliance.
 - Consistent leaks found on a particular piece of equipment may warrant replacement.

Probe extension for monitoring equipment



Open Ended Line



Module 3

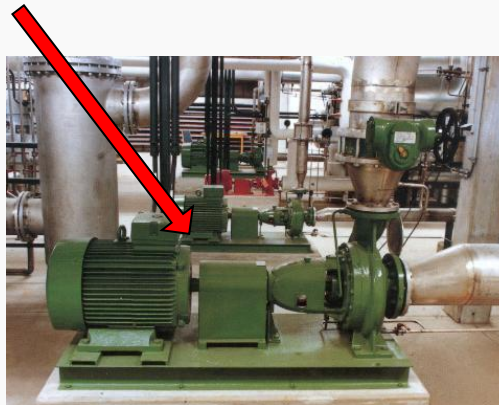
COMMON AREAS OF CONCERN



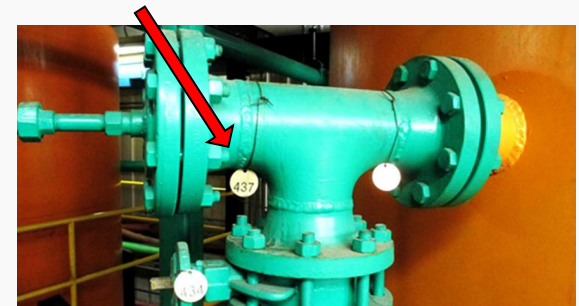
1. Equipment Tagging

- Equipment subject to Subpart BB must be “marked”.
 - Can each piece of equipment subject to Subpart BB be easily identified in the field?
 - Can each piece of equipment be uniquely identified AND tied back to monitoring records?
- One method for complying is to implement a physical tagging system with unique component identification numbers.
- **Even if claimed under certain exemptions, equipment is not excluded from Subpart BB identification/marking**, recordkeeping, and reporting (refer to 40 CFR sections 264.1050(d) through 264.1050(f), or 40 CFR sections 265.1050(c) through 265.1050(e)).

No physical marking seen
(possible noncompliance)



Physical tag with unique ID number



2. Documentation for Exemptions

- If you are claiming an exemption, you must have sufficient documentation to support the claim.
 - Calculations alone may not be sufficient to support a claim (e.g., logs or records that substantiate the assumptions in calculations may be necessary).
 - Wastewater treatment units managing hazardous waste are only exempt if there is documentation showing it meets the definition of “wastewater treatment unit” in 40 CFR 260.10, which includes management of the unit under Section 402 or 307(b) of the Clean Water Act.
 - Documentation should be provided to support throughputs of material in units managing recycled material to show that speculative accumulation is not occurring.

Example scenario for “Less than 300-hour” exemption under Subpart BB...

Claim 66,000 gallons of waste generated per year is transferred into 55-gallon drums through pumping. Estimate that it takes 5 minutes to fill a drum at typical pump rates.

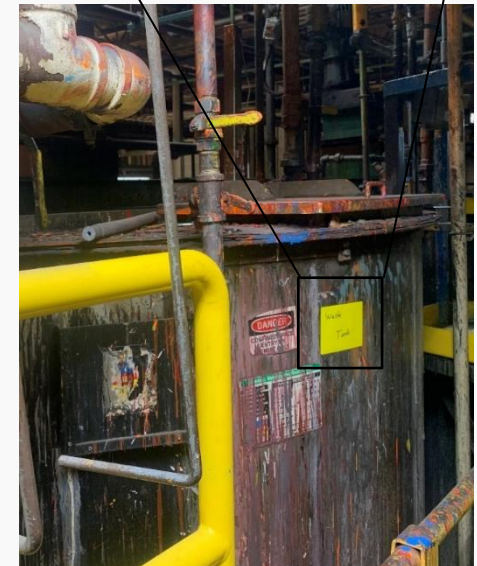
$$\frac{66,000 \text{ gal}}{\text{yr}} \times \frac{\text{drum}}{55 \text{ gal}} \times \frac{5 \text{ min}}{\text{drum}} \times \frac{\text{hr}}{60 \text{ min}} = \mathbf{100 \text{ hrs/yr}}$$

The calculation estimates that equipment is used for less than 300 hours per year to transfer hazardous waste, but you should also maintain records supporting these calculations. Supporting documentation might include logs showing that 66,000 gal/yr of waste is generated or waste manifests showing waste quantities, documentation showing pump operating parameters, and a SOP that includes purging of lines following pumping. This calculation must be current and should be updated with any throughput changes.

The calculation and supporting records could be used to support a claim for an exemption from certain Subpart BB standards under 40 CFR 265.1050(e).

3. Tank or Component Applicability

- Facilities may not properly identify tanks or components that are subject to ROAES requirements.
- Example: Dual Use
 - Tanks that are used to manage multiple material streams, including product, are still regulated as hazardous waste tanks if **any** of the material streams (stored in the tank) are hazardous waste.
 - Tanks that contact hazardous waste (that meet CC applicability) would be subject to Subpart J requirements as well as Subpart CC air emission requirements.
 - Picture to the right is an example of a product mixer tank that was being used temporarily as a waste tank by a facility at the time of an EPA inspection. The tank would be regulated as a hazardous waste tank under RCRA.



"Waste Tank" label observed by an EPA inspector at the time of an inspection

4. Relief Devices – Leaks and Maintenance

- Pressure relief devices (e.g., conservation vents) for tanks should not be venting under normal operating pressure range.
- Pressure relief set points (gauge pressure) for tanks should be greater than the maximum vapor pressure of the liquid managed in the tank as a rule of thumb.
- Alternatively, personnel should confirm that relief devices are in good condition and appropriate maintenance is conducted.



Inspectors using an FID observed detectable emissions (>500 ppm) from relief device on a fixed-roof tank

5. Closure Devices on Tanks

- Annual visual inspections are required for closure devices on fixed-roof tanks.
 - Ensure all flanges and manway covers are fully sealed and screws tightened.
 - Check for signs of corrosion → repairs or replacement may be necessary!
- Inspectors may use monitoring equipment (e.g., a Method 21 device) to identify leaks from closure devices during an inspection.
 - Inspectors will use the “no detectable emissions” threshold (500 ppm) as a leak definition to determine if a closure device is properly functioning.



Potential fixed-roof tank defect / leak



Inspectors using an FID observed detectable emissions (>500 ppm) from a closure devices on a fixed-roof tank

6. Air Emission Control Devices

- Bypass stacks/vents/ports on closed vent system before control device should remain closed with no detectable emissions except when an emergency event release is required.
 - Bypass devices on closed vent systems are required to have a bypass flow indicator, seal, or locking device to ensure there are no open-ended lines in the system.
- Maintain documentation of control device performance tests → operate with a control efficiency of at least 95 percent per Subpart AA requirements.
- Carbon as a control device
 - Carbon control devices must be regenerated or replaced with new carbon to continue adsorbing vapors and avoid “breakthrough” → to comply, **document a sufficient carbon changeout schedule.**
 - Inspectors may monitor the exhaust vent stream to check if breakthrough has occurred.



Carbon Absorption/Capture/Filtration Systems

SUMMARY



Key Takeaways

- Identify all equipment that meets applicability for ROAES and determine how that equipment will comply – whether it may be exempt, requires regular monitoring, requires emission controls, etc.
 - Ensure waste streams are well-characterized, including vapor pressures.
- Document any exemptions that are intended to be claimed.
- LDAR programs should be well-documented with individual components easily identifiable and with traceable records.
- The regulations specify instrument calibration methods for LDAR programs as well as the monitoring methods required based on type of service and type of component.
- Review compliance with ROAES regularly and update documentation, procedures, and equipment as necessary, especially as process or throughput changes occur
 - Preventing equipment failure is one of the goals of ROAES, and this can be done by replacing or improving equipment as needed based on monitoring and inspection data.

Available Resources

- June 2020 EPA Enforcement Alert – National Compliance Initiative Focus on RCRA Air Emissions (EPA 300-F-20001)
- April 2018 EPA Compliance Advisory – Reduction of Hazardous Waste Air Emissions
- EPA December 2021- Applicability of RCRA Organic Air Emission Standards to Equipment and/or Control Devices.
- 1997 Clarification and Technical Amendment to the rule: 62 Federal Register 64636
- ORCR ROAES Resources
 - Implementing the RCRA/CAA Air Emission Controls Compliance Exemption/Election Provisions through RCRA Permits (EPA530-R-19-006)
 - RCRA Organic Air Emissions Standards for TSDFs and Generators, December 2022 (EPA 530-F-22-007)
- Leak Detection and Repair – A Best Practices Guide (EPA-305-D-07-001)

Remember: you can also reach out to your implementing state agency or regional EPA office to ask questions or to request compliance assistance