Eliminating Unpermitted BWON Emissions with Low-Emission Gaskets or Sealants

Recent Federal inspections of refinery & chemical facility BWON programs are finding many sources of unpermitted benzene emissions from facility Waste Management Units (WMUs). The prominent leaking equipment is poorly maintained fixed and internal floating roof tanks and equipment associated with oil-water separation (oil-water separators, APIs, CPIs, etc.). The standards, in § 61.643-§ 61.347, § 61.349, expressly state that WMUs must be engineered to operate with No Detectable Emissions (NDE) as indicated by an instrument reading of less than 500 ppmv VOC above background. It is therefore important to mitigate any risk of NDE with the appropriate assets.

By Tim Goedeker, Bronson Pate, and Mark Ruffin – Teadit

There are two keys ways to improve compliance with the No Detectable Emissions (NDE) control standards for WMUs: use reliable, low emission gaskets or sealants, and use an optical gas imaging camera to identify detectable emissions around all seams, seals, covers, and openings on WMUs. All detectable emissions >500 ppmv must be timely mitigated (repaired). Inspections are finding sources emitting significantly higher than 500 ppmv.

The Benzene Waste Operations NESHAPs (National Emission Standards for Hazardous Air Pollutants) or more commonly known as BWON, was promulgated in 1990 under the Clean Air Act (40 Code of Federal Regulations (CFR) Part 61, Subpart FF). The BWON standard was put in place to control benzene emissions from facility waste and applies to petroleum refineries, chemical plants, coke by-product recovery facilities, and Treatment, Storage, and Disposal facilities (TSDFs). TSDFs are included only if they handle waste from one of the other facilities mentioned above. BWON is a unique standard as it combines waste and wastewater quality management in an air standard for controlling benzene emissions.

The regulation (40 CFR Part 61, Subpart FF) includes multiple subsections; Applicability, Waste & Waste Stream determination, Compliance options, Point of Waste Generation, and Treatment & Equipment Standards. With many complicated standards, it is essential to understand the key terms used in the standard and throughout this article.

Total Annual Benzene (TAB) Quantity

So, what options does a site have for compliance? Is there only one way to comply? Compliance requirements are determined by the facility's TAB quantity. To calculate the TAB quantity for a Waste Stream, multiply the annual waste quantity of the waste stream by the flow-weighted, volume basis, and annual average benzene concentration (weight %) of the waste stream. The waste stream quantities will be calculated in Megagrams per year (Mg/yr), one (1) Megagram is equivalent to one (1) metric ton.

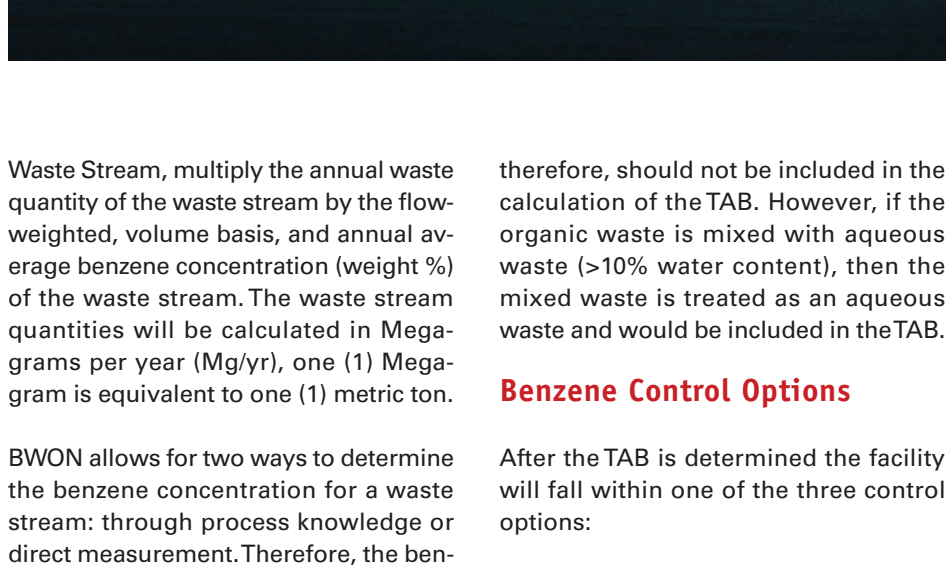
BWON allows for two ways to determine the benzene concentration for a waste stream: through process knowledge or direct measurement. Therefore, the benzene quantity (BQ) of each waste stream is determined by estimating the stream's annual benzene waste quantity.

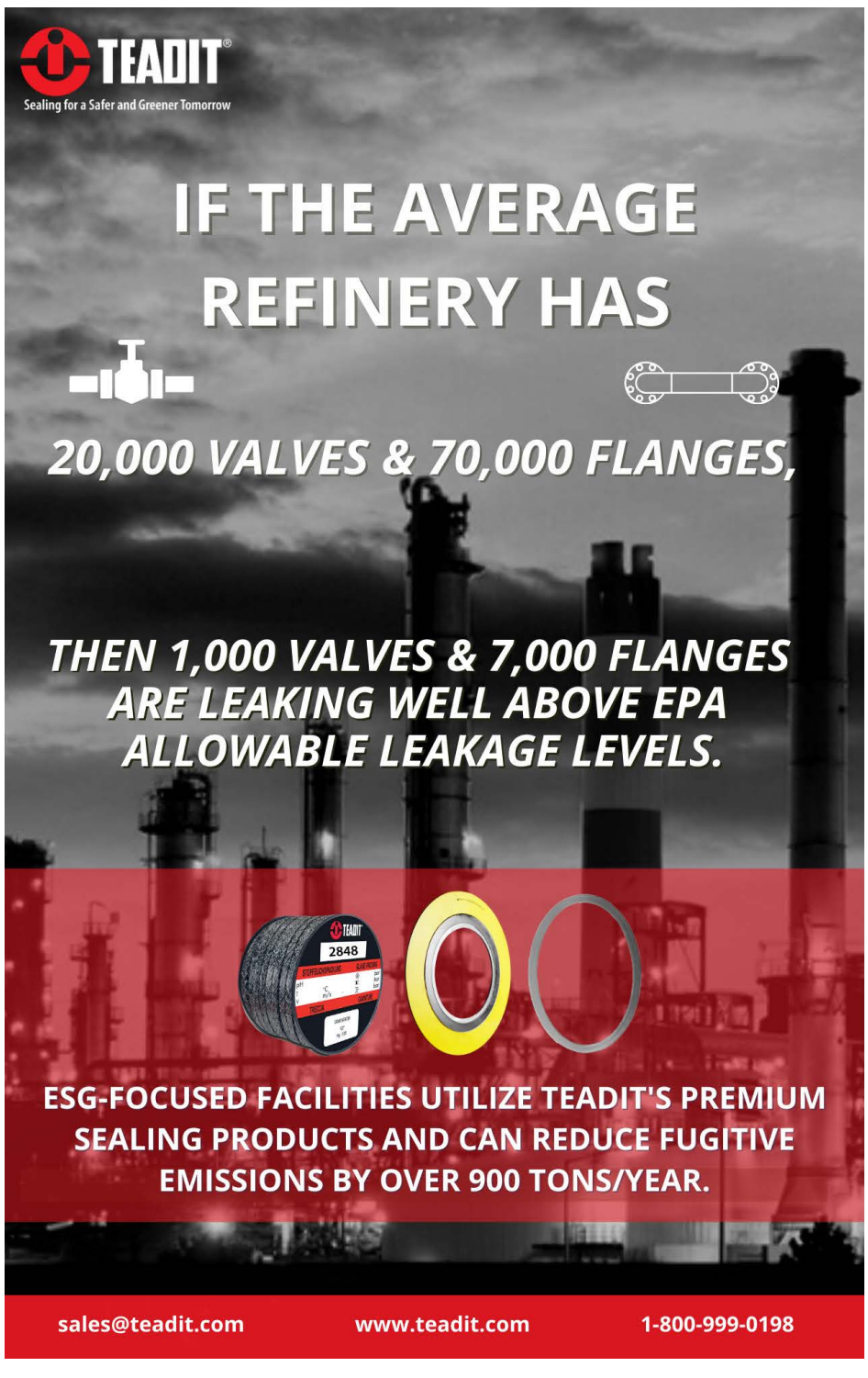
The main point is to ensure the waste quantity is representative; the oil and water fraction of the waste must be determined. There are vital thresholds that must be used when determining which streams are applicable and which are not. For example, waste streams that are <10% water are organic waste and, therefore, should not be included in the calculation of the TAB. However, if the organic waste is mixed with aqueous waste (>10% water content), then the mixed waste is treated as an aqueous waste and would be included in the TAB.

Benzene Control Options

After the TAB is determined the facility will fall within one of the three control options:

1. Facilities with a TAB greater than 10 Mg/yr: are required to install environmental controls on their waste streams and WMU and submit quarterly and annual reports [§61.355(a)(3)].
2. Facilities with a TAB less than 10 Mg/yr but greater than 1 Mg/yr: are not required to install controls but must submit an annual TAB report and an updated report if the TAB goes above 10 Mg/yr [§61.355(a)(4)].





3. Facilities with a TAB of less than 1 Mg/yr: Are required to submit an initial TAB report and update the report if the TAB goes above 1 Mg/yr [§61.355(a)(5)].

An important point to consider is that most facilities will have a TAB greater than 10 Mg/yr and will require environmental controls on the equipment transporting process wastewater including the WMUs. This equipment is subject to no detectable emissions threshold and no detectable emissions monitoring standards as noted in §61.343 thru §61.347 and §61.349.

Benzene Compliance Options

The rule also provides three options for managing uncontrolled Benzene Quantity (BQ). Most facilities, however, use either the 2MG or 6BQ option. A facility under these compliance options will include the TAB and the uncontrolled BQ.

1. 2 MG Compliance Option: The facility may choose certain wastes to exclude from control up to a cumulative uncontrolled BQ of no more than 2 Mg/yr. The uncontrolled wastes must be counted at the POG. The benefit of the 2 MG option is that a facility may exclude from control or the cumulative 2 Mg/yr calculation any stream with less than ten ppm benzene and any Process Wastewater Stream with a flowrate less than 0.0005 GPM or wastewater quantity <10 Mg/yr [§61.342(c)(2)].

2. 6BQ Compliance Option: The facility may choose certain wastes to exclude from control up to a cumulative uncontrolled BQ of no more than 6 Mg/yr. However, all streams with greater than 10% water are included in the cumulative 6 Mg/yr calculation, including those less than ten (10) ppm benzene. All organic streams must be controlled. The uncontrolled waste must be counted when it enters the first uncontrolled WMU. Waste streams never managed in uncontrolled WMUs are counted at the facility discharge [§61.342(e)].

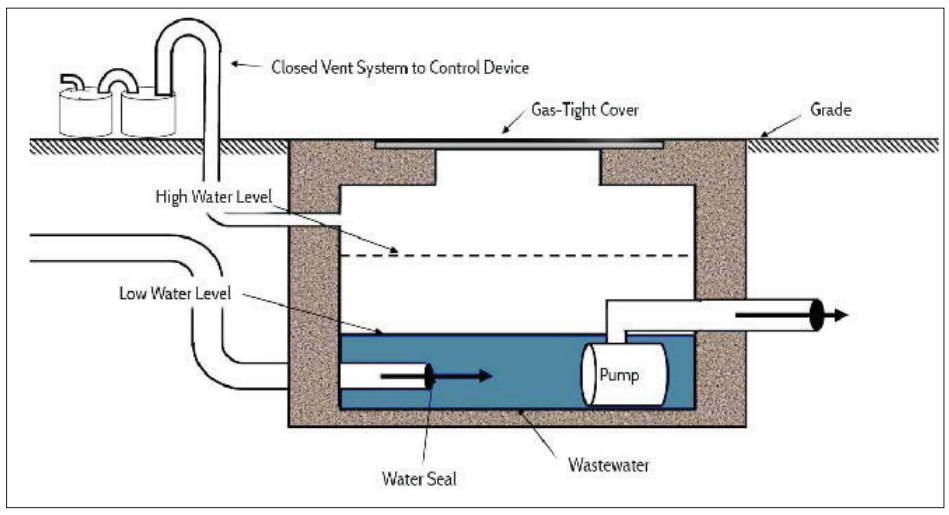
Control or Treatment of a Waste Stream

Control or treatment of Waste Streams must meet one of the following requirements:

- Remove benzene from the waste stream to less than 10 ppm on a flow-weighted average basis.
- Remove benzene from the waste stream by 99% or more on a mass basis.
- Destroy benzene in the waste stream by incinerating the waste in a combustion unit that achieves a destruction efficiency of 99% or greater for benzene.

Waste Management Units (WMUs)

Wastewater Treatment Systems include equipment with specific control requirements, except for Enhanced Biodegradation Units. The control, periodic monitoring and leak repair requirements for WMUs are listed in Table 1.



KEY TERM GLOSSARY

- **Waste –** Any material resulting from industrial, commercial, mining, or agricultural operations, or from community activities that is discarded or is being accumulated, stored, or physically, chemically, thermally, or biologically treated prior to being discarded, recycled, or discharged."
  - Examples of waste include slop oil routed to slop tanks, spent caustics, sludge, DAF float sent offsite, pump drainages, lab wastes, and unit wash-down material.
- **Waste Management Unit (WMU) –** A piece of equipment, structure, or transport mechanism used in handling, storage, treatment, or disposal of waste.
  - Examples of a WMU include a tank, surface impoundment, container, oil-water separator, individual drain system, steam stripping unit, thin-film evaporation unit, waste incinerator, and landfill.
- **Wastewater Treatment System (WTS) –** Any component, piece of equipment, or installation that receives, manages, or treats process wastewater, product tank drawdown, or landfill leachate prior to direct or indirect discharge in accordance with the National Pollutant Discharge Elimination System permit regulations under 40 CFR part 122. These systems typically include Individual Drain Systems (IDS), Oil-Water Separators (OWS), air flotation units, equalization tanks, and biological treatment units.
- **Waste Stream –** The waste generated by a particular process unit, product tank, or WMU. The characteristics of the waste stream (e.g., flow rate, benzene concentration, water content) are determined at the point of waste Generation.
  - Examples of a Waste Stream include Process Wastewater, product tank drawdown, sludge and slop oil removed from Waste Management Units, and landfill leachate.
- **Closed-vent system (CVS) –** A system that is not open to the atmosphere and is composed of piping, ductwork, connections, and, if necessary, flow-inducing devices that transport gas or vapor from an emission source to a Control Device (CD).
- **Container –** Any portable WMU with a capacity greater than or equal to 0.1 cubic meters (26.4 gallons) in which a material is stored, transported, treated, or otherwise handled. Examples of containers are drums, barrels, tank trucks, barges, dumpsters, tank cars, dump trucks, and ships.
- **Control device (CD) –** An enclosed combustion device, vapor recovery system, or flare.
- **Cover –** A device or system which is placed on or over a Waste placed in a WMU so that the entire Waste surface area is enclosed and sealed to minimize air emissions. A cover may have openings necessary for the operation, inspection, and maintenance of the WMU, such as access hatches, sampling ports, and gauge wells, provided that each opening is closed and sealed when not in use. Example of covers includes a fixed roof installed on a tank, a lid installed on a container, and an air-supported enclosure installed over a WMU.
- **Individual Drain System (IDS) –** The system used to convey Waste from a processing unit, product storage Tank, or WMU to another WMU. The term includes all process drains and common junction boxes, together with their associated sewer lines and other junction boxes, down to the receiving WMU.
- **No Detectable Emissions (NDE) –** Less than 500 parts per million by volume (ppmv) above background levels, as measured by a detection instrument reading in accordance with the procedures specified in § 61.355(h).
- **Oil-Water Separator (OWS) –** A WMU, generally a Tank or Surface Impoundment, is used to separate oil from water. An OWS consists of not only the separation unit but also the forebay and other separator basins, skimmers, weirs, grit chambers, sludge hoppers, and bar screens that are located directly after the IDS and prior to additional treatment units such as an air flotation unit, clarifier, or biological treatment unit.
  - Examples of an OWS include an API separator, parallel-plate interceptor, and corrugated-plate interceptor (CPI) with the associated ancillary equipment.
- **Point of Waste Generation (POG) –** The location where the waste stream exits the process unit component or storage tank prior to handling or treatment in an operation that is not an integral part of the production process, or in the case of WMU that generate new Wastes after treatment, the location where the Waste stream exits the WMU component.
- **Process Wastewater –** Water that encounters benzene during manufacturing or processing operations conducted within a processing unit. Process wastewater is not organic waste, process fluids, product tank drawdown, cooling tower blowdown, stream trap condensate, or landfill leachate.
- **Surface Impoundment –** A WMU is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of liquid wastes or waste containing free liquids, and which is not an injection well.
  - Examples of surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons.
- **Tank –** A stationary WMU that is designed to contain an accumulation of waste and is constructed primarily of non-earthen materials (e.g., wood, concrete, steel, plastic) which provide structural support.
- **Total Annual Benzene (TAB) –** The sum of the annual benzene quantity for each waste stream at the facility that has a flow-weighted, volume basis, annual average water content greater than 10% or that is mixed with water (or other Wastes), at any time, and the mixture has an annual average water content greater than 10%."
- **Treatment Process –** A stream stripping unit, thin-film evaporation unit, waste incinerator, or any other process used to comply with § 61.348.

Waste Management Unit (WMU) Type	BWON Control Standard	Citation	Visual Inspection Frequency	Method 21 Monitoring Frequency	Repair Timing ASAP but no later than:
Tanks	Fixed roof vented to CVS and CD	§61.343	Quarterly - §61.343(c	Annual - §61.343(a)(1)(i)(A)	45 days - §61.343(d)
	Internal floating roof tanks (NSPS Kb in lieu of BWON)	§61.351 (BWON) to §60.112b(a)(1) (NSPS Kb)	Annually	None	up to 45 days
	External floating roof ranks (NSPS Kb in lieu of BWON)	§61.351 (BWON) to §60.112b(a)(2) (NSPS Kb)	Primary seal - every 5 yrs Secondary seal - annually	None	up to 45 days
Surface Impoundment	Cover vented to CVS and CD	§61.344	Quarterly - §61.344(b)	Annual - §61.344(a)(1)(i)(A)	15 days - §61.344(c)
Container	Cover and submerged fill piping when pumped	§61.345(a)(2)	Quarterly - §61.345(b)	Annual - §61.345(a)(1)(i)	15 days - §61.345(c)
	Cover vented to CVS and CD - treatment occurring in container	§61.345(a)(3)	Quarterly - §61.345(b)	Annual - §61.345(a)(3)(ii)(C)	15 days - §61.345(c)
Individual Drain System (IDS)	Cover (closed) vented to CVS and CD	§61.346(a)(1)	Quarterly - §61.346(a)(2)	Annual - §61.346(a)(1)(i)(A)	15 days - §61.346(a)(3)
	Drain w/ H2O seal controls, junction boxes vent to CD	§61.346(b)	Quarterly - §61.346(b)(4)	None	15 days - §61.346(b)(5)
Container	Fixed roof OWS vented to CVS and CD	§61.347	Quarterly - §61.347(b)	Annual - §61.347(a)(1)(i)(A)	15 days - §61.347(c)
	Floating Roof OWS (NSPS QQQ in lieu of BWON)	§61.352 (BWON) to §60.693-2(a) (QQQ)	Primary seal - every 5 yrs - 693-2(a)(1)(iii)(A) Secondary seal - annual - 693-2(a)(1)(iii)(b) Covers - semi-annual - 693-2(a)(5)(i)	None	30 days - §693-2(a)(1)(iv), §693-2(a)(5)(ii)
Treatment Processes	Control requirements for Waste Management Units (WMU)	§61.348	Quarterly - §61.348(e)(1)	None	15 days - §61.343(e)(2)
Closed Vent Systems (CVS) and Control Devices (CD)	CVS vents to CD except during shutdown or maintenance	§61.349	CVS, CD - Quarterly - §61.349(f)	CVS - Annual - §61.349(a)(1)(i)	CVS, CD - 5 days - 1st attempt, 15 days - repair complete
	- bypass lines have specific requirements			CD - None	
	CD have specific performance requirements				

Table 1.

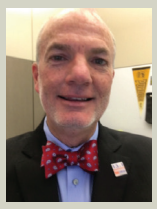
As mentioned above, most facilities will have a TAB greater than 10 Mg/yr and will require environmental controls on the equipment transporting process wastewater to the WMUs. This equipment is subject to no detectable emissions threshold and no detectable emissions monitoring standards as noted in §61.343 thru §61.347.

The standard in each paragraph states: "The cover and all openings (e.g., access hatches, sampling ports, and gauge wells) shall be designed to operate with no detectable emissions as indicated by an instrument reading of less than 500 ppmv above background, as determined initially and thereafter at least once per year."

The standard for closed-vent systems and control devices, §61.349, varies slightly, "The close-vent system shall be designed to operate with no detectable emissions as indicated by an instrument reading of less than 500 ppmv above background, as determined initially and thereafter at least once per year."

There are two key factors to improving compliance with the NDE control standards for WMUs. First, the facility should be proactive using reliable, low emission gasket or sealant material on all seams, seals, covers, and openings (any interface that could have detectable emissions to the atmosphere) for each WMU. Second, the facility should proactively use an optical gas imaging camera to 'look' for detectable emissions from all BWON equipment with an interface that could leak process vapors to the atmosphere at each WMU.

ABOUT THE AUTHOR



With 38 years of experience in the energy industry, Tim Goedeker, formerly Senior Principal Environmental Consultant and recently retired from Phillips 66, knows the value of experience and the importance of innovation. Currently, Tim is an Environmental SME Consultant for Teadit. Starting his career as a Process Engineer in the oil refining sector and moving into the environmental side of the business, Tim has a vast knowledge and understanding of this ever-evolving industry.

Bronson Pate is currently the Environmental Consulting Manager for Teadit North America. He has more than 15 years of experience dealing with regulatory and technical issues related to Leak Detection and Repair (LDAR) for numerous industries both here and abroad, specifically within refining, petrochemical and chemical industry plants. As one of the world's leading experts on equipment leak fugitive emission source monitoring, tagging, and LDAR database management he has participated and/or lead 375 audits at multiple facilities on U.S.EPA LDAR Consent Decree (CD) requirements. In addition to being able to provide all levels of training for EPA Method 21 monitoring and other LDAR related Technician trainings, he also has experience dealing with air quality compliance and permitting issues for refining, petrochemical, and natural gas processing industries.

Mark Ruffin is the Technical Director for Teadit North America in Pasadena, TX, overseeing its team of Applications Engineers, Technical Field Sales Operations, and Quality team. With 15+ years of industry experience, he's had the unique experience of starting a bolting program at the site level as well as maintaining/improving a mature bolting and packing program at the corporate level. Additionally, he participates as a voting member of a myriad of industrial committees related to bolted flanged joints.