TRIUMVIRATE ENVIRONMENTAL

VOCLok

A Closed-Loop HPLC Solvent Waste Solution

How to keep your employees safe and your SAAs compliant



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About the Author



Kelly Koerner is Triumvirate Environmental's VOCLok expert. With vast experience on the operations team, Kelly has been hands-on in the field as well as behind the scenes, helping make the decisions that make a difference.

Passionate about customer service and dedicated to safety, Triumvirate Environmental has been providing environmental, health, and safety (EHS) services to leading organizations for more than 30 years. Our service capabilities are expansive, including hazardous waste management, EHS training, and more. Triumvirate Environmental partners with clients throughout North America to enable them to stay safe, productive, and compliant.

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1 Introduction: Closed-Loop Solvent Waste Systems

Laboratories generate a lot of chemical solvent waste, especially during the high-performance liquid chromatography (HPLC) process. Traditionally, this liquid waste has been collected in whatever container is available without consideration of potential risks. Unfortunately, this often results in emergency response calls when collection containers with improper lids are knocked over or otherwise broken. These emergency events risk employee or first responder injury or environmental damage. On top of this, such occasions may damage brand reputation and trust, which may contribute to financial loss.

Health Impacts

Emergency events aren't the only thing that threaten human health and well-being. Improperly contained hazardous waste can mean a release of hazardous vapors into the air or spills of hazardous material into a lab space—which can be extremely harmful, or even deadly. Inhalation of dangerous vapors and bodily contact with spilled chemical can cause:

- Burning
- Loss of vision
- Skin abrasion
- Organ failure
- Death, in extreme circumstances



Volatile Organic Compounds (VOCs)

VOCs are a major risk of hazardous waste collection, storage, and disposal. These compounds are emitted as gas from certain hazardous wastes, including many of the chemicals that will be collected in a lab space. Exposure to VOCs can cause a number of long- and short-term health impacts to employees, especially in enclosed areas like labs. In the short term, exposure to VOCs can cause:

- Headaches
- Eye, nose, and throat irritation
- Nausea

Long-term health impacts include:

- Liver, kidney, or central nervous system damage
- Memory impairment
- Cancer

Compliance Concerns

Additionally, many existing solvent waste collection systems risk non-compliance with the Resource Conservation and Recovery Act's (RCRA's) Title 40 regulations. RCRA 40 CFR 264.173 dictates specific guidelines in regards to hazardous waste collection. This regulation indicates that: "A container holding hazardous waste must always be closed ... " But what exactly defines closed? The Environmental Protection Agency (EPA), which oversees RCRA compliance, defines "closed" based on specific parameters that vary based on the waste type. For liquid solvent wastes, a container is considered closed when "all openings or lids are properly and securely affixed to the container ... " Traditional methods for hazardous chemical waste collection usually are not compliant with this definition.

Noncompliance with this specific RCRA regulation, and others, could mean:

- Fines of up to $90,702 per day (at time of publication)
- Loss of brand reputation and damage to public image
- Employee distrust

This mini guide has been compiled to outline the inadequacies of current collection methods and introduce a new, compliant, and effective solution: the **VOCLok system**. This system enables filtered ventilation and proper solvent waste storage—all while mitigating health risks and remaining compliant with all relevant regulations, including the closed container guidelines above. This solution provides an increased level of safety, compliance, and efficiency to solvent waste disposal processes, specifically when tubing is needed for constant waste collection.



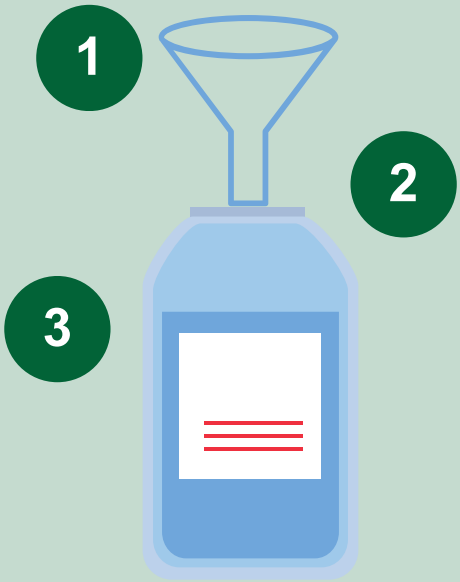
2 Traditional Collection Processes

Traditional waste collection methods involve an empty container placed near the workstation and chemical waste being funneled or tubed into the container through waste lines into the top opening, with the funnel either attached or unattached. Several problems present themselves with this collection method, including that:

- Collection is done with an **open container**. Satellite Accumulation Area (SAA) regulations require all containers to be properly sealed. Open containers also present compliance issues with regards to OSHA worker safety standards, as uncapped containers can mean the release of **dangerous vapors** like VOCs.
- Typical bottles used for collection are easily knocked over. When combined with the fact that this is an open container, this results in **frequent spills** leading to lost time incurred to clean up the material.
- Smaller and inconsistent container sizes result in **inefficient collection**, as this will require more frequent consolidations.

Typical Solvent Waste Collection

1. Waste line or funnel soaked with hazardous waste
2. Open container releases toxic vapors
3. Lack of handle makes transport difficult



Traditional Closed Container Systems

The conventionally-used closed container waste storage systems are better, yet still come with shortcomings. Closed containers prevent leakage from equipment tubing when swapping from a full container to an empty container. While risk is reduced when performing change-outs in a well-ventilated area or chemical fume hood, this isn't always practical.

While better, this method still results in a number of process issues, including:

- **Unsafe change-outs**, as the carboy or waste container is being physically opened to input waste. These safety issues mainly arise due to unsecure tubing with this method; waste can flick or otherwise spread when tubing is pulled out, or it can get caught on the cap.
- **Increased spill risk**. In the same vein as the point above, uncapping the waste container means an open exit point for waste to spill out of if accidentally knocked over or bumped into.
- **Deterioration of the funnel**. While the waste container itself should not deteriorate with repeated use, the funnel or other pouring device could if waste is being directly poured and the tool is not rated for the specific chemicals being disposed of.
- **Lack of a filtration system** to filter VOCs out of the vapors released when a waste container is opened.

These problems—as well as the compliance, safety, time, and cost issues they raise—are often very difficult to overcome. It's clear that the old, traditional solvent waste disposal strategies are outdated. A new, more appropriate method is needed.



Hazardous vapors being emitted into the lab; non-compliant unclosed container



Possible spill if kicked, causing a splash hazard; hazardous vapors being emitted into the lab; non-compliant unclosed container; no berming or spill protection; multiple wastes to one container with no waste tube organization

3 The VOCLok System

The VOCLok system was developed in response to some of the major compliance and safety issues that arise with the traditional collection methods. This solution is Triumvirate Environmental's branded solvent waste system, designed to be an affordable solution for liquid waste disposal. Each system is manufactured to safely collect waste from one or more HPLC systems. The carbon exhaust filter of the VOCLok solution improves air quality by capturing potentially harmful VOCs and other vapors emitted from solvents. Each kit includes a cap and/or drum adapter, various ports for waste tubing, one port for a carbon exhaust filter, and plugs for unused ports.



The VOCLok Solution

1. Carbon exhaust filter; tube fittings to securely attach waste tubes; and plugs for unused ports
2. Versatile two-part cap—by using both a ring and a puck, tubing can stay in place, even when the ring is unscrewed or removed; replaceable, sulfur-cured rubber gasket prevents degradation; and closed cap for safe transport
3. Ergonomic design and compatible with all common chemicals



Carbon exhaust filter traps harmful VOCs, with 90° adapter for maximum storage flexibility



Convenient VOCLok cap is fully customizable for your waste streams and RCRA-compliant

Implementation

Triumvirate Environmental will deliver VOCLok devices directly to your facility and install them for you. They will also provide comprehensive training to your employees about how to use the devices. The Triumvirate Environmental team will also perform routine and emergency maintenance on this equipment.

Set-up involves either a Department of Transportation (DOT)-rated carboy or a waste drum, both of which are standard to the waste industry. This carboy is placed under the VOCLok equipment, where the puck is placed over the opening of the container. The ring is twisted over the puck onto the threads of the container, and any waste tubes that have been sized to the appropriate length, including fitting sizes 1/4", 1/8", or 1/16", can be placed directly into the puck's ports. The carbon filter can then be twisted on, and any unused ports can be sealed with provided plugs.

The Triumvirate Environmental team will handle all the labor for set-up and maintenance of VOCLok devices—meaning you can maximize the benefits of this solution while still being able to focus on your core competencies.



Maintenance

"Breakthrough" is a function of how many VOCs are being generated and captured by the filters. Breakthrough is affected by two parts of the process:

- Throughput volume, or how fast waste is pumped out of the machine
- The chemical constituents used for a specific process

Larger throughput volumes and certain chemical constituents will cause the filter to load faster and thus, become ineffective faster. Routine filter replacement is necessary on a regular basis, depending on the type and quantity of chemical passing through, to ensure harmful VOCs are not being emitted.

When to Change Out Your VOCLok Filter

As breakthrough can vary based on chemical type, quantity, and other factors, it is tough to provide a blanket policy on how frequently to change filters.

The industry standard is to change filters every 3-6 months. You can use this recommendation safely—but as each process, flow rate, and group of chemical constituents is different, this typically will not be the most accurate representation of filter lifespan. This may mean more frequent procurement, changeout, and minimized return on investment (ROI) for the device. As such, Triumvirate Environmental suggests a different, more scientific strategy to determine filter life and maximize cost savings.

A breakthrough indicator can help determine a filter's effective life. This tool is a colorimetric indicator that attaches to the end of the filter. The color of the indicator will change when VOCs are being emitted, indicating the need for a new filter.

When beginning to implement VOCLoks at your facility, we recommend purchasing a breakthrough indicator for each machine for which you will be using the device and attaching it to the end of a new filter. Monitor the breakthrough indicator over time, and make note of how long the indicator takes to turn red.

As long as the process, throughput, or chemical constituents of a machine do not change, the length of time it takes for the indicator to change colors (from the installation date) should be reliable enough to set a safe filter changeout schedule for that specific machine without having to buy breakthrough indicators every time. In doing so, you can maximize the life of your filters, avoid repeated breakthrough indicator purchases, and ensure employee safety.

Of course, if the methodology, throughput, constituents, or any other aspect of waste collection changes, a new breakthrough indicator should be purchased and the determination process should begin again.



Benefits of the New System

Features and benefits of the VOCLok solution include:

- It is compatible with DOT-rated containers, which can help the user **eliminate consolidations**.
- Instead of directing multiple waste lines from the equipment to only one opening, the new system allows for **up to seven separate waste lines** to be placed in isolated ports. The ports are part of the puck, and the ring, gasket-sealed, fits around the puck. This prevents leakage and twisted waste lines during container changeouts.
- Pucks are available for **different waste line diameter port sizes**, depending on the diameter of line the equipment uses. These port sizes are 1/4", 1/8", and 1/16", so different lines and ports can easily be installed.
- **Plugs** are available for unused ports, preventing leakage and VOC emission.
- A **carbon exhaust filter** captures VOCs from the collected liquid. This improves operational safety and reduces harmful vapors.
- The filter is made for **ease of swapping out** with a new filter, on a routine basis, depending on the need and type of liquid being collected.
- Decreased potential for **corrosion/deterioration** of the container cap. Waste flows through the waste line connection point directly into the waste container, so no liquid waste touches the container cap and causes breakdowns.
    - As an aside, this also provides a **cost saving** as caps will not need to be replaced as frequently. There is also a **sustainability** aspect, as caps are not turning into microplastics nor are they landfilled at high frequency.
- **Full compliance** with RCRA and other regulations, as containers using a VOCLok are considered closed containers.
- Ease of **installation and customization** makes implementation and upkeep a breeze for your team.



















4 Conclusion

The battle for compliance is constant, but the VOCLok system gives you a huge advantage in terms of chemical safety. This innovative closed-loop HPLC solvent waste solution provides numerous benefits with widespread implications for your SAAs, your employees, and your overall operations. It is also easy to install, use, and maintain, allowing you to reap the benefits without any of the headache.

Having Triumvirate Environmental on your side to install the VOCLok technology can improve employee safety, organizational compliance, and EHS efficiency. For more information on how to get started, contact us!



Learn more at www.triumvirate.com, or contact us at salesoperations@triumvirate.com.

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