HSIA Comments
March 15, 2017
Tetrachloroethylene (perchloroethylene) – EPA-HQ-OPPT-2016-0732
Carbon Tetrachloride – EPA-HQ-OPPT-2016-0733
Methylene Chloride – EPA-HQ-OPPT-2016-0742
Trichloroethylene – EPA-HQ-OPPT-2016-0737
EPA-HQ-OPPT-2017-0002

EXECUTIVE SUMMARY

As a result of their physical and chemical properties, halogenated solvents have a wide range of applications as industrial solvents. Compared to other organic solvents, halogenated solvents exhibit unique chemical properties such as high solvency, non-flammability, low boiling point, and high vapor density. Halogenated solvents are remarkably stable, noncorrosive to most metals, and have low rates of evaporation and low vapor pressures. As a class of chemicals, halogenated solvents include includes four (4) of the initial 10 chemical substances listed by EPA to be reviewed under Toxic Substance Control Act ("TSCA"), as amended: methylene chloride (dichloromethane); carbon tetrachloride (tetrachloromethane); perchloroethylene (Perc or tetrachloroethylene); and TCE (trichloroethylene). Because of the difference in the properties of these products, each has some particular application for which it is best suited.

In addition, halogenated solvents are among the most heavily regulated group of chemicals by federal and state governments in the United States such as, among others, the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Consumer Product Safety Commission (CPSC).

This summary first summarizes the regulations applicable to halogenated manufacturers. The second section addresses best practices and recommendations for customer uses. Finally, the third section provides a summary of the halogenated manufacturing process. We also submit this information together with the following comments on the risk evaluation process:

Because of the expedited comment period, additional information after the comment period may be needed. HSIA submits these comments to support EPA's development of the scope and risk evaluation for the four above-referenced halogenated solvents. We recognize that the amended TSCA imposes an expedited June 2017 deadline for EPA to issue a scope for these substances. Due to the expedited review, the lack of a draft scope to comment on and because this process is proceeding with final EPA Risk Evaluation Rules, we offer our assistance to provide information after the comment deadline and respectfully request that EPA contact our organization with any comments or questions they may have. We believe that ongoing dialogue after the short comment period is critical to ensure a valid and sound-science based risk evaluation as mandated by TSCA Section 26.

Occupational Exposure Assessments May be Appropriate to Exclude as a TSCA Condition of Use or, Alternatively, Can be Subject to an Early and Streamlined Assessment. As described below, the halogenated solvent manufacturing process is heavily regulated under environmental and labor laws to protect human health. Worker exposures are regulated under the Occupational Safety and Health Act (OSHA) which is designed to regulate risk to worker populations through exposure monitoring, controls, and personal protective equipment (PPE). Accordingly, EPA should find that occupational conditions of use do not pose an unreasonable risk during the scoping phase or, alternatively, implement a limited streamlined screening process for substances where the condition of use is well controlled in a manufacturing process.

I. REGULATORY SUMMARY FOR MANUFACTURES

Most halogenated solvents are included on the Clean Air Act, Section 112(b) list of Hazardous Air Pollutants. As such, the manufacturing of these chemicals is tightly controlled by Federal and State regulations. In particular, a standard known as the Hazardous Organic NESHAP (HON) was instituted specifically as the Synthetic Organic Chemical Manufacturing Industry: Organic National Emission Standards for Hazardous Air Pollutants (NESHAP) - 40 CFR 63 Subparts F,G,H,I. According to EPA,

> "This National Emission Standards for Hazardous Air Pollutants (NESHAP) rule consists of four subparts in 40 CFR part 63. Subpart F provides the applicability criteria for Synthetic Organic Chemical Manufacturing Industry (SOCMI) sources, requires that owners and operators of SOCMI sources comply with subparts G and H, and specifies general recordkeeping and reporting requirements. The specific control, monitoring, reporting, and recordkeeping requirements are stated in subpart G for process vents, storage vessels, transfer racks, and wastewater streams, and in subpart H for equipment leaks. Subpart I provides the applicability criteria for the non-SOCMI processes subject to the negotiated regulation for equipment leaks and requires owners and operators to comply with subpart H."

In addition, many of the specific uses of halogenated solvents are regulated by other air rules (*e.g.*, Halogenated Solvent Cleaning, Dry Cleaning Facilities: National Perchloroethylene Air Emission Standards, Flexible Polyurethane Foam Production, Paint Stripping and Miscellaneous Surface Coating Operations).

Specific to Carbon Tetrachloride (CTC), in 1992, the EPA issued its final rule implementing Section 604 of the Clean Air Act. That section implemented the United States' obligations under the Montreal Protocol by limiting the production and consumption of substances with a potential to deplete stratospheric ozone. CTC was identified as an Ozone Depleting Substances (ODS). This rule, published as 40 CFR Part 82, Subpart A, required the phase out of production of CTC and other ODS's for emissive uses on December 31, 1995. Exceptions to the ban include feedstock use of CTC and other ODS's where they are transformed into other products in chemical processes, and other essential uses as approved by the EPA.

OSHA regulates the workplace use of all halogenated solvents, either under chemical specific standards or under the general industry standard. OSHA requires the use of engineering controls, personal protective equipment (PPE), training, and in some cases medical monitoring in order to protect workers from exposure to halogenated solvents.

All DOT regulations related to the transportation of halogenated solvents must be obeyed. The regulations are listed in the Code of Federal Regulations (CFR) in Title 49.

EXPOSURE MONITORING AND PPE

Similar Exposure Groups (SEG), Homogeneous Exposure Groups (HEG), or Exposure Groups (EG) are groups of workers believed to have the same general exposure profile due to the similarity and frequency of tasks performed, the materials and/or processes with which they interact, and similarities in how work is performed. The development of exposure groups simplifies the exposure assessment process since representative exposure monitoring can be performed on each exposure group as a whole rather than each individual employee and/or job category within the facility.

Monitoring data collected for each exposure group is collectively analyzed to determine the overall exposure potential. If the 90th percentile analysis results are below the applicable Occupational Exposure Limits (OELs), then the exposures are considered acceptable and periodic

monitoring/reassessments are performed to confirm/validate. Any individual sample results exceeding applicable OELs is investigated to determine cause(s) and mitigated.

The following Exposure Groups have been developed to characterize potential exposures to halogenated solvents such as Carbon Tetrachloride, Perchloroethylene, and Methylene Chloride. The tasks generally performed by each exposure group and generalized PPE requirements are included:

- Control Lab Technician
  - Collects samples (half or full-face respirator with acid/gas organic vapor cartridges, goggles, acid coat or apron or PVC jacket and pants, Nitrile gloves)
  - *Disposes of laboratory solvent waste jugs to totes (half or full-face respirator with acid/gas organic vapor cartridges, goggles, lab coat, Nitrile or PVA gloves)
  - *Dumping of solvent retains (Nitrile or PVA gloves; task performed under laboratory hood)
  - *Waste handling/dumping solvent waste (half or full-face respirator with acid/gas organic vapor cartridges only for carbon tetrachloride)
- Process/Unit Operator/Technician
  - Performs filter/trap changes (half-face respirator with acid/gas organic vapor cartridges or full-face respirator with airline)
  - Load/unload spent solvent (nitrogen purge system)
  - *Transfers chlorinated solvent waste to solvent recovery (half-face or full-face respirator with acid/gas organic vapor cartridges)
  - Transfers from tanks to trailers (half-face respirator with acid/gas organic vapor cartridges required during disconnect)
  - Collect samples (where samples are not collected inline a half-face respirator with acid/gas organic vapor cartridges is required)
  - Collect samples (where samples are not collected inline a half-face respirator with acid/gas organic vapor cartridges is required)
  - Maintenance preparation (half-face respirator with acid/gas organic vapor cartridges)
- Shipping/Drum Fill/Loaders
  - Preparing equipment for maintenance activities (half-face respirator with acid/gas organic vapor cartridges)
  - Transfer solvent from truck to tank (half-face respirator with acid/gas organic cartridges required for hose disconnection)
  - Truck loading for methylene chloride (performed under vacuum)
  - Loading tank trucks
  - Loading railcars (closed process)
  - Collect samples (where samples are not collected inline a half-face or full-face respirator with acid/gas organic vapor cartridges is required)
  - Fill drums with carbon tetrachloride (closed process)

- Collect samples (half or full-face respirator with acid/gas organic vapor cartridges)
- Change traps/filters (full-face respirator with airline)

*Note that solvent waste and retains may contain a mixture of carbon tetrachloride, methylene chloride, and other chemical derivatives. An air-purifying respirator is primarily worn to provide protection for potential carbon tetrachloride exposures.

CHAIN OF COMMERCE

U.S. producers manufacture halogenated solvents at their facilities and then sell that material either directly to customers or indirectly through chemical distributors. The halogenated solvents may also be used internally as a feedstock for other products. Product is often also exported to other geographies. Product is also imported from manufacturing locations outside of the US. This chain of commerce is reflected in Figure 1.

IHS Markit provides detailed information for estimated production and trade volumes for halogenated solvents.[1] EPA may have access to this service and is encouraged to use it.

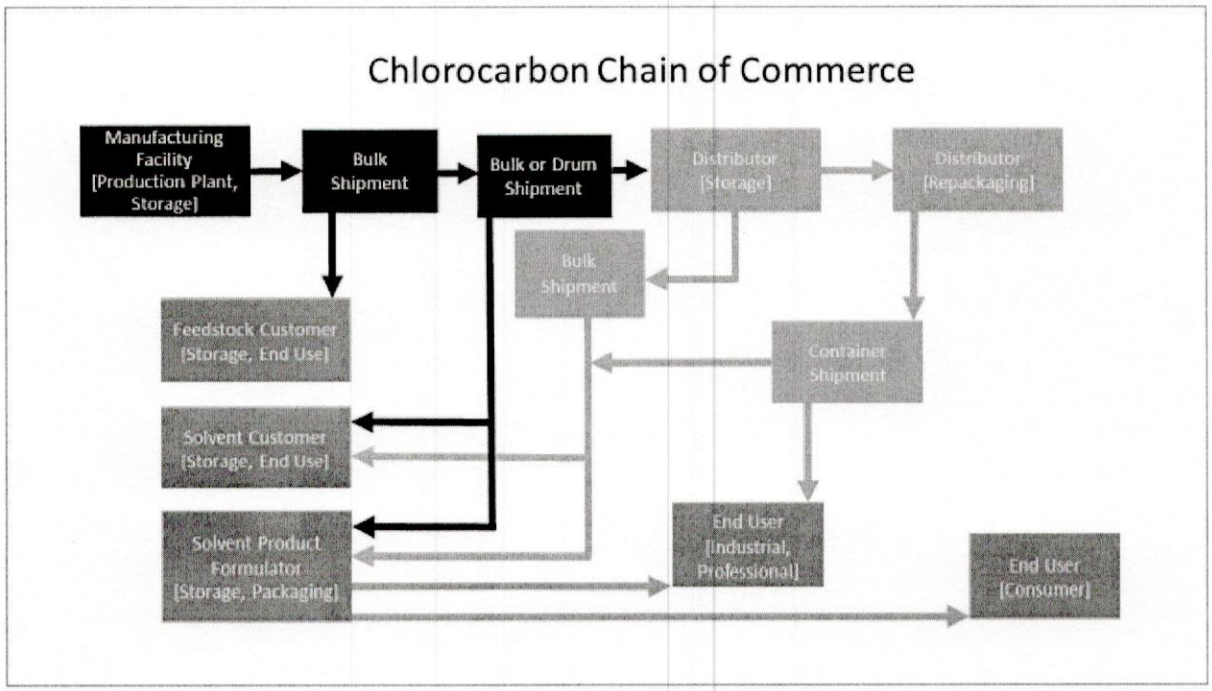


Figure 1: Chlorocarbon Chain of Commerce

MANUFACTURING FACILITY PRODUCT HANDLING

At the manufacturing site, trained and supervised operators with proper Personal Protective Equipment (PPE) load the halogenated solvents product into bulk shipping containers, which could include truck

[1] Chloromethanes: https://www.ihs.com/products/chlorinatedmethanes-chemical-economics-handbook.html
C2 Chlorinated Solvents: https://www.ihs.com/products/c2-chlorinated-chemical-economics-handbook.html

tank trailers, iso-containers, railcars, marine barges, and ships. These shipments are either sent directly to manufacturing customers or to distributors. The product may also be shipped internally via pipeline.

Manufacturers may also repackage bulk solvents from their storage tanks into drums. These containers are then shipped directly to their customers (Solvent Users and Solvent Product Formulators) and/or distributors.

Halogenated solvents are delivered to the customer receiving site and are generally used by customers in one of three ways:

A. Feedstock - The product is used as a raw material and is chemically transformed into other chemical products (e.g. fluorocarbon refrigerants).

B. Solvent - The product is used as a solvent in a chemical process to produce another new chemical product (e.g. pharmaceutical active ingredients). Residual halogenated solvents from the customer's process are normally recycled or disposed.

C. Solvent Product Formulation - The product solvent is blended with other materials into a new product for a specific end use (e.g. paint stripper). These formulated products are then sold to industrial end users, professional end users, or even consumers via retail outlets.

Manufacturers provide guidance on the proper storage and handling of their halogenated solvent products via Safety Data Sheets and other printed/electronic literature such as Technical Data Sheets and Product Stewardship Manuals. This material is made available to both distributors and direct customers.

Some chemical distributors may repackage bulk solvents from their storage tanks located at certain sites into smaller containers. These containers include drums, reusable tote tanks, and other smaller refillable containers designed for specific end-use markets (e.g. dry cleaning). These containers (or factory-packed drums if received directly from a manufacturer) are then shipped to their customers (Solvent Users and Solvent Product Formulators). Additional guidance for distributor repackaging operations is provided by the manufacturer and/or specialized third parties. This assistance could include literature, teleconferences, webinars and on-site visits for assessment and training.

Since carbon tetrachloride is tightly controlled by the Montreal Protocol and most emissive uses have been banned by EPA since 1995, only feedstock customers are served via direct bulk shipment. Small volumes of product for essential use applications (e.g. certain laboratory uses) may be shipped in drums.

II. GENERAL SAFETY PRECAUTIONS

Manufacturers recommend, via published literature or Safety Data Sheets (SDS's), that all individuals involved with halogenated solvents throughout all parts of the chain of commerce practice these general safety precautions:

- Always consult the appropriate SDS before beginning work and keep it nearby for reference in case of an accident or exposure.
- Know which type of solvent and grade you are handling, and be aware of its properties and hazards.
- Always use the appropriate Personal Protective Equipment (PPE) and safety equipment for the task. Wear protective garments and eye protection at all times.
- Be alert. When working with chlorinated solvents, avoid situations that can result in overexposure.

- Monitor the air regularly for the presence of chlorinated solvents. Do not rely on smell alone as an indicator of hazardous exposure levels (see Table 1). Odor is not an adequate warning signal for potential overexposure.
- Trained personnel should regularly monitor solvent concentrations in the air to ensure safety and to comply with all applicable regulations.
- Immediately seek fresh air and assistance if you become lightheaded while working with halogenated solvents; dizziness and loss of coordination can lead to more serious accidents.
- Avoid contact with your skin. Prolonged or repeated contact of halogenated solvents with the skin may cause irritation. Certain inhibitors in some products and certain halogenated solvent products may cause skin sensitization.
- Do not drink alcohol before working with halogenated solvents or after possible overexposure. Alcohol consumption in an industrial workplace is unwise, dangerous and often illegal. Alcohol consumption may accentuate the central nervous system symptoms associated with overexposure to halogenated solvents, and may lower your tolerance to adverse effects caused by inhaling solvent vapor.

PERSONAL PROTECTIVE EQUIPMENT USE

When handling halogenated solvents at any of the locations in the chain of commerce, individuals should be trained on safe handling and proper PPE which may include:

- Protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.
- Safety glasses with side shields (or their equivalent), or chemical goggles, when working in situations where the solvent may splash.
- Respiratory protection in case of likely overexposure (or have appropriate ventilation).
- Impervious gloves made from resistant materials. When determining which type of gloves to use, it is important to verify what type of solvent you are handling and how long the gloves will be exposed.

Manufacturers encourage formulators of end-use products containing halogenated solvents as raw materials to label their products with appropriate safe-handling and PPE guidance for end users.

EXPOSURE MONITORING

Companies working with halogenated solvents are encouraged by manufacturers to monitor vapor levels and worker exposures during various tasks to ensure that mandated workplace exposure limits are not exceeded. In some cases, OSHA requirements mandate initial monitoring be done representing all exposed employees. This can be accomplished via direct and indirect exposure measurement methods:

Direct Measurement

The simplest method for performing spot measurements is to use a commercially available colorimetric device, such as a Draeger tube or an MSA/Auer tube. These devices give only spot measurements, and can be affected at times by humidity or by other chemicals present in the air, making results difficult to interpret. Sophisticated instruments for continuous measurement of solvent vapors, such as infrared spectrometers, flame ionization detectors, or photo ionization detectors, are also available. However, special training is required to become proficient with their use. Always read the instructions carefully before using any detection device.

Indirect Exposure Measurements

Indirect exposure measurements are more accurate than direct methods. The most common indirect devices (vapor monitoring badges and personal monitoring pumps) sample a known quantity of air either by diffusion or drawing through a tube containing activated carbon. A laboratory analyzes the carbon to determine the contaminants present and measure their concentrations.

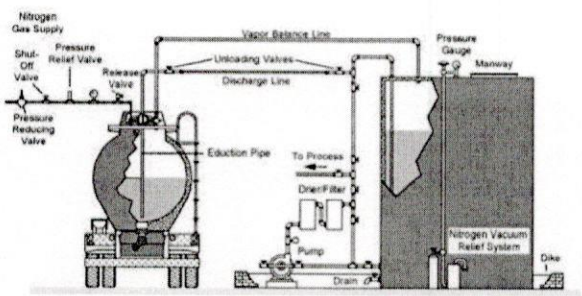
BULK TRANSPORT CONTAINER FILLING/UNLOADING

Properly trained and equipped personnel, who are present at all times, should carry out loading and unloading operations in areas that are contained with a solvent-resistant material. Whenever a container is unloaded by gravity or a pump, a vapor piping system should connect between the shipping container and the receiving tank to reduce solvent losses.

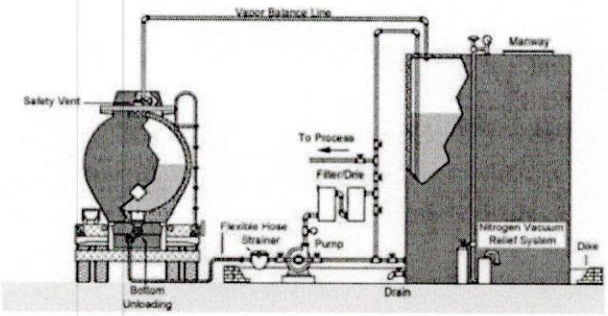
Halogenated solvents may be delivered in bulk by either tank trailers or by tank cars. Since there are significant differences in the equipment configurations of these two modes of transport, different unloading procedures are required. The typical unloading procedures are designed for deliveries to top-loading storage tanks. These procedures may require modifications for deliveries to bottom-loaded storage tanks, or for other variations in storage or delivery equipment.

Pump unloading is the preferred method for unloading tank trailers. Transfers of halogenated solvents by pump allows the option of vapor recovery, in which vapors are returned from the storage tank to the transportation vessel via hose. However, if vapor recovery is not utilized, the tank trailer dome lid or vapor recovery inlet must be opened before commencing the transfer process to prevent tank trailer or pump damage.

Tank trucks or tank cars containing halogenated solvents should be located on a level, paved surface in a designated unloading area. All unloading and receiving areas for halogenated solvents should be surrounded by total containment for the control of potential spills and leaks. Where large scale containment (i.e., diking) is not practical, drip pans or other suitable containers must be placed under connections in the event of a leak.



Typical Tank Truck or Tank Car Top Unloading Diagram



Typical Tank Truck or Tank Car Bottom Unloading Diagram

Both single and multi-compartment tank trailers may be available for shipment of halogenated solvents. Each compartment should be equipped with a bottom outlet valve, a vapor recovery inlet and a pressure activated vent. Considerable care should be taken when transferring halogenated solvents to storage tanks. These careful practices will ensure the health and safety of workers, and ensure that no product is allowed to escape into the air, soil or water.

Other forms of bulk transportation of halogenated solvents include barge, ship, and intermodal bulk liquid containers. Halogenated solvents may also be delivered in drums that meet the performance-oriented packaging requirements of US DOT and UN regulations.

REPACKAGING

Customers or distributors who receive bulk quantities of halogenated solvents and repackage them into tote tanks, 55-gallon drums, or other small volume refillable containers should first unload the solvent from the delivery vessel into a stationary bulk storage tank, and then repackage from the storage tank.

To provide adequate ventilation and to prevent spills and solvent contamination, manufacturers recommend that repackagers ensure that all fittings and transfer operations take place in an area protected with safety and environmental controls.

HOUSEKEEPING

Workers at manufacturing sites adhere to strict procedures, housekeeping, and use of PPE to maintain low risk to workers' health and prevent release of the material into the environment.

This same level of commitment and diligence is recommended by distributors, customers, and end users throughout all sections of the Chain of Commerce.

TRANSFER OF HALOGENATED SOLVENTS TO POINT OF USE

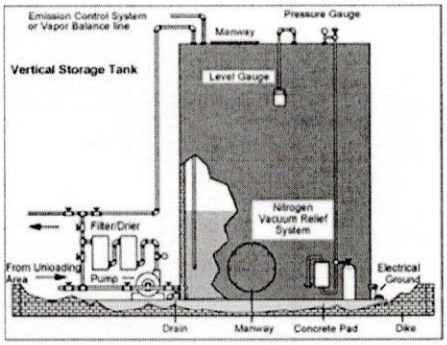
Customers who receive halogenated solvents into their storage tank will then need to move that product to other parts of their facility for the intended end use. Manufacturers recommend that they do not transfer even small amounts of halogenated solvents in open containers. If permanently installed piping is not available, then a mobile tank with covered openings and pressure relief should be used to move the solvent to the application that needs filling. Always use proper nozzles and approved fluid flow lines to connect the mobile tank to the machine or process equipment. Vapor return lines from the point of use back to the storage tank will minimize solvent vapor emissions during transfer.

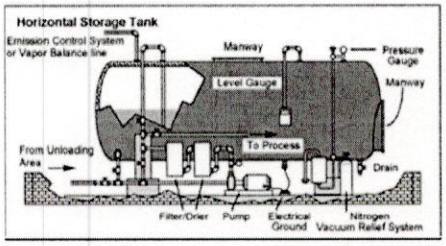
STORAGE & EQUIPMENT

Above ground storage tanks are preferred whenever a large volume of halogenated solvents is to be stored at a customer or terminal site. Storage tanks should be large enough to contain a minimum of 150% of the normal delivery volume. Top-filled tanks are preferred over bottom-filled tanks. Use of bottom-filled tanks requires installation of check valves in the product transfer line to prevent catastrophic tank draining, should the transfer line fail.

All applicable federal, state and local regulations concerning above ground storage tanks must be followed and all permits obtained before installing a bulk storage system. Storage tanks may be mounted horizontally or vertically. Storage tanks used for halogenated solvents should meet the American Petroleum Institute (API) Standard 650, Welded Tanks for Oil Storage; API standard 620, Design & Construction of Large, Welded, Low-pressure Storage Tanks; ASME Section VIII, or other suitable design and fabrication standards. Bulk storage containers should be constructed of either carbon or stainless steel. Aluminum or fiberglass reinforced plastic storage tanks are not recommended for halogenated solvents service. Storage tanks should not be constructed of, nor contain, any non-compatible plastic components.

All storage facilities should be designed to protect the environment from contamination through the use of secondary containment. Typical secondary containment systems employ impermeable surfaces such as double-walled tanks, sumps, dikes (non-earth). All storage tanks should be diked to contain the tank contents in the event of a spill or tank rupture.





Typical Storage Tank Diagrams

DISPOSAL

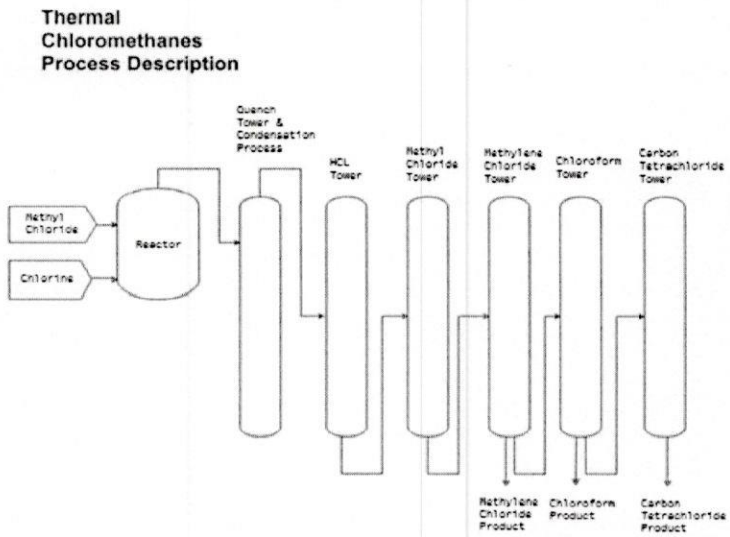
Manufacturers stress that all containers used for disposal of halogenated solvent-containing waste are to be labeled and sealed according to regulations and taken to the designated storage area for the exclusive collection of halogenated solvent waste. All waste should be sent to incinerators or other permitted treatment devices that are approved for halogenated solvent waste.

This same level of commitment and diligence is recommended by distributors, customers, and end users throughout all downstream sections of the Chain of Commerce. Manufacturer Safety Data Sheets and other literature stresses the following guidance:

- It is not acceptable to dispose of halogenated solvent wastes in landfills.
- Users are encouraged to reduce, reuse, and recycle halogenated solvents as much as possible in any operation.
- Reduce the use of halogenated solvents at the source by choosing process equipment that minimizes fugitive emissions, or use control systems that capture emissions for recovery.
- Reuse/recycle halogenated solvents by recovering and purifying solvent through filtration and distillation.
- Contact a reputable recycling company in your area to reclaim spent halogenated solvents.

III. MANUFACTURING PROCESS BACKGROUND

A typical halogenated solvents plant may produce methylene chloride, tetrachloroethylene, carbon tetrachloride, or trichloroethylene using various methods and technologies. One example is the chloromethanes process shown below. The process may produce methylene chloride, chloroform, and carbon tetrachloride from the thermal chlorination of methyl chloride. Hydrogen chloride produced in the thermal chlorination reaction is recycled back to the methyl chloride process.



Typical Thermal Chlorination Process Diagram

In another example, chlorinated organics technology may use a versatile process to produce perchloroethylene (PERC) and carbon tetrachloride (CCl4), with anhydrous hydrogen chloride (HCl) and crude 1,2-dichloroethane (EDC) by-products. A wide variety of feedstocks including C1 to C3 hydrocarbons and partially chlorinated hydrocarbons may be utilized in this process. Chlorine (Cl2), in excess of stoichiometric requirements, is reacted at high temperature with the organic feed to produce PERC and CCl4. The organic products are separated from the excess chlorine and the HCl in a series of condensation steps, and then further purified in a series of distillation columns.

There are several other manufacturing technologies for the production of halogenated solvents, but they all have one thing in common. Emissions and releases from these units are heavily regulated by EPA and the states in which the units are located. There is great incentive for manufacturers to run a very tight operation related to emissions and to enforce the procedures in place to protect human health and the environment.

Halogenated Solvents Manufacturing Exposure Monitoring Overview & Task-Specific PPE Requirements

Exposure groups are developed by each manufacturer to reflect the operating conditions specific to their sites. Therefore, the exposure group listing may vary from manufacturer to manufacturer. Below is an example of exposure groups development by one manufacturer that may be illustrative of the industry as a whole.

Similar Exposure Groups (SEG), Homogeneous Exposure Groups (HEG), or Exposure Groups (EG) are groups of workers believed to have the same general exposure profile due to the similarity and frequency of tasks performed, the materials and/or processes with which they interact, and similarities in how work is performed. The development of exposure groups simplifies the exposure assessment process since representative exposure monitoring can be performed on each exposure group as a whole rather than each individual employee and/or job category within the facility.

Monitoring data collected for each exposure group is collectively analyzed to determine the overall exposure potential. If the 90th percentile analysis results are below the applicable Occupational Exposure Limits (OELs), then the exposures are considered acceptable and periodic monitoring/reassessments are performed to confirm/validate. Any individual sample results exceeding applicable OELs is investigated to determine cause(s) and mitigated.

Exposure Groups have been developed to characterize exposures to halogenated solvents (e.g. methylene chloride, carbon tetrachloride, and perchloroethylene).

The following exposure groups have been developed to characterize potential exposures to halogenated solvents. The tasks generally performed by each exposure group and generalized PPE requirements are included:

- Control Lab Technician
  - Collects samples (half or full-face respirator with acid/gas organic vapor cartridges, goggles, acid coat or apron or PVC jacket and pants, Nitrile gloves)
  - *Disposes of laboratory solvent waste jugs to totes (half or full-face respirator with acid/gas organic vapor cartridges, goggles, lab coat, Nitrile or PVA gloves)
  - *Dumping of solvent retains (Nitrile or PVA gloves; task performed under laboratory hood)
  - *Waste handling/dumping solvent waste (half or full-face respirator with acid/gas organic vapor cartridges only for carbon tetrachloride)
- Process/Unit Operator/Technician
  - Performs filter/trap changes (half-face respirator with acid/gas organic vapor cartridges or full-face respirator with airline)
  - Load/unload spent solvent (nitrogen purge system)
  - *Transfers chlorinated solvent waste to solvent recovery (half-face or full-face respirator with acid/gas organic vapor cartridges)
  - Transfers from tanks to trailers (half-face respirator with acid/gas organic vapor cartridges required during disconnect)
  - Collect samples (where samples are not collected inline a half-face respirator with acid/gas organic vapor cartridges is required)
  - Collect samples (where samples are not collected inline a half-face respirator with acid/gas organic vapor cartridges is required)

    - Maintenance preparation (half-face respirator with acid/gas organic vapor cartridges)
- Shipping/Drum Fill/Loaders
    - Preparing equipment for maintenance activities (half-face respirator with acid/gas organic vapor cartridges)
    - Transfer solvent from truck to tank (half-face respirator with acid/gas organic cartridges required for hose disconnection)
    - Truck loading for methylene chloride (performed under vacuum)
    - Loading tank trucks
    - Loading railcars (closed process)
    - Collect samples (where samples are not collected inline a half-face or full-face respirator with acid/gas organic vapor cartridges is required)
    - Fill drums with carbon tetrachloride (closed process)
    - Collect samples (half or full-face respirator with acid/gas organic vapor cartridges)
    - Change traps/filters (full-face respirator with airline)

*Note that solvent waste and retains may contain a mixture of carbon tetrachloride, methylene chloride, and other chemical derivatives. An air-purifying respirator is primarily worn to provide protection for potential carbon tetrachloride exposures.

Methylene chloride is regulated per OSHA 1910.1052 (Methylene Chloride Standard). Exposure monitoring data is collected for full-shift and tasks associated with methylene chloride.

No "Regulated Areas" have been established according to OSHA 1910.1052 since monitoring data indicates exposures are below the 8-Hour Time-Weighted Average (TWA) Permissible Exposure Limit (PEL) and Short-Term Exposure Limit (STEL).

A medical surveillance program has not been established according to OSHA 1910.1052 since employees are not exposed at or above the action level on 30 or more days per year, or above the 8-hour TWA PEL or the STEL on 10 or more days per year.

COMPANY A

Summary of Data

Chemical	Number Samples Collected	Results Range ppm	% Non-Detected	Avg Concentration ppm	% Samples Over OSHA PEL	Number of Samples above OSHA PEL	Employee True Exposure w/ Respirator
Trichloroethylene	19	ND - 40	37	2.7	0	0	
Comments:	Note that this data represents the air quality near the worker's face while work is being done. It does not include credit for the respiratory protection used. Workers sampled for a majority of the data from the field were wearing respiratory protection that is noted in each table. Most samples where there was no respiratory protection used were from lab tasks that are conducted in a vent hood which provides protection.						
Comments:	Worker activities while sampling included: General 8-12 hour exposure; Catch samples (closed system); Filter change; Large - Line and Equipment Opening; Line opening ; Loading/ unloading; Process sampling; Transferring hazardous waste						
ND = non detected							

COMPANY B

Halogenated Solvents Exposure Monitoring Summary

Chemical	OSHA/ACGIH Exposure Limit	Number of Full-Shift Samples Collected	Range of Full-Shift Sample Results[1]	Number of Full-Shift Samples Less Than Limit of Detection (LOD)[2]	Number of Samples Above OSHA/ACGIH Full-Shift Limit	PPE Requirements
Carbon Tetrachloride	10/5 ppm	330	<0.017 ppm - 12 ppm	257	1	PPE, including respiratory protection, provides further reduction in exposure, as described in the HSIA narrative/summary for halogonated solvents Task-Specific PPE Requirements
Methylene Chloride	25/50 ppm	272	<0.011 ppm - 13 ppm	142	0	
Perchloroethylene	100/25 ppm	138	<0.015 ppm - 4.6 ppm	97	0	
Chemical	**OSHA/ACGIH Exposure Limit**	**Number of Short-Term Samples Collected**	**Range of Short-Term Sample Results[1]**	**Number of Short-Term Samples Less Than Limit of Detection (LOD)[2]**	**Number of Samples Above OSHA/ACGIH Limit**	
Carbon Tetrachloride	25 ppm - Ceiling/10 ppm STEL	154	<0.048 ppm - 200 ppm	45	3/13	
Methylene Chloride	125 ppm - STEL	116	<0.082 ppm - 140 ppm	26	1	
Perchloroethylene	200 ppm - Ceiling/100 STEL	33	<0.2 ppm - 1.1 ppm	32	0	

Footnotes:

1. All of the monitoring data ranges between the years 2005 to 2016.
2. Limit of Detection (LOD) is the amount of a substance that can be reliably reported based on the analytical method and laboratory's instrumentation.
3. Standard PPE generally includes the following (may vary by location and/or area): hard hat, safety glasses, steel-toed shoes, and earplugs as required.
4. Assigned Protection Factor (APF) for respirators: Half-face air purifying respirator = 10; Loose fitting hood with continuious flow breathing air = 25; Loose fitting PAPR = 25; Tight fitting PAPR = 1,000. To determine the Maximum Use Concentration for respirators, multiply the Assigned Protection Factor and the Permissible Exposure Limit.

3/10/2017

COMPANY C

Summary of Data

Chemical	Number Samples Collected	Results Range ppm	% Non-Detected	Avg Concentration ppm	% Samples Over OSHA PEL	Number of Samples above OSHA PEL	Employee True Exposure w/ Respirator
Carbon Tetrachloride	61	ND - 28	44	2.02	3	2	All 2 samples were under OEL with respirator
Perchloroethylene	13	ND - 2.7	85	0.45	0	0	
Methylene Chloride	30	ND - 2.7	67	0.7	0	0	
Comments:	Note that this data represents the air quality near the worker's face while work is being done. It does not include credit for the respiratory protection used. Workers sampled for a majority of the data from the field were wearing respiratory protection that is noted in each table. Most samples where there was no respiratory protection used were from lab tasks that are conducted in a vent hood which provides protection.						
Comments:	Worker activities while sampling included: General 8-12 hour exposure; Catch samples (closed system); Filter change; Large - Line and Equipment Opening; Line opening ; Loading/ unloading; Process sampling; Transferring hazardous waste						

ND = non detected