Disclaimer

This Guide is intended to provide general information to persons who may handle or respond to emergencies involving methyl bromide or mixtures of methyl bromide and chloropicrin. It may also be useful in increasing awareness of the hazards of improperly handling methyl bromide and the general procedures that should be followed in the event of a spill, leak or other emergency. It is not a substitute for in-depth training on specific emergency response techniques or procedures.

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Additional copies of this Guide may be obtained, free of charge, from the CMA Methyl Bromide Industry Panel.

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Section 1:
Emergency Response System
1.1 Introduction

An emergency with methyl bromide or mixtures of methyl bromide and chloropicrin may occur during manufacture, repackaging, use or transportation.\(^1\) In most cases, quick, appropriate responses by trained personnel can help to mitigate the consequences of the emergency.

The member companies of the Methyl Bromide Industry Panel of the Chemical Manufacturers Association (MBIP) are available to provide technical information about methyl bromide products in an emergency. As more fully explained in Section 1.3 below, there are individuals in certain geographic areas that can provide technical information to professional emergency responders at the scene of an emergency involving methyl bromide or methyl bromide/chloropicrin products. This Guide provides some important information about the handling of methyl bromide products in emergency situations. The MBIP also has a safety video that provides additional safe handling information. Copies of the video (English and Spanish versions) are enclosed in this Guide.

In the event of an unintended release of methyl bromide or chloropicrin, quick assessment of the situation and evacuation of any people in the area of the leak is critical. Emergency situations involving the release of methyl bromide typically require notification to state and/or Federal authorities. Notification begins with a call to local emergency response agencies (e.g., the local fire department). After local emergency response agencies are notified, additional assistance can be obtained by calling one of the numbers listed below in Sections 1.2.1 or 1.2.2.

1.2 Emergency Contact Numbers

Valuable information for emergency situations can be obtained from either the manufacturer or CHEMTREC at the phone numbers listed below. These contacts can provide advice and help with arranging professional emergency response assistance. They also can provide the name and telephone number of a “technical specialist” who can provide important technical information about methyl bromide and mixtures of methyl bromide and chloropicrin to professional emergency responders at the scene of the emergency.

Depending on the nature and extent of the emergency situation, notification of additional local, state, and federal agencies may be required. (Appended at the end of Section 2 is a chart summarizing the federal notification requirements for incidents involving methyl bromide and mixtures of methyl bromide/chloropicrin.) Important emergency response contacts for site emergency response coordinators may include: local emergency response agencies (e.g., fire department, police department, and local emergency planning committee); state emergency response coordinator; and CHEMTREC.

\(^1\) Methyl bromide is a colorless, odorless gas at room temperature. Some formulations include mixtures with chloropicrin.
1.2.1 **Primary Contacts**

**Manufacturers/Formulators:**

**Albemarle Corporation**
Baton Rouge, Louisiana: 225-344-7147 (please call collect)

**AmeriBrom, Inc.**
Fort Lee, New Jersey: toll free, 1-800-280-2766

**Great Lakes Chemical Corporation**
El Dorado, Arkansas (day or night): toll free, 1-800-949-5167

**Trical, Inc.**
Hollister, California (during business hours): 408-637-0195

1.2.2 **Secondary Contact**

**CHEMTREC** (day or night): toll free, 1-800-424-9300

CHEMTREC provides immediate technical emergency response information concerning chemicals. Information is obtained from several sources, including the manufacturer's product-specific Material Safety Data Sheet (MSDS), a chemical product specialist from the manufacturer, or other technical sources and computer databases. CHEMTREC's library of nearly 2.8 million MSDS (including those for methyl bromide and chloropicrin products) can be accessed in seconds and faxed in minutes to responders at the scene of a hazardous materials incident. The details of an emergency incident will be quickly relayed to the shipper or manufacturer of the product involved. The shipper manufacturer is put in contact with the incident scene to provide further technical advice and assistance.

1.2.3 **Other Contacts**

Individuals in certain geographic areas are available to provide technical information about methyl bromide products in an emergency. These Technical Specialists are knowledgeable in handling methyl bromide and mixtures of methyl bromide/chloropicrin. Contact them if you need advice or assistance after emergency personnel have responded. (A list of Technical Specialists is provided inside the front cover of this Guide.)

As noted above, regulations may require that certain regulatory agencies or emergency response authorities be contacted to report a chemical release. Consult the chart appended at the end of Section 2 for more information.
1.3 The Role of Technical Specialists

Technical Specialists can provide the following information to incident commanders at the emergency site: 1) the physical and chemical properties of methyl bromide and chloropicrin; 2) the hazards associated with both products; 3) the types of personal protective equipment required to be worn; 4) the likely behavior of methyl bromide and methyl bromide/chloropicrin mixtures; 5) the types of containers in which both products are packaged and shipped; 6) ways to approach the site of the release; 7) ways to detect leaks; 8) ways to contain leaks; 9) health effects that may result from overexposure to methyl bromide and chloropicrin; and 10) emergency first aid.

IMPORTANT NOTE:
Technical Specialists are not emergency responders. They are not authorized to become actively involved in a response action unless they have obtained the required OSHA HAZWOPER training certifications. Under OSHA’s regulations, Technical Specialists may not enter the danger zone at the scene of an emergency unless they have been fully trained in the use of personal protective equipment and are accompanied by a fully trained “hazardous materials technician” or “hazardous materials specialist” who is part of the emergency response team.
Section 2: Emergency Response Guidelines
2.1 Incidents Involving Spills or Releases

Methyl bromide has been classified as an “extremely hazardous substance” under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and is subject to certain emergency response reporting and notification requirements. Methyl bromide and mixtures of methyl bromide and chloropicrin that are involved in a spill, whether in the air, on the ground, or in the water, have a minimum reportable quantity (RQ). The RQ for methyl bromide is 1000 pounds. Chloropicrin has not been classified as an extremely hazardous substance. Thus, there is no RQ for chloropicrin and it is not subject to the CERCLA reporting requirements. However, any release of methyl bromide or methyl bromide in a mixture of methyl bromide/chloropicrin that exceeds the 1000 pound RQ for methyl bromide within a 24-hour period must be reported to the National Response Center at 1-800-424-8802, and any other applicable federal, state, and local emergency agencies.

The reporting requirement applies to any products that contain methyl bromide. Whenever there is a release of methyl bromide above the RQ, there is an obligation to report, even if the methyl bromide is contained in a mixture of methyl bromide and chloropicrin. (Consult the notification chart appended at the end of this Section for more information.)

2.2 Transportation Incidents

Recommended procedures for handling transportation incidents with methyl bromide and chloropicrin are provided in the North American Emergency Response Guidebook (2000) published by the U.S. Department of Transportation. Additional procedures are specified in regulations promulgated by the U.S. Department of Transportation and U.S. Federal Aviation Administration. The following provides additional information on handling those incidents.

2.2.1 Vehicle Wrecks

Vehicle wrecks involving pesticides may present special hazards because they usually occur where equipment and facilities for clean-up are not readily available. A wreck involving the release of a large amount of methyl bromide or a mixture of methyl bromide/chloropicrin may increase the risk of exposure to the fumes or liquid. In case of a vehicle wreck in which methyl bromide or chloropicrin is involved, the following procedures have been shown to be effective in mitigating the risk of injury and exposure.

Depending on the particular circumstances of the incident, other steps may be deemed necessary by emergency response personnel and may be implemented in addition to these.

2.2.1.1 Immediately notify local emergency response agencies, e.g., police and fire departments. Notify the product manufacturer at the number given in Section 1.2.1.

2.2.1.2 In order to minimize potential exposures to methyl bromide vapors, keep personnel upwind and isolate the affected area or vehicle. Keep people away. Stop or reroute traffic, if necessary. Depending on the quantity of product
involved and the potential for exposure, it may be necessary to follow FAA procedures regarding temporary aircraft/flight restrictions and no-fly zones over the area of the emergency.

The most recent version of the North American Emergency Response Guidebook (2000) provides the following recommended evacuation distances for methyl bromide and mixtures of methyl bromide/chloropicrin:

**Methyl Bromide Containing Up to 2% Chloropicrin (UN 1062):**

- **Small Spills**
  - (Day) Isolate in all directions 100 feet
  - Protect people downwind 528 feet (0.1 mi)
  - (Night) Isolate in all directions 100 feet
  - Protect people downwind 1056 feet (0.2 mi)

- **Large Spills**
  - (Day) Isolate in all directions 300 feet
  - Protect people downwind 1584 feet (0.3 mi)
  - (Night) Isolate in all directions 300 feet
  - Protect people downwind 4752 feet (0.9 mi)

**Methyl Bromide Containing Greater Than 2% Chloropicrin (UN 1581):**

- **Small Spills**
  - (Day) Isolate in all directions 100 feet
  - Protect people downwind 1056 feet (0.2 mi)
  - (Night) Isolate in all directions 100 feet
  - Protect people downwind 0.7 miles (3,696 ft)

- **Large Spills**
  - (Day) Isolate in all directions 700 feet
  - Protect people downwind 1.3 miles (6,864 ft)
  - (Night) Isolate in all directions 700 feet
  - Protect people downwind 3.5 miles (18,480 ft)

**NOTE:** The UN number for chloropicrin is UN1580 and the UN number for pressurized methyl bromide cylinders is UN1955.

2.2.1.3 Quickly get medical help for anyone affected by the spilled pesticide. Move affected people upwind. Under OSHA HAZWOPER requirements, emergency response personnel must assess and follow the requirements for appropriate personal protective equipment (PPE). EPA-approved product labels specify PPE requirements and mandate the use of respiratory protection when entering a contaminated area. (Consult Section 4 for more information on PPE)
requirements.) Trained personnel may provide first aid until affected persons are under the care of a physician or hospital. (Consult Section 3 for first aid information.)

NOTE: If the attending physician needs assistance in proper treatment, have the physician call Great Lakes Chemical Corporation, Emergency Response, El Dorado, Arkansas, day or night, at 1-800-949-5167 or Albemarle Corporation at (504) 344-7147.

2.2.1.4 Emergency responders and on-site personnel should assess their ability to keep spills or leaks from spreading contamination. In doing so, if there is a potential of exposure to liquid or vapors, wear appropriate PPE including a self-contained breathing apparatus (SCBA). Quick action may be necessary to limit the spread of product. (Consult Section 2.3).

2.2.1.5 Follow any appropriate clean-up and decontamination procedures. (Consult Sections 2.5 and 2.6 for leaking container and clean-up information.)

2.3 Methyl Bromide Spills or Releases -- General Information

A release of methyl bromide may occur in two possible forms: vapor or liquid (especially if the product has a high chloropicrin content). A minor leak of low volume will usually vaporize and can be detected by vapor detection equipment. A light frost condensate may form at the source of the leak. Since removal of the methyl bromide is fully accomplished by the vaporization process, a minor vapor leak has no additional recommended cleanup activity, except to be sure that any downwind areas, which may be impacted by the leak, are evacuated. Methyl bromide is 100% volatile and will leave no residue.

A larger leak or a leak at low temperatures may result in the formation of a solid form of methyl bromide. This is a hydrate of methyl bromide usually formed with methyl bromide and moisture from the air. It looks similar to snow, slush, or sleet. The rapid vaporization of the liquid methyl bromide cools the material below its boiling point of 4°C (38°F). The hydrate can be vaporized with a flow of water or allowed to warm and vaporize naturally. Solid methyl bromide should not be collected and placed in a closed drum because as it warms, the methyl bromide will become gaseous and may exert pressure on the container beyond its safe working limits. This may result in a greater hazard than allowing the material to vaporize. (Materials contaminated with residues of methyl bromide, such as soil or other debris may be placed in drums for proper disposal.)
2.4 Detecting Cylinder Leaks

2.4.1 General Information

There are many available methods for identifying leaks. Section 5 provides information on leak detection devices. Section 6 provides information on container types.

IMPORTANT NOTE: As explained in Section 2.1, methyl bromide and mixtures of methyl bromide and chloropicrin that are released, whether into the air, onto the ground, or into the water, have a minimum reportable quantity (RQ). Any release of methyl bromide or methyl bromide in a mixture of methyl bromide/chloropicrin that exceeds the 1000 pound RQ for methyl bromide within a 24-hour period must be reported to the National Response Center at 1-800-424-8802, and any other applicable federal, state, and local emergency agencies. The reporting requirement applies to any products that contain methyl bromide. Whenever there is a release of methyl bromide above the RQ, there is an obligation to report, even if the methyl bromide is contained in a mixture of methyl bromide and chloropicrin. (Consult the notification chart appended at the end of Section 2 for more information.)

The procedures discussed below are summarized on EPA-approved product labels. They are provided here for the guidance of emergency response personnel who are involved in responding to incidents involving leaking cylinders. Depending on the particular circumstances of the incident, emergency personnel may need to implement other actions.

2.4.2 Identifying and Addressing Leaks

2.4.2.1 In the event of a suspected spill or leak, all PPE requirements mandated on the product label must be followed, including requirements for respiratory protection. In accordance with these requirements, all personnel entering an affected area (e.g., to take methyl bromide air concentration measurements or check for leaks) must wear a NIOSH/MSHA approved self-contained breathing apparatus (SCBA) or a supplied air respirator with auxiliary SCBA (escape bottle) for entry into the affected area to correct the problem. Consult Section 4 for additional information on PPE requirements.

2.4.2.2 Evacuate everyone from the immediate area of the spill or leak. Only personnel wearing proper PPE (e.g., SCBA) should enter or remain in the area of the leaking cylinder. Keep personnel upwind and isolate the affected area. Keep persons away who are not wearing appropriate PPE. EPA requirements prohibit entry into the leak area by persons without the appropriate respiratory protection until the concentration of methyl bromide in the air is determined to be less than 5 ppm and the concentration of chloropicrin is determined to be less than 0.1 ppm. (NOTE: These safety levels have been established by the U.S. EPA and OSHA, and must be followed.)
2.4.2.3 If the leak occurs indoors, immediately open windows (if applicable) and doors to hasten the dissipation of harmful vapors. In the case of a rupture of hoses or fittings during use or application of the product, immediately stop tractor and shut off motor.

2.4.2.4 After putting on the appropriate PPE, approach the cylinder from upwind and employ an appropriate detector to determine the presence of methyl bromide or chloropicrin vapor. Consult Section 5 for information on leak detection devices. In all cases, operating instructions issued by the manufacturer of the detection device should be obtained and followed.

2.4.2.5 Take steps to stop the leak. Consult Section 2.5 below for information on stopping leaks.

2.4.2.6 Consult Section 2.6 for information on spill clean-up and decontamination requirements. NOTE: U.S. EPA and OSHA requirements prohibit persons from entering the leak area without appropriate respiratory protection until the concentration of methyl bromide in the air is determined to be less than 5 ppm and the concentration of chloropicrin is determined to be less than 0.1 ppm.

2.5 Stopping Cylinder Leaks

2.5.1 General Information

As noted above, there are several mechanisms for determining whether a cylinder containing methyl bromide is leaking. Onsite personnel or emergency responders may follow the guidance set forth in Section 2.4 above for identifying leaks. Section 5 provides information on leak detection devices. Section 6 provides information on container types.

The following procedures have been shown to be effective in handling cylinder leaks. Depending on the particular circumstances of the incident, other steps may be deemed necessary by emergency response personnel and may be implemented in addition to these.

2.5.2 Stopping Vapor Leaks

IMPORTANT NOTE:
If the presence of methyl bromide vapor is detected, follow all PPE requirements set forth on the product label, including the use of respiratory protection. Consult Section 4 for more information on required PPE.

- After putting on the proper PPE, proceed to remove the leaking cylinder to a remote location where it can be isolated and handled safely.
• Remove the cylinder bonnet. Determine the exact location of the leak by using a proper detection device, such as a Halide Torch or liquid Leak Detector (soap solution).
  
  NOTE: For severe, visible leaks, tipping the cylinder on end (opposite the location of the leak) will help to put the methyl bromide product into a vapor state.

• If the liquid valve is leaking, remove the screw in the valve handle and remove the valve handle. Consult Section 6 for diagrams of a cylinder and typical single port and double port cylinder valves. If the valve handle is stripped, replace as necessary.

• Use an adjustable wrench to tighten the valve stem to stop a valve seat leak. If the leak is around the threads on the packing nut, use a socket wrench to tighten the packing nut, BUT BE CAREFUL NOT TO OVERTIGHTEN!

• Check the gasket in the 1/8” gas port cap. Replace as necessary. Use an adjustable wrench to tighten the packing nut.

• If the leak cannot be stopped, call the manufacturer of the product for specific instructions.

• Follow all appropriate clean-up and decontamination procedures.

2.6 Spill Clean-Up

The options that follow are provided for the guidance of decontamination teams and other emergency response personnel who are involved in cleaning up spills of methyl bromide or mixtures of methyl bromide/chloropicrin, and decontaminating equipment and premises. Depending on the particular circumstances of the incident, emergency personnel may need to implement other actions. A properly equipped and trained decontamination team should perform these tasks. **Spill and disposal requirements are set forth on product labels and must be followed.**

2.6.1 If the vehicle or leaking container can be moved without spreading the contamination, it is better to move it to an area equipped with a pesticide sump and water supply. If moving the vehicle or container would create a hazard, on-the-spot clean-up and decontamination may have to be carried out. (Consult Section 2.5, Stopping Cylinder Leaks, for additional information.)

Avoid inhalation of vapor and personal contact. Wear proper PPE as described below and in Section 4 of this Guide. **These requirements are specified on EPA-approved product labels and must be followed.**

2.6.2 For Methyl Bromide Containing Up To 10% Chloropicrin:
Evacuate everyone from the immediate area of the spill or leak. Wear a self-contained breathing apparatus (SCBA) or a supplied air respirator with auxiliary SCBA (escape bottle) for entry into the affected area to correct the problem.

Allow the spill to evaporate. Because of its volatility, methyl bromide will evaporate and dissipate rapidly. Absorbent material may slow the evaporation of methyl bromide and may hamper clean-up efforts. Dissipation may also be slowed by absorption of methyl bromide into a porous medium such as soil or asphalt.

Do not permit entry into the spill or leak area by persons without the appropriate PPE (including respiratory protection), until the air concentration of methyl bromide is determined to be less than 5 ppm and the concentration of chloropicrin is determined to be less than 0.1 ppm. (NOTE: These safety limits have been established by the U.S. EPA and OSHA and must be followed.)

Follow all storage and disposal requirements set forth on the EPA-approved product label. The U.S. EPA considers pesticide wastes, contaminated soil, water and other clean-up debris to be toxic and hazardous. Dispose of such materials in accordance with the label. Improper disposal of excess pesticide is a violation of Federal law. Contact your state pesticide or environmental control agency, or the hazardous waste representative at the nearest U.S. EPA Regional Office for guidance.

Users and responders are strongly encouraged to return empty cylinders “freight collect” to the manufacturer or distributor from whom shipment was made. Call the appropriate manufacturer listed in Section 1.2.1 before sending the cylinder back to obtain specific instructions for preparing defective containers for proper shipment.

2.6.3 For Methyl Bromide Containing More Than 10% Chloropicrin:

Follow the guidance described above and consult the guidelines for UN 1581 and 1580 (chloropicrin) under the North American Emergency Response Guidebook.

2.7 Fire

2.7.1 General Information

Under normal conditions, methyl bromide is a nonflammable, noncombustible chemical. However, if a fire occurs in a storage area or during transport, cylinders and/or cans of product could rupture, causing methyl bromide and/or chloropicrin to contaminate the area.
IMPORTANT NOTE: The auto-ignition temperature of methyl bromide is 998°F. Methyl bromide is ignitable by a high-energy spark at air concentrations of 10-15% by volume. Methyl bromide may decompose into hydrogen bromide, carbon monoxide and nitrogen oxide. Section 8 provides additional information on the physical and chemical properties of methyl bromide.

Chloropicrin is a noncombustible, nonflammable liquid, but if it is quickly heated in an enclosed container, it may detonate. Chloropicrin may decompose violently at 112°C (233.6°F) into severely toxic gases, especially if it comes in contact with certain metals. Section 8 provides additional information on the physical and chemical properties of chloropicrin.

2.7.2 Specific Guidance

The options that follow are provided for the guidance of emergency responders and other personnel who are involved in a fire that may affect containers of methyl bromide or mixtures of methyl bromide/chloropicrin. Depending on the particular circumstances of the incident, emergency personnel may need to implement other actions.

2.7.2.1 In case of fire, notify the local fire department immediately. Identify all the products that might be involved. Notify the product manufacturer at the number given in Section 1.2.1.

2.7.2.2 Avoid inhalation of vapors and personal contact with methyl bromide and chloropicrin. Wear proper PPE. PPE requirements are specified on EPA-approved product labels and must be followed. Persons required to use appropriate PPE include firefighters and other emergency personnel at the fire site. All persons in the area of the fire are required to wear respiratory protection (either a NIOSH/MSHA approved self-contained breathing apparatus (SCBA, MSHA/NIOSH approval number prefix TC-13F) or a supplied air respirator (MSHA/NIOSH approval number prefix TC-19C)) if the air concentration of methyl bromide is above 5 ppm and the concentration of chloropicrin is above 0.1 ppm. (NOTE: These reentry parameters have been established by U.S. EPA and OSHA and must be followed.) Section 4 provides more information on PPE requirements. Section 5 provides information on leak detection and air monitoring.

2.7.2.3 Evacuate everyone from the immediate area of the fire. Any of the known fire-extinguishing agents can be used to extinguish a fire involving methyl bromide or chloropicrin unless the presence of electrical equipment dictates a need to be selective. Use water to keep fire-exposed containers cool.

2.7.2.4 Consult Section 2.4 and 2.5 for information on detecting and stopping cylinder leaks. Consult Section 2.6 for information on spill clean-up. Follow all spill and disposal requirements set forth on the product label. The U.S. EPA
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considers pesticide wastes and contaminated soil, water and other clean-up debris to be toxic and hazardous. Dispose of such materials in accordance with the product label. Improper disposal of excess pesticide is a violation of Federal law. Contact your state pesticide or environmental control agency, or the hazardous waste representative at the nearest U.S. EPA Regional Office for guidance.

2.8 References


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Federal Notification Requirements Chart
Section 3:
First Aid Procedures
3.1 Personal Injury or Overexposure (First Aid)

Methyl bromide is a potentially hazardous chemical that must be safely used, handled and transported precisely as its label and accompanying materials describe. The potential routes of exposure are inhalation, dermal (through skin contact) and oral. Procedures for practical treatment and first aid are specified on EPA-approved product labels, and are summarized below. (Refer to Section 7 for information on the symptoms of overexposure.)

3.1.1 Inhalation

The main route of exposure to methyl bromide and chloropicrin is through the lungs. If a person appears to have been exposed and overcome by methyl bromide vapors:

- Call for assistance.
- Call “911” or other emergency medical assistance.
- Put on a self-contained breathing apparatus (SCBA) and other appropriate PPE, and remove the person from the contaminated area.
- Make sure the person can breath freely. If breathing has stopped, administer artificial respiration, but not by mouth-to-mouth. If oxygen is available, it should be administered by personnel trained in first aid procedures.
- Keep the patient comfortably warm with head and chest slightly elevated.
- If not unconscious, rinse mouth out with water. Do not give anything by mouth to an unconscious person.
- Get medical attention immediately.

3.1.2 Contact with Skin

If someone is splashed with liquid methyl bromide, the removal of contaminated clothing is critical to mitigating the potential for severe chemical burns and skin irritation. In the event of contact with liquid methyl bromide:

- Immediately remove soiled clothing, shoes and any other items of clothing on skin.
- Flush the skin with copious quantities of water for not less than 15 minutes. If redness of the skin occurs seek medical attention.

  NOTE: 15 minutes is a minimal time period, additional flushing is advised for significant skin exposures

- Anyone assisting the exposed person should wear a SCBA to avoid inhaling methyl bromide vapors.
- Discard all drenched articles of clothing and shoes. These items must not be worn again.
- Product spilled on the skin or clothes may liberate vapors, which may be inhaled with serious results. Thus, workers treated for skin exposure also should be monitored for injury by vapors.
• All persons who assisted in removing the exposed person’s clothing or in flushing their skin, should remove all of their clothing and shower to clean off any methyl bromide that may have been splashed on their body.

3.1.3 Contact with the Eyes

Severe corneal burns may result from splashes of methyl bromide in the eye. Chloropicrin vapors from mixtures of methyl bromide/chloropicrin also may cause eye irritation. If product enters the eyes or if the eyes have been exposed to high concentrations of the vapor:

• Flush the eyes immediately for not less than 15 minutes. Hold eyelids open and flush with a steady, gentle stream of water.
• Obtain medical attention immediately.
• Contact lenses may worsen eye irritation and damage because they can trap methyl bromide against the surface of the eye. Contact lenses should not be worn in areas where methyl bromide has been released.

3.1.4 Oral Ingestion

Oral ingestion of the product can produce the same injury as when inhaled. Consult Section 3.1.1 for practical treatment and first aid procedures.

NOTE: If the attending physician needs assistance or information, have the physician call Great Lakes Chemical Corporation, Emergency Response, El Dorado, Arkansas, day or night, at 1-800-949-5157 or Albemarle Corporation at 504-344-7147.

At publication, there is no known medical antidote for methyl bromide or chloropicrin.
Section 4: Personal Protective Equipment
4.1 Personal Protective Equipment (PPE)

4.1.1 General Information

The proper use of personal protective equipment (PPE) can minimize accidental exposure and reduce the risk of injury due to a spill or leak. The PPE requirements set forth in Sections 4.1.2 through 4.1.5 below are specified on EPA-approved product labels and must be followed at all times. Persons required to use PPE include applicators, handlers and emergency response personnel. These persons must be trained in the use and care of PPE.

Table 4.1 provides examples of various activities and the types of PPE required to be worn for them. Respiratory PPE is required if the concentration of methyl bromide in the air exceeds 5 ppm or the concentration of chloropicrin exceeds 0.1 ppm. Consult Section 4.1.4 for additional information about respirator requirements.

<table>
<thead>
<tr>
<th>Activity</th>
<th>PPE for:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Body</td>
</tr>
<tr>
<td>Connecting/disconnecting cylinders</td>
<td>x</td>
</tr>
<tr>
<td>Opening cylinder valves (connected to line):</td>
<td></td>
</tr>
<tr>
<td>Outdoors</td>
<td>x</td>
</tr>
<tr>
<td>Opening cylinders: Indoors</td>
<td>x</td>
</tr>
<tr>
<td>Checking for leaks: Outdoors</td>
<td></td>
</tr>
<tr>
<td>Checking for leaks: Indoors</td>
<td></td>
</tr>
<tr>
<td>Repairing/handling leaks</td>
<td>x</td>
</tr>
<tr>
<td>Emergency entry into fumigated space</td>
<td>x</td>
</tr>
<tr>
<td>Filling cylinders: Outdoors</td>
<td></td>
</tr>
<tr>
<td>Filling cylinders: Indoors</td>
<td>x</td>
</tr>
</tbody>
</table>

See Sections 4.1.2 through 4.1.5 for specific equipment descriptions. Appropriate respiratory protection is required for emergency responders involved in evacuation and decontamination activities if the air concentration of methyl bromide or chloropicrin exceeds the established safety levels.

Follow the PPE equipment manufacturer’s instructions for cleaning and maintaining PPE.
4.1.2 Body, Skin, and Hands

Persons handling methyl bromide products should wear loose fitting, well-ventilated long-sleeved shirts, long trousers and socks that are cleaned after each wearing. Wear shoes, but avoid heavily oiled leather boots.

Under conditions of relatively high vapor concentrations, methyl bromide may become trapped in clothing and shoes and cause chemical burns or blisters on the skin and feet. If such exposure is suspected, clothing and shoes should be removed. Typical fire fighting gear (e.g., turnout gear or bunker gear) can trap methyl bromide vapors and cause burns.

DO NOT wear jewelry, goggles, certain chemical protective suits, gloves, rubber boots, or other confining apparel.

IMPORTANT NOTE:
Most chemical protective suits have been shown to be ineffective in preventing permeation and exposure to methyl bromide. If the suit is permeable, methyl bromide vapors can become trapped inside the suit next to the skin and result in injury. Before using a chemical protective suite, check with the suit manufacturer to ensure that the suit has the proper permeation resistance. Porous cotton gloves may be worn because they are not likely to trap vapors.

After accidental exposure, immediately remove clothing, shoes and socks. Do not reuse contaminated clothing until thoroughly aerated outside, and washed and dried. Use detergent and hot water. Keep contaminated clothes separate from other laundry items. Discard drenched shoes and clothing. These items must not be worn again. Consult Section 3 for more information on practical treatment and first aid procedures.

Refer to Table 4.1 for activities that require body, skin and hand protection.

4.1.3 Eyes

Depending on the activity, eye protection may include safety glasses with brow and side shields, full-face shield, or a full-face respirator (SCBA). Do not wear goggles, or contact lenses as they may trap methyl bromide vapors. Follow all instructions on the product label. Refer to Table 4.1 for activities that require eye protection.

4.1.4 Lungs (Respiratory System)

For Methyl Bromide Products Containing Up To 0.5% Chloropicrin:

If the concentration of methyl bromide in the air exceeds the U.S. EPA reentry level of 5 ppm, as measured by a pump and appropriate detector tubes (consult Section 5 for additional information), OR if the concentration is unknown, all persons in the contaminated area must use a self-contained breathing apparatus (SCBA) (NIOSH/MSHA approval number TC-13F), or an air-line respirator with an auxiliary
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Section 4 - Personal Protective Equipment

SCBA/escape bottle operated in constant flow or positive pressure mode (NIOSH/MSHA approval number TC-19F).

For Methyl Bromide Products Containing More Than 0.5% Chloropicrin:

If the air concentration of methyl bromide exceeds the U.S. EPA reentry level of 5 ppm, OR the concentration of chloropicrin exceeds 0.1 ppm, OR if the concentration is unknown, all persons in the contaminated area must use a self-contained breathing apparatus (SCBA) (NIOSH/MSHA approval number TC-13F), or an air-line respirator with an auxiliary SCBA/escape bottle, operated in constant flow or positive pressure mode (NIOSH/MSHA approval number TC-19F).

IMPORTANT NOTE:
Air purifying respirators are no longer approved for respiratory protection for methyl bromide in the U.S.

4.1.5 Head, Foot, and Other PPE

Other PPE may be necessary for some activities. For example, steel-toed shoes may provide protection when moving cylinders. A hard hat or protective headgear may be necessary in certain work situations. Certain types of chemical gloves may be necessary or recommended when other chemicals are present.
Section 5: Area Monitoring and Leak Detection
5.1 Air Sampling and Testing

Air sampling is used to determine the presence and/or concentration of methyl bromide or chloropicrin vapor at levels that may be harmful to human health. There are a variety of sampling techniques and types of equipment for determining the air concentration of methyl bromide and chloropicrin. The technique and/or equipment chosen will depend on the type of monitoring system needed to meet a specific regulatory requirement. Types of sampling techniques include time weighted average (TWA) exposure, continuous monitoring, or point-in-time exposure measurements.

EPA-approved product labels require air concentration levels for determining respirator use and reentry to be measured using a direct reading detection device. These detection devices take point-in-time measurements and display the concentration in air as a direct reading. The following table presents current analytical techniques (including direct reading point-in-time devices), detectors, achievable detection limits, and approximate costs for setting up the analytical system.

NOTE: All operating instructions provided by the equipment/device manufacturer should be followed at all times.

Table 5.1
Summary of Air Monitoring Techniques for Methyl Bromide and/or Chloropicrin

<table>
<thead>
<tr>
<th>Analytical Technique</th>
<th>Chemical Detected</th>
<th>Monitoring Exposure Requirement</th>
<th>Achievable(^2) Detection Limit (ppm)</th>
<th>Detector</th>
<th>Other Chemicals May Interfere</th>
<th>Approximate Cost (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Flame Test</td>
<td>Methyl bromide</td>
<td>Point-in-time</td>
<td>20</td>
<td>Colorimetric</td>
<td>Yes</td>
<td>50</td>
</tr>
<tr>
<td>Detector Tubes</td>
<td>Methyl bromide or Chloropicrin</td>
<td>Point-in-time</td>
<td>0.05 – 50</td>
<td>Electrolytic Potential</td>
<td>Yes</td>
<td>50+300(pump)</td>
</tr>
<tr>
<td>Electronic Leak</td>
<td>Methyl bromide</td>
<td>Point-in-time</td>
<td>5</td>
<td>Infrared PID FID ECD</td>
<td>No</td>
<td>1000-5000 + instrument cost</td>
</tr>
<tr>
<td>Other Electronic Systems</td>
<td>Methyl bromide</td>
<td>Continuous or point-in-time</td>
<td>5</td>
<td>IR</td>
<td>Yes</td>
<td>1000-2000</td>
</tr>
<tr>
<td>Adsorbent Tubes</td>
<td>Methyl bromide</td>
<td>Time weighted average or point-in-time</td>
<td>0.1</td>
<td>GC-FID</td>
<td>No</td>
<td>50-200 + instrument cost (GC)</td>
</tr>
<tr>
<td>Infrared</td>
<td>Chloropicrin</td>
<td>Continuous or point-in-time</td>
<td>0.1</td>
<td>IR</td>
<td>Yes</td>
<td>1000-2000</td>
</tr>
<tr>
<td>Impinger</td>
<td>Chloropicrin</td>
<td>Time weighted average</td>
<td>0.1</td>
<td>GC-ECD</td>
<td>No</td>
<td>100-200 + instrument cost (GC)</td>
</tr>
</tbody>
</table>

\(^2\) Source of Detection Limits -- information from manufacturer or other data.
5.1.1 Methyl Bromide

Several exposure limits have been established for methyl bromide concentrations in air:

- OSHA Permissible Exposure Limit (PEL) -- 20 ppm (80 mg/m$^3$)
- U.S. EPA Reentry/Respiratory Protection Level -- 5 ppm
- California Proposition 65 Guideline Limit -- 0.21 ppm
- American Conference of Governmental Industrial Hygienists (ACGIH) TLV -- 1 ppm
- NIOSH Recommended Exposure Limit (REL) -- None established
- Immediately Dangerous to Life and Health (IDLH) -- 250 ppm
  (NIOSH Pocket Guide to Chemical Hazards)

5.1.1.1 Analytical Detection System Information

Certain detectors can identify and quantify specific chemicals while others can not. The following provides information on some of the advantages and disadvantages of using various types of detectors. The suitability of a given type of detector may vary depending on the situation presented. Suppliers of these devices can provide additional information about the advantages and limitations of specific detection systems. For several sampling and testing techniques it is possible that the presence of other airborne chemical vapors may interfere with sampling results.

Open Flame Torch Type (Halide). The Open Flame Torch operates on an air diffusion principle. Approximate concentration levels of methyl bromide, if present, will be detected according to the color of the flame produced. This type of detector might be appropriate for leak detection. However, it is NOT sensitive enough to measure methyl bromide at low ppm levels and thus, U.S. EPA has concluded that it may not be used to determine if an area or structure is safe for reentry without the use of respiratory protection.

**Advantages:** Low cost; simple to use; does not require external power source; fairly specific for methyl bromide (only Halogen-containing gases may interfere); and each reading takes only a few seconds.

**Disadvantages:** Limited sensitivity; gives only approximate indication of concentrations; and color may be difficult to see under bright conditions.

**Possible Applicability:** Detecting leaks in structures or containers under fumigation; checking for leaks in cylinders prior to shipment; checking for leaks in valves and piping, determining IDLH levels.
Consult and follow the manufacturer’s instructions for specific operating information.

**Detector Tubes.** Colorimetric detector tubes allow the direct indication of airborne chemical levels. With this technique, a known volume of air is drawn through a tube containing a chemical reagent. The reagent changes color in the presence of the chemical, such as methyl bromide. The length of the stain or the color intensity indicates the concentration level. There are several types of color detector tubes available including a short-term tube using a hand-operated pump and a long-term tube using a low flow pump.

**Advantages:** Sensitive to 1 ppm of methyl bromide; few interferences; low initial investment; more simple to operate than other detectors; and indicates actual concentration.

**Disadvantages:** Detector tubes are relatively expensive ($5 per tube); each tube is good for only one measurement; and each reading takes about 4 minutes. Measurements also have limited accuracy and tubes have expiration dates (defined shelf life).

**Possible Applicability:** Clearing areas for reentry after fumigation; determining when PPE (respiratory protection) is required for entry into an area, determining IDLH levels.

Consult and follow the manufacturer’s instructions for specific operating information.

**Electronic Leak Detectors.** Air samples are introduced into the electronic leak detector either by simple diffusion or by using pumps. Contaminant concentration levels are determined by measuring the difference in potential across the detector electrolytic cells. Consult and follow the manufacturer’s instructions for operating each type of electronic detector.

- **Electrolytic Leak Detectors**

  **Advantages:** Known to be reliable; no moving parts; each unit can have sensors in multiple locations; and sensitive to 1 ppm methyl bromide.

  **Disadvantages:** Other gases may interfere; slower response than other detectors; and more expensive than other types of detectors.

  **Possible Applicability:** Area monitoring in manufacturing or filling operations.

Another type of electronic leak detector uses a thermal conductivity (TC) cell to compare the thermal conductivity of a mixture of gas or vapor and dry air to that of ambient dry air. This difference is converted into an electric current, which represents the concentration of the gas or vapor.
The digital display shows ounces of fumigant per 1000 cubic feet. This type of detector might be appropriate for detecting the presence of methyl bromide. However, it is NOT sensitive enough to measure low ppm levels of methyl bromide and therefore, U.S. EPA has determined that it may not be used to determine if an area or structure is safe for reentry without respiratory protection.

*Thermal Conductivity (TC)*

**Advantages:** Rapid results; specific for methyl bromide; direct reading; and known to be accurate and reliable.

**Disadvantages:** Not sensitive to very low concentrations; and requires external power source.

**Possible Applicability:** Verification of proper concentrations during fumigation and product use.

*Other Electronic Detectors.* Other more sophisticated detection systems are available and use a wide range of instrument detectors, including Infrared (IR), Photo-ionization Detector (PID), Flame Ionization Detector (FID), and Electron Capture (EC). In-line gas chromatographic systems are also available for monitoring in-process manufacturing operations.

- **Photo-ionization Detector (PID)**

  **Advantages:** Rapid results; portable; direct reading; sensitive to 1 ppm methyl bromide; and wide range of sensitivity.

  **Disadvantages:** Other gases may interfere; relatively expensive; and routine maintenance and calibration required.

  **Possible Applicability:** Testing for uniform distribution of fumigant; checking for leaks; and preliminary clearing for reentry (verify with detector tubes).

- **Flame Ionization and Electron Capture Detectors**

  **Advantages:** Sensitive to less than 1 ppm methyl bromide.

  **Disadvantages:** Other gases may interfere; more expensive than other detectors; and more difficult to maintain.

  **Possible Applicability:** Specific installations where high sensitivity is required and trained personnel are available for operation and maintenance.

- **Infrared Detectors**

  **Advantages:** High sensitivity; specific for methyl bromide; and multiple sampling points.
Disadvantages: More expensive than other detectors; and more difficult to maintain.

Possible Applicability: Monitoring system for manufacturing or packaging location where trained personnel are available for calibration and maintenance; useful where electrolytic detectors are not sufficiently specific.

**Adsorbent Tubes with Sampling Pumps.** Many gases and vapors are sampled using a sorbent tube, which is a glass tube normally containing two layers of a solid adsorbent material. The adsorbent tubes required for methyl bromide detection contain petroleum charcoal and consist of a 400-milligram front tube and a 200-milligram back tube. When air is actively pulled through the tube, the first adsorbent layer traps airborne chemicals (i.e., methyl bromide) and the second layer serves as a backup layer, indicating sample breakthrough. The sample is collected and the tubes are sent to a laboratory and extracted with a suitable solvent. Suitability of the solvent depends on the type of gas chromatographic detector that is used and/or specified in various methyl bromide analytical methods. The extract is then analyzed by a qualified technician using a gas chromatograph, equipped with an appropriate detector. Detector types cover a range of sensitivities (e.g., thermal conductivity (less sensitive) to electron capture (most sensitive)).

Advantages: Sensitive to 0.001 ppm methyl bromide; and provides average concentration over several hours.

Disadvantages: More expensive than other types of detectors; requires laboratory analysis for results; determination of results may take several days; and requires highly trained personnel.

Possible Applicability: Determination of average worker exposure levels (PEL/TWA); and determination of concentrations around fumigated areas.

5.1.1.2 Assistance in Collection and Analysis of Samples

The American Industrial Hygiene Association (phone # 703-849-8888) can provide a list of Certified Industrial Hygienists and/or certified laboratories in the United States that are available to collect and analyze air samples.
5.1.2 Chloropicrin

Several exposure limits have been established for chloropicrin concentrations in air:

- OSHA TWA – 0.1 ppm (0.7 mg/m$^3$) TWA
- NIOSH REL -- 0.1 ppm (0.7 mg/m$^3$) TWA
- IDLH - 2 ppm (NIOSH Pocket Guide to Chemical Hazards)
- U.S. EPA Reentry/Respiratory Protection Level – 0.1 ppm (0.67 mg/m$^3$) TWA
- American Conference of Governmental Industrial Hygienists (ACGIH) TLV – 0.1 ppm (0.67 mg/m$^3$) TWA

There are a few types of sampling techniques that can be used for determining the airborne concentration of chloropicrin. Several known air monitoring methods have been adapted for chloropicrin but, at this time, there are no universally validated test methods for determining air concentrations of chloropicrin. The suitability of a given type of detector may vary depending on the situation presented. Suppliers can provide additional information about specific detection systems. Consult the manufacturer’s operating instructions for additional information.

The OSHA Chemical Information Manual (CIM) lists the following methods for determining levels of chloropicrin:

**Impinger Method.**
Impingers are glass bubble tubes used to collect airborne chemicals. With this technique, a known volume of air is bubbled through the impinger, which contains a liquid solvent. The solvent will chemically react or physically dissolve the chemical of interest (e.g., chloropicrin). The liquid is then analyzed by a gas chromatograph system equipped with an ECD detector that determines airborne concentrations of chloropicrin.

**Detector Tubes.**
Colorimetric detector tubes (Section 5.1.1.1) allow the direct indication of airborne chemical levels. With this technique, a known volume of air is drawn through a tube containing a chemical reagent. The reagent changes color in the presence of the airborne chemical. The length of the stain or the color intensity indicates the concentration level. There are several types of color detector tubes available, including a short-term tube using a hand operated pump and a long-term tube using a low flow pump.

**Infrared Methods.**
The OSHA CIM (1991) identifies an infrared detection system as another method for determining chloropicrin levels. This method has a detection concentration of 0.1 ppm at 11.5 µm. A pump introduces air samples into the
detection chamber. The infrared detector is set at prescribed wavelength(s). The detector response is used to determine the airborne concentration of chloropicrin.

5.2 References


Methyl Bromide Emergency Response Guide

Section 6: Methyl Bromide Containers
6.1 Cylinders and Cans

Storage, handling, transportation and disposal requirements are set forth on EPA-approved product labels and in the DOT’s HAZMAT regulations. The following sections summarize and further explain those requirements:

6.1.1 Cylinders

Cylinders containing methyl bromide and methyl bromide/chloropicrin mixtures should be handled, stored, and transported in accordance with all specified label requirements to prevent injuries and avoid contact with the chemical contents.

6.1.1.1 Cylinder and Valve Diagrams

Sample diagrams of a typical 1500 lbs. cylinder (commonly known as a “PIG”) and a 200 lbs. cylinder are shown in Figures 6.1 and 6.2 below.

![Cylinder Diagram](image)

Figure 6.1
1500 lbs. Cylinder (a “PIG”)
Methyl bromide cylinders have special valves that are designed according to DOT specifications. Sample diagrams of typical double port and single port cylinder valves are show in Figures 6.3 and 6.4 below.
6.1.1.3 Labeling, Transportation, Handling and Storage

Labeling
Pursuant to U.S. EPA and DOT HAZMAT regulations, cylinders must display a legible label that is in compliance with all applicable Federal and State requirements.

Transportation
Methyl bromide is a “hazardous material” under DOT HAZMAT regulations. Thus, it must be packaged and transported in accordance with all applicable DOT HAZMAT requirements, including vehicle placarding, labeling, shipping documentation, training and license endorsement requirements.

DOT regulations prohibit the transport of full or empty cylinders or used application equipment and hoses inside the passenger compartment or trunk of a vehicle. Cylinders on vehicles are required to be secure in order to prevent theft, unauthorized access, or tampering and movement during transportation.

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**Storage**
Storage areas should comply with all regulations for chemical storage. Store full or empty cylinders in an upright position, either outdoors under ambient, dry conditions or indoors in a well-ventilated location away from work areas or offices. When cylinders are stored in an enclosed area, the area should be monitored for leaks to ensure that people entering or working in the area are not exposed to concentrations of methyl bromide or chloropicrin above established EPA and OSHA safety levels. The chemical storage area should be locked and secured to prevent unauthorized access. Only trained personnel should be allowed to enter the area. Identify the area as a pesticide storage area and post all required National Fire Protection Association placards on the outside doors of the storage area. Figure 6.5 shows sample placards.

![NFPA Placards](image)

**Figure 6.5**
Examples of National Fire Protection Association (NFPA) Placards

The NFPA designations listed above for methyl bromide and chloropicrin products conform to specifications contained in NFPA-704, Recommendations for Identification of Fire Hazards of Materials.

There are four hazard categories displayed in the diamond shape in Figure 6.6: Health (blue), Flammability (red), Reactivity (yellow), and Specific

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Hazard (white). For the health, flammability, and reactivity categories the degree of hazard is noted by a number in the corresponding diamond. The degree of hazards range from 0 to 4 where, 0 = minimal hazard, 1 = slight hazard, 2 = moderate hazard, 3 = serious hazard, and 4 = extreme hazard. Specific hazards are indicated by the use of symbols in the white diamond.

![NFPA Hazard Rating System](image)

**Figure 6.6**
NFPA Hazard Rating System

**Handling**
Since full or empty cylinders are heavy, training in the proper handling of heavy objects should be considered for individuals handling and transporting cylinders. The most common injuries among handlers are back injuries and falls. Applicators, sealing crews, warehouse personnel, handlers and emergency responders should follow established safety practices to avoid back strain. Consider using supports, mechanical lifting equipment, and safety lines. Carrying cylinders up or down ladders can result in injury.

Load, unload and move cylinders using a hand truck, fork truck, or other device to which the cylinder can be firmly secured. Product labels prohibit the use of rope slings, hooks, tongs, or similar devices to unload cylinders. Do not subject cylinders to rough handling or mechanical shock such as dropping, bumping, rolling, dragging, or sliding. The cylinders may contain more than 50 pounds of pressurized liquid fumigant. Under hot conditions, cylinder pressure will increase. Therefore, cylinders should be handled so as to prevent physical injuries that may result from a rupture of the pressurized tank. Cylinders are required to be stored in an upright position and secured to a rack or wall to prevent tipping and to minimize the risk of accidental damage and rupture.

Cylinders are equipped with threaded safety caps and a threaded bonnet to protect the

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valve outlet assembly from damage. Valve damage may result in injury due to a high-pressure release or leak of product. The safety caps and bonnet are required to be securely in place when the cylinder is not being used. Consider using a chain wrench or a special bonnet wrench to remove a tight or sticky bonnet.

**IMPORTANT NOTE:**

The use of a hammer, screwdriver, adjustable wrench, or pliers may damage the valve and/or the cylinder and produce a leak.

**Connecting**

Extra care should be taken when connecting or disconnecting hoses from a cylinder. The low boiling point of methyl bromide can create pressure at normal ambient temperatures. Always assume that all valves, hoses and connections are pressurized. At least two trained persons are required to be present when connecting or disconnecting hoses. All personnel involved are required to wear appropriate PPE. (Consult Section 4 for more information.) Prior to opening the cylinder and removing the safety cap, always check the valve to determine if it is tightly closed. Use a wrench of appropriate size to remove or tighten the safety cap.

When connecting or disconnecting equipment from cylinders, wear appropriate PPE, including eye protection. Liquid methyl bromide may react with aluminum, magnesium or zinc alloys and plastic such as polyvinyl chloride (pvc). Thus, hoses made from these materials should not be used. Some examples of compatible materials include polyethylene tubing, copper tubing, or Teflon® lined-stainless steel braid for pressurized hoses. The use of garden hoses, polyvinyl tubing, or rubber hoses will result in rupturing and leaks. When using hose barbs to attach the hose, use a barb that fits the hose tightly and use a gear clamp to ensure that the hose won't blow loose under pressure. Anchor loose ends of tubing.

**Leaks**

Consult Section 2 for information on detecting and handling cylinder leaks and spills.

**Returning Cylinders**

When a cylinder is empty, the valve should be closed, the safety cap screwed on the valve outlet, and the protective bonnet replaced prior to its return to the shipper. Only the manufacturer, or his designee, is authorized to refill cylinders. Do not use cylinders for any other purpose. Arrange to return all partial and empty cylinders promptly to your supplier. Do not abandon or dispose of cylinders. Consult Section 2.5 for information on cylinder return.

**Pesticide Disposal**

Consult Section 2.6 for information on proper disposal.

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6.1.2 Cans

Storage
Storage areas should comply with all regulations for chemical storage and notification. Store cans in a well-ventilated location that is protected from weather and large fluctuations in temperature and humidity (NOTE: Conditions that promote the formation of rust may compromise the integrity of the can construction and eventually result in a slow chemical leak.) Do not store cans directly on the floor or on damp surfaces. The storage facility should be located a safe distance away from work areas or offices. EPA-approved product labels prohibit the storage of cans in dwellings or livestock quarters. Whenever cans are stored in an enclosed area, the area should be monitored for leaks to prevent people from entering into or working in the area if the levels of methyl bromide are above EPA or OSHA safety levels. The chemical storage area is required to be locked and secured to prevent unauthorized access. Only trained personnel should enter the area. Cases of cans should be protected from damage by fork trucks or other equipment. Identify the area as a pesticide storage area and post all required National Fire Protection Association placards on the outside door of the pesticide storage area. See Figure 6.5 for sample placard depictions. Do not store partially used cans.

Transportation
Methyl bromide is a “hazardous material” under DOT HAZMAT regulations. Thus, cans must be packaged and transported in accordance with all applicable DOT HAZMAT requirements, including vehicle placarding, labeling, shipping documentation, training and license endorsement requirements.

DOT regulations prohibit the transport of full or empty cans or used application equipment and hoses inside the passenger compartment or trunk of a vehicle. The only DOT-approved shipping container for cans is the cardboard case in which they are packaged by the manufacturer. The transport of loose cans or cans in any other package is prohibited under the regulations.

Leaks
Consult Section 2 for information on detecting and handling cylinder leaks and spills.

Pesticide Disposal
Consult Section 2.6 for information on proper disposal.

Disposal of Cans
Keep open and empty cans in a well-ventilated location for at least 12 hours while allowing the product to completely evaporate. Dispose of empty cans in a sanitary landfill, or by other procedures approved by federal, state and local authorities. Consult the product label for more information.
6.2 Railcars and Isotanks

Bulk shipments of methyl bromide and methyl bromide/chloropicrin mixtures are usually transported in railcars and isotanks. Railcars have a methyl bromide capacity of 130,000 to 180,000 pounds, and isotanks have a capacity of 32,000 to 36,000 pounds. These containers must comply with established DOT design criteria.

Figures 6.6 and 6.7 show the typical design of an isotank used to transport methyl bromide. DOT regulations require that these containers be insulated and that they be equipped with excess flow valves on the liquid delivery lines.
Figure 6.6
Side View of Typical Isotank

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Figure 6.7
Top and End View of Typical Isotank
6.2.1 Vessel Dome and Valves

Rail cars and isotanks have five valves in the dome: two liquid angle valves along the axis of the vessel, two vapor valves to each side of the axis, and a pressure relief valve in the center. The position of these valves is shown below in Figure 6.8.

![Configuration of Angle Valves](image)

Since the vessels are of welded steel construction, leaks usually occur only in the valves or at the point the valves are attached to the vessel. This is discussed in Sections 6.2.3 and 6.2.4 below.

**IMPORTANT NOTE:**
Shippers occasionally receive reports of suspicious liquids dripping from these vessels. In most cases, this liquid is water or condensate, which has
somehow accumulated in the insulation area between the outer shell and the tank itself. This phenomenon should always be considered before assuming that the liquid indicates a leak of methyl bromide from the vessel. As discussed in Section 2, methyl bromide quickly volatilizes into a vapor state because of its low boiling point. Chloropicrin likely would be readily identifiable due to its intensely irritating odor and lacrimating properties.

6.2.2 Typical Angle Valve Design

The following diagram illustrates the design of a typical methyl bromide angle valve.

![Figure 6.9 Methyl Bromide Angle Valve Design](image)

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6.2.3 Characteristics of Valve Operation

The angle valve seals when the valve stem closes against the valve seat in a downward clockwise rotation. The valve opens by turning the valve handle counter clockwise. At the top of the valve position, the stem will be above the outlet that is at a 90-degree angle to the valve base. The packing consists of several solid Teflon® rings that tightly fit around the valve stem. The packing gland is squeezed down by turning the nuts on either side until the packing compresses enough to form a seal between the valve body and stem. In the closed position, the valve seat forms the seal and contains the product. With the valve open the packing will be the seal preventing the product from escaping to the atmosphere. With the plug in place and tightened there should be no leakage from around the packing gland even with the valve open.

In accordance with DOT requirements, these valves are bench tested using certified test equipment to 450 psi in the open and closed (plug in place) positions before being approved for methyl bromide service. The leak test is witnessed and approved by an on-site DOT authorized inspector.

6.2.4 Methyl Bromide Angle Valve Leak Repair

The following examples give details on repairing a leak in the angle valve. These procedures have proven effective in many situations where valves were leaking.

Remember:
Proper PPE should be worn when repairing leaks.
(Consult Section 4 for additional information on recommended PPE)

1. If the leak is between the female thread on the angle valves and the pipe nipple, close the angle valve and the facility valve nearest the vessel. Vent the pressure off the transfer line and purge to a scrubber if possible to remove all methyl bromide vapors. The leak can be stopped by tightening the nipple, if loose, or by replacing the nipple if the threads are worn. Use Teflon® sealant tape on all of the pipe threads for connecting the container to your process.

2. If the leak is on a union or flange, close the angle valve and the facility valve nearest the vessel. Vent the pressure off of the transfer line and purge the line to a scrubber if possible to remove all methyl bromide vapors. A leaking union can usually be stopped by tightening the union. If the union is worn, replace it with a new one. Tightening a flange in an alternating (cross-torquing) pattern evenly on all sides will generally stop a leak. The gasket should be inspected and replaced if excessive compression or wear is evident.

3. If the angle valve is leaking at the packing gland, close the angle valve and the facility valve nearest the vessel. Do not vent the transfer line.
The leak can now be stopped by carefully tightening the packing gland nuts. Tightening should be done equally on each nut; a half turn on one and then a half turn on the other until the leak stops. The packing gland should be kept horizontal at all times. Once the leak has stopped do not tighten the packing gland any further.

4. If you are unable to stop a leak on the packing gland by tightening, you should close the valve tightly. The block valve to the facility should be closed and the connecting line vented and disconnected. The valve plug should be installed and tightened. A tightly closed and plugged angle valve should not leak through the packing gland even if the gland is defective. The valve should be tagged as defective and the supplier contacted. The valve will be replaced when returned to the supplier.

5. The two liquid valves are on the centerline of the vessel. If there is a problem with the first valve, try using the other liquid valve to unload the vessel. For a failure of both liquid valves, notify the supplier of the problem and secure the vessel for return to the supplier for inspection and repairs.

6. The Chlorine Institute Emergency Kit "C" may be used to contain the leak. It has been designed for use with standard DOT chlorine tank cars, but has been shown to be effective in containing leaks in DOT methyl bromide tank cars and isotanks. (A copy of the Chlorine Institute's Kit "C" instructions is provided in the Appendix to this Guide.) Depending on the particular circumstances of the incident, other steps or methods of containment may be deemed necessary by emergency response personnel.

For Emergencies: Contact a Manufacturer at the number listed in Section 1.2.1 of this Guide.

Methyl Bromide Emergency Response Guide

Revision 2 - March 2000
Section 7:
Health and Environmental Effects
7.1 Introduction and Exposure Limits

Methyl bromide is a potentially hazardous chemical that must be safely used, handled and transported precisely as its label and accompanying materials describe. The potential routes of exposure are inhalation, dermal and oral. Exposure limits for hazardous chemicals are typically established by scientific organizations and governmental agencies to minimize adverse health and safety effects.

7.1.1 Exposure Limits for Methyl Bromide

The following exposure limits have been established for methyl bromide concentrations in air:

- OSHA Permissible Exposure Limit (PEL) -- 20 ppm (80 mg/m³)
- U.S. EPA Reentry/Respiratory Protection Level -- 5 ppm
- California Proposition 65 Guideline Limit -- 0.21 ppm
- American Conference of Governmental Industrial Hygienists (ACGIH) TLV -- 1 ppm
- NIOSH Recommended Exposure Limit (REL) -- None established
- Immediately Dangerous to Life and Health (IDLH) -- 250 ppm
  (NIOSH Pocket Guide to Chemical Hazards)

7.1.2 Chloropicrin

The following exposure limits have been established for chloropicrin concentrations in air:

- OSHA TWA – 0.1 ppm (0.7 mg/m³) TWA
- NIOSH REL -- 0.1 ppm (0.7 mg/m³) TWA
- IDLH - 2 ppm (NIOSH Pocket Guide to Chemical Hazards)
- U.S. EPA Reentry/Respiratory Protection Level – 0.1 ppm (0.67 mg/m³) TWA
- American Conference of Governmental Industrial Hygienists (ACGIH) TLV – 0.1 ppm (0.67 mg/m³) TWA

7.2 Symptoms of Overexposure

Immediate health effects may be caused by overexposure to methyl bromide or chloropicrin. The primary route of exposure is inhalation. Overexposure to methyl bromide can occur from either a short exposure to a high concentration of vapor or from a longer exposure to a low concentration of vapor.

7.2.1 Methyl Bromide
The inhalation of high concentrations of methyl bromide may cause serious acute illness and injury to the lungs, throat and nervous system. It can even cause death. Contact with the skin and eyes can lead to severe irritation and burns.

Symptoms of methyl bromide overexposure may not appear immediately. Often symptoms may develop from 2 to 48 hours after exposure. An immediate professional medical diagnosis is critical.

Early symptoms of overexposure are dizziness, headache, nausea, slurred speech and vomiting, weakness and collapse. These symptoms may be accompanied by cardiac irregularities and are the usual cause of death. Individuals exposed to a single, small overexposure usually recover and no delayed or long-term effects are likely to occur. However, repeated overexposures can result in significant neurological effects such as blurred vision, staggering gait and mental imbalance.

In all cases of overexposure, the person must be taken to an emergency medical treatment facility immediately for observation, testing, and treatment. Since the appearance of symptoms is delayed in some patients, it is advisable to keep the patient under observation for at least 24 to 48 hours. Do not allow the person to drive or operate mechanical equipment.

Frequent or continuous exposure to low levels of methyl bromide and other bromide sources may lead to bromism, or chronic bromide intoxication. Symptoms of bromism are similar to the acute symptoms described above but develop more slowly. Blood bromide levels suggest the occurrence, but not the degree, of exposure. Treatment is symptomatic.

### 7.2.2 Chloropicrin

Airborne exposure to concentrations of chloropicrin as low as 0.1 to 0.3 ppm may cause eye irritation that reverses upon cessation of exposure. The eye response is variable among individuals but seems to be the most sensitive indicator of exposure. Irritation of the eye produces lacrimation (tearing) and discomfort. The response of the eye to contact with chloropicrin vapor may not correlate with the concentration of chloropicrin in the air. However, once eye irritation occurs, an avoidance reaction (i.e., action to terminate exposure) will follow. Because of this reaction, chloropicrin is used as a safety warning-agent in certain methyl bromide products.

Signs of exposure to higher levels of chloropicrin vapor include respiratory irritation (nose and throat), as well as eye irritation and may include nausea and vomiting. These symptoms are also reversible following termination of chloropicrin exposure. Since low-level chloropicrin exposure causes immediate and unpleasant physical reactions, dangerous overexposure is minimized by a desire to terminate exposure by moving away from the source of chloropicrin.
Inhalation exposure to chloropicrin at 4 ppm for a few seconds may cause some degree of incapacitation. In trying to escape the effects of higher levels of chloropicrin, overexposed individuals may rub their eyes and have difficulty keeping their eyelids open. Very brief exposure (a few seconds) to much higher concentrations, 15 ppm, can cause respiratory tract injury. Exposure to concentrations above 15 ppm can result in lacrimation, vomiting, and if allowed to continue for a minute or more, can cause lung damage that is life threatening.

Undiluted chloropicrin is highly toxic following ingestion or direct contact with the skin or eyes. Skin or eye contact with chloropicrin liquid can cause chemical burns with permanent scaring. Eye irritation and respiratory irritation can occur from exposure to chloropicrin vapor that has evaporated from contaminated skin or clothing.

Consult Section 3: First Aid for practical treatment and first aid information.

Symptoms of overexposure to chloropicrin vapors are immediate and include intense tearing of the eyes, respiratory distress, and vomiting. Other symptoms may include nausea, headache, nose and throat irritation, coughing and expectoration. Pulmonary edema may develop later. Since chloropicrin exposure causes immediate and unpleasant physical reactions, and overexposure is minimized by avoidance movement away from the chemical, the actual potential for chloropicrin to cause human death by inhalation is very small.

For further medical information contact: Great Lakes Chemical Corporation, El Dorado Arkansas, day or night, at 1-800-949-5167 or Albemarle Corporation (504) 344-7147.

### 7.3 Animal Toxicity and Environmental Fate

This section presents a brief overview of available information regarding the effects of methyl bromide and chloropicrin on animal toxicity and environmental fate. For more in-depth information on these topics, contact the Methyl Bromide Industry Panel or the manufacturer, or refer to the reference materials listed in section 7.3.5.

#### 7.3.1 Animal Toxicity

##### 7.3.1.1 Methyl Bromide

Prolonged excessive exposure may cause lung damage and neurotoxic effects. Symptoms of overexposure include dizziness, blurred vision, lassitude, sensation of fatigue, staggering gait, slurring speech, nausea, vomiting, lack of appetite, and loss of muscle coordination.

The EPA has classified methyl bromide as highly toxic requiring the signal word “DANGER.”
Methyl bromide can be rapidly absorbed by all routes. The most common route of exposure is by inhalation, although methyl bromide also can cause severe chemical burns if it comes in contact with the skin or is trapped in gloves or boots.

**Ingestion.** Because methyl bromide is a gas at typical ambient temperatures, oral toxicity is of more minor concern. Nevertheless, under conditions of evaluation, oral doses of 60 to 65 mg/kg of body weight were reported to be the minimal amount lethal to rabbits; a dose of 100 mg/kg was reported to be lethal to rats 5 to 7 hours after exposure, and 214 mg/kg was reported to be an oral LD$_{50}$ in rats.

**Eye Contact.** Severe corneal burns may result from exposure to liquid methyl bromide to the eye. While vapor exposures to the eye will cause irritation, burns are less likely.

**Skin Irritation.** Human experience indicates that methyl bromide is irritating to the skin. Serious burns and blistering can result from entrapment of methyl bromide in or under shoes, gloves, or clothing. This includes watchbands, rings, boots or bandages.

**Skin Absorption.** There are a limited number of animal studies on methyl bromide using dermal exposures. These studies have indicated no detectable increase in blood bromide after dermal exposure to vapor.

**Inhalation.** Toxic response appears to differ significantly between test animal strains and species. The 8-hour LC$_{50}$ for rats is reported to be 302 ppm. Deaths were accompanied by lung hemorrhages and convulsions. The LC$_{50}$ (rat) for a 15-minute exposure is 3120 ppm. An LC$_{50}$ of 1200 ppm was determined for a 1-hour exposure in mice. Inhalation studies with methyl bromide have typically shown a very steep dose response curve. For example, in a 4-hour acute study in rats, the 0 percent and 100 percent lethal concentrations were 650 and 900 ppm, respectively.

**Systemic and Other Effects.** Unless the concentration is high enough to cause lung irritation, the response observed in animals from repeated exposures to methyl bromide is essentially one of paralysis of the extremities. Rats, rabbits, guinea pigs, and monkeys respond similarly with some quantitative differences. In a two-generation inhalation reproduction study with rats dosed at 3, 30, and 90 ppm, the no observable effect level (NOEL) was 3 ppm. At the higher doses, organ weight variation was observed in some offspring. In a 29-month inhalation cancer study, male and female rats were exposed to 0 - 90 ppm of methyl bromide 6 hours/day, 5 days/week. Increased incidences of degenerative and hyperplastic changes in the nasal olfactory epithelium were observed in a dose related manner in all groups. There was no indication of a relationship between exposure and tumor incidence. Methyl bromide is in U.S. EPA’s Carcinogenic Classification Group D, “Not classifiable as to human carcinogenicity.”
7.3.1.2 Chloropicrin

Undiluted chloropicrin is severely and immediately irritating to the upper respiratory tract, eyes and skin following direct contact. Exposure to airborne concentrations of chloropicrin equivalent to 0.15 ppm can cause tearing and eye irritation, which is reversible upon termination of chloropicrin exposure. Prolonged inhalation exposures at airborne concentrations above 1 ppm may cause symptoms of respiratory system damage including irritation of the airways, shortness of breath and/or tightness in the chest and difficulty in breathing. Inhalation exposure, even brief, to very high levels can lead to pulmonary edema, unconsciousness and death.

The acute rat oral LD$_{50}$ of chloropicrin is reported to be 250 mg/kg of body weight.

The acute rat LC$_{50}$ (4-hour) of chloropicrin is reported to be 19.9 ppm and the respiratory irritation potential threshold (RD$_{50}$) is 9.98 ppm.

The target tissue for chloropicrin toxicity, including chronic toxicity, depends on the route of chloropicrin exposure. For inhalation exposure, the respiratory tract is the target of chloropicrin toxicity. Inflammation and nonspecific irritation occurred in rats and mice along the respiratory tract following lifetime inhalation of chloropicrin vapor at concentrations above 0.1 ppm. Lifetime feeding studies with chloropicrin produced stomach irritation and liver damage in rats but long-term feeding studies in dogs did not show signs of internal organ damage. In no case was evidence of cancer produced as a result of chloropicrin administration.

Reproductive and developmental toxicity (birth defects) studies have been completed in rats and rabbits exposed to chloropicrin vapor. The studies indicate that reproductive performance is not adversely affected by chloropicrin inhalation even at levels that produced systemic toxicity in the adult animals. The studies also demonstrated that the developing fetus is not a target for chloropicrin toxicity.

Systemic and Other Effects. An oral carcinogenicity bioassay on chloropicrin by the National Cancer Institute was inconclusive. Chronic health hazards are unknown, although it has been reported that individuals injured by inhalation exposure to chloropicrin may become more susceptible, so that concentrations of the gas, not producing symptoms in others, caused them distress.
7.3.2 Fish and Other Wildlife Toxicity

7.3.2.1 Methyl Bromide

Because of the volatility of methyl bromide, there is little likelihood of exposure to fish and wildlife. However, specially designed studies have demonstrated that the acute 96-hour LC$_{50}$ for rainbow trout is 3.9 mg/L and the acute single dose oral LD$_{50}$ value for northern bobwhite quail is approximately 73 mg/kg.

7.3.2.2 Chloropicrin

Chloropicrin is toxic to fish. 96-hour LC$_{50}$ values include 0.0165 mg/L in tests with trout, and 0.105 mg/L in tests with bluegill. It also has been determined that the average acute 48-hour LC$_{50}$ for *Daphnia Pulex* is 0.080 mg/L.

7.3.3 Human Experience

7.3.3.1 Methyl Bromide

Although methyl bromide is a highly toxic and odorless gas capable of causing injury or death, experience has shown that it can be used safely when handled in accordance with labeling instructions. Prevention of exposure and prompt evacuation in case of exposure is most effective in preventing injury.

Reports of a toxic absorption of methyl bromide gas through the skin have been published but it is possible that some leakage around or through respiratory protective devices occurred. Repeated splashes on the skin have resulted in severe skin lesions. In less severe exposures, itching dermatitis may occur. Methyl bromide may cause burns when it is held in contact with skin by clothes, gloves, or shoes. Spills onto or into a shoe may cause a severe burn if allowed to remain in contact with the skin. Liquid methyl bromide can cause severe corneal burns and vapors may cause irritation to eyes. Under OSHA and EPA requirements, an air-supplied respirator is required for vapor concentrations above 5 ppm. Many reports of methyl bromide’s toxicity to humans after overexposure via inhalation indicate a failure to use recommended handling precautions. The symptoms observed in humans due to acute exposure have been reported by a number of authors. Early symptoms of overexposure are dizziness, headache, nausea, vomiting, weakness and collapse. Tremors and even convulsions may be observed, as well as lung edema and associated cyanosis.

7.3.3.2 Chloropicrin

Data on exposures of humans to various concentrations of chloropicrin, largely obtained during World War I, are summarized in the table below.
Chloropicrin is both a lacrimator and a lung irritant. It has been reported that exposure to 4 ppm for a few seconds renders a man unfit for combat, and 15 ppm for approximately the same period of time results in respiratory tract injury. Deaths may occur from secondary infections, bronchopneumonia, or bronchiolitis obliterans.

7.3.4 Environmental Fate

7.3.4.1 Methyl Bromide

Because of its volatility, methyl bromide does not accumulate in soil or water. Methyl bromide has not been detected in hundreds of water samples taken in regions of high pesticide usage. Studies have shown that approximately 50% of the methyl bromide applied as a soil fumigant escapes to the atmosphere. The remainder is degraded by hydrolysis or biological action in the soil. At a pH of 7.0 and a temperature of 18°C, the half-life of methyl bromide in water is 12 days.

7.3.4.2 Chloropicrin

In sandy loam soil under aerobic conditions, chloropicrin degrades primarily to carbon dioxide with a half-life of 4.5 days. Under anaerobic aquatic conditions, nitromethane is the principal degrade with a chloropicrin half-life of 1.3 hours. Photohydrolysis at pH 7 and 25°C gave a half-life of 31.1 hours with primary degradation products of Cl, NO$_3^-$, NO$_2^-$, and CO$_2$.

Plants grown in soil fumigated with 14C labeled chloropicrin showed the incorporation of radiocarbon into virtually every plant part, which is consistent with CO$_2$ absorption. No chloropicrin or nitromethane was detected in the plant tissues.

7.4 References


Section 8: Physical Properties and Characteristics
8.1 Physical and Chemical Data

The following table summarizes the physical and chemical characteristics of methyl bromide and chloropicrin.

<table>
<thead>
<tr>
<th>Property</th>
<th>Methyl Bromide</th>
<th>Chloropicrin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State at 25°C</td>
<td>Gas</td>
<td>Liquid</td>
</tr>
<tr>
<td>Odor</td>
<td>None</td>
<td>Pungent odor, irritating lacrimator</td>
</tr>
<tr>
<td>Flammability</td>
<td>Not flammable</td>
<td>Not flammable</td>
</tr>
<tr>
<td>Flammable Limits</td>
<td>10-15% by volume</td>
<td>Not flammable</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>537°C (998°F)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Freezing Point</td>
<td>-93.4°C (-136.12°F)</td>
<td>-64°C (-83.2°F)</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>3.7°C (38.66°F)</td>
<td>112°C (233.6°F)</td>
</tr>
<tr>
<td>Vapor Pressure at 0°C (32°F)</td>
<td>670 mm</td>
<td>5 mm</td>
</tr>
<tr>
<td>at 10°C (50°F)</td>
<td>975 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>at 20°C (68°F)</td>
<td>1340 mm</td>
<td>18 mm</td>
</tr>
<tr>
<td>at 40°C (104°F)</td>
<td>2720 mm</td>
<td>52 mm</td>
</tr>
<tr>
<td>Heat Capacity (cal/gram °C)</td>
<td>0.1976</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure at 0°C (32°F)</td>
<td>0.1976</td>
<td></td>
</tr>
<tr>
<td>at 10°C (50°F)</td>
<td>0.1983</td>
<td></td>
</tr>
<tr>
<td>at 20°C (68°F)</td>
<td>0.1994</td>
<td></td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>1.75 g/100 g water at 20°C (68°F)</td>
<td>0.2 g/100 g water</td>
</tr>
<tr>
<td>Other Solvents</td>
<td>High solubility in most organic solvents</td>
<td>High solubility in most organic solvents</td>
</tr>
<tr>
<td>Weight (1 U.S. Gal)</td>
<td>14.44 pounds at 68°F (20°C)</td>
<td>13.76 pounds at 68°F (20°C)</td>
</tr>
<tr>
<td>Specific Gravity of Liquid</td>
<td>1.732 at 0°C (32°F)</td>
<td>1.651 at 22.8°C</td>
</tr>
<tr>
<td>Specific Gravity of Gas</td>
<td>3.27 at 0°C (32°F)</td>
<td></td>
</tr>
<tr>
<td>Density of gas at 20°C</td>
<td>4.042 grams/liter</td>
<td></td>
</tr>
<tr>
<td>Viscosity of liquid at 20°C</td>
<td>0.320 centistokes</td>
<td></td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>94.94</td>
<td>164.37</td>
</tr>
<tr>
<td>Latent heat of vaporization</td>
<td>58.00 kcal/kg at 20°C (68°F)</td>
<td></td>
</tr>
<tr>
<td>Material Compatibility</td>
<td>Incompatible with aluminum, magnesium, zinc, alkali metals, strong alkalis</td>
<td>Incompatible with organic amines, reducing agents, and sulfuric acid. Incompatible with containers or equipment made of aluminum, magnesium or their alloys</td>
</tr>
</tbody>
</table>
Section 9: Review Questions and Answers
REVIEW QUESTIONS

Please complete the following review questions to familiarize yourself with the information provided in this emergency response guide:

1. What is the boiling point of chloropicrin? ___________ F.
2. What is the boiling point of methyl bromide? ___________ F.
3. What is the autoignition temperature of methyl bromide? ___________
4. What are the flammable limits of methyl bromide? Upper limit: ________
   Lower limit: ________
5. Methyl bromide is considered to be non-flammable under DOT criteria. True _____
   False _____
6. Chloropicrin is considered to be non-flammable under DOT criteria. True _____
   False _____
7. Containers of methyl bromide may rupture if exposed to fire or excessive heat. True _____
   False _____
8. What is the vapor density for chloropicrin? _________________________________
9. What is the vapor density of methyl bromide? _______________________________
10. What is the OSHA(TWA) and the U.S. EPA reentry limit for exposure to chloropicrin? _____________________________________________
11. What is the OSHA exposure limit and the U.S. EPA reentry limit to methyl bromide? _____________________________________________
12. What is the UN number for chloropicrin? _________________________________
13. What is the UN number for methyl bromide mixtures containing up to 2.0% of chloropicrin? _________________________________
14. What is the UN number for methyl bromide containing greater than 2.0% of chloropicrin?
   ____________________________

15. What is the UN number for pressurized methyl bromide cylinders.
    ____________________________

16. What is considered a lethal dose of methyl bromide in rats? _______________________

17. What is considered a lethal dose of chloropicrin in rats. _________________________

18. What is the liquid weight for a U.S. gallon of methyl bromide at 68° F.? ____________

19. What is the liquid weight for a U.S. gallon of chloropicrin at 68° F.? _______________

20. Chloropicrin is immediately dangerous to life and health at a concentration of ______ P.P.M.

21. Methyl bromide is immediately dangerous to life and health at a concentration of _____ P.P.M.

22. What is the main route of exposure for chloropicrin? ____________________________

23. What is the main route of exposure for methyl bromide? _________________________

24. What is the CERCLA Reportable Quantity limit for releases of methyl bromide? 1000 lbs. (Federal Notification Requirements Chart behind Section 2).

25. Medical antidote for methyl bromide is ________________________________________

26. If the skin is exposed to liquid methyl bromide or chloropicrin, for how long must you flush with water? _____________________________________________

27. Give 5 symptoms of acute inhalation overexposure to methyl bromide.
   1. _________________________________________________________________
   2. _________________________________________________________________
   3. _________________________________________________________________
   4. _________________________________________________________________
   5. _________________________________________________________________

28. Give 2 symptoms of chronic overexposure to methyl bromide.
   1. _________________________________________________________________
   2. _________________________________________________________________

29. Methyl bromide may be absorbed through the skin. True _______
    False _______

Revision 2 - March 2000
30. Symptoms of overexposure to methyl bromide and chloropicrin are always immediately detected. True _______  False _______

31. Exposure of high vapor concentrations of methyl bromide may damage the ___________ and central nervous system.

32. In case of a liquid spill, in which direction would you evacuate? ___________________

33. Explain a safety procedure for a liquid spill that splashes into the eyes.
   1. _________________________________________________________________
   2. _________________________________________________________________
   3. _________________________________________________________________
   4. _________________________________________________________________
   5. _________________________________________________________________
   6. _________________________________________________________________

34. Explain a safety procedure for a liquid spill on the upper torso of the body.
   1. _________________________________________________________________
   2. _________________________________________________________________
   3. _________________________________________________________________
   4. _________________________________________________________________
   5. _________________________________________________________________
   6. _________________________________________________________________

35. What does S.C.B.A. mean? _____________________________________________

36. When is respiratory protection (a SCBA) required to be used? _____________________
________________________________________________________________________

37. Why are gloves, goggles, rubber boots, jewelry (rings and watches) and contact lenses not to be worn around methyl bromide facilities and areas of release or application? _______
________________________________________________________________________

38. Name 2 metals that are not compatible with methyl bromide.
   1. ____________________________________________________________________
   2. ____________________________________________________________________

39. Name 2 materials that are unsuitable for use with methyl bromide and chloropicrin.
   1. ____________________________________________________________________
   2. ____________________________________________________________________

40. What substance is used to disperse methyl bromide liquid? ________________________

41. _________ in removing methyl bromide and chloropicrin from the skin is of extreme importance.
42. Explain a safety procedure for vapor exposure to methyl bromide.
1. _________________________________________________________________
2. _________________________________________________________________
3. _________________________________________________________________
4. _________________________________________________________________
5. _________________________________________________________________
6. _________________________________________________________________

43. Repeated skin exposure to methyl bromide liquid may cause contact ________________.
1. 233° F. (Section 8.1)
2. 38.5° F. (Section 8.1)
3. 998° F. (Sections 2.7 and 8.1)
4. 8.6 % upper (Section 8.1)
   20% lower (Section 8.1)
5. True (Section 8.1)
6. True (Sections 2.7.1 and 8.1)
7. True (Section 8.1)
8. 5.7/A (Section 8.1)
9. 3.27/A (Section 8.1)
10. 0.1 ppm/8 hrs. (Section 5.1.2)
11. OSHA = 22 ppm; U.S. EPA = 5 ppm (Section 5.1.1)
12. UN 1580 (Section 2.2.1.2)
13. UN 1062 (Section 2.2.1.2)
14. UN 1581 (Section 2.2.1.2)
15. UN 1955 (Section 2.2.1.2)
16. 302 ppm/8 hrs. (Section 7.3.1.1)
17. 19.9 ppm/4 hrs. (Section 7.3.1.2)
18. 14.4 (Section 8.1)
19. 13.7 (Section 8.1)
20. 2.0 ppm (Section 5.1.2)
21. 250 ppm (Section 5.1.1)

22. Lungs/respiratory system (Section 7.3.1.2)

23. Lungs/respiratory system (Sections 3.1.1 and 7.3.1.1)

24. 1000 lbs. (Federal Notification Requirements Chart behind Section 2) (Section 2.4.1)

25. None (Section 3.1.4)

26. Not less than 15 minutes (Section 3.1.2)

27. 1. Headache  
2. Dizziness  
3. Blurred Vision  
4. Slurred Speech  
5. Nausea and Vomiting  
   (Sections 3.1.2, 7.2.1, 7.3.3.1)

28. 1. Mental confusion  
2. Inability to focus eyes  
   (Section 7.2.1)

29. True (Section 7.3.3.1)

30. False (Section 7.2.1)

31. liver, kidneys (Section 7.2.1)

32. Upwind or laterally. Away from the spill. (Sections 3.1.2 and 3.1.3)

33. 1. Don’t panic.  
2. Let others know you have a problem.  
3. Move upwind or laterally away from the spill.  
4. Remove contaminated clothing.  
5. Get to water, flush eyes for not less than 15 minutes.  
6. Get medical attention  
   (Section 3.1.3)

34. 1. Don’t panic.  
2. Let others know you have a problem.  
3. Move upwind or laterally away from the spill.  
4. Remove contaminated clothing.  
5. Get to water, flush eyes for not less than 15 minutes.  
6. Get medical attention  
   (Section 3.1.2)
35. Self Contained Breathing Apparatus (Section 4.1.4)

36. When the concentration of methyl bromide exceeds 5 ppm, or if the concentration of chloropicrin exceeds 0.1 ppm, or if the concentration is unknown. (Section 4.1.4)

37. They can trap vapors and absorb liquid. (Sections 4.1.2 and 4.1.3)

38. 1. Aluminum
2. Magnesium
   (Section 8.1)

39. 1. PVC
2. Natural Rubber
   (Section 6.1.1.3)

40. Water (Section 2.3)

41. Speed (Section 3.1.2)

42. 1. Don’t panic.
2. Let others know you have a problem.
3. Move upwind or laterally away from the spill or vapor.
4. Get to water, flush affected area, if necessary.
5. Ventilate clothing.
6. Get medical attention if necessary
   (Sections 3.1.1 and 3.1.2)

43. Dermatitis (Section 7.3.3.1)
Appendix:

Instructions for Chlorine Institute Kit “C”
CHLORINE INSTITUTE
EMERGENCY KIT “C”
FOR CHLORINE TANK
CARS & TANK TRUCKS

Edition 8
December 1996

INSTRUCTION BOOKLET
The Chlorine Institute, Inc., 1300 Wilson Boulevard, Arlington, VA 22209
Leaks in chlorine tank cars, cargo tanks and portable tanks rarely occur. When they do occur, however, prompt corrective action is required by trained competent personnel with special equipment. The Chlorine Institute Emergency Kit “C” and this instruction booklet are made available by The Chlorine Institute, Inc. in the belief that they will be helpful in handling such emergencies.

The information in this booklet is drawn from sources believed to be reliable. The Chlorine Institute, Inc. and its members, jointly and severally make no guarantee and assume no liability either as to these instructions or the equipment to which they apply. The user should be aware that changing technology may require a change in the equipment or in the instructions concerning their use. Appropriate steps should be taken to insure that the material is current when used.
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1. GENERAL DESCRIPTION

The Chlorine Institute Emergency Kit “C” is designed for use with the standard DOT 105J500W chlorine tank car, DOT MC331 chlorine tank and DOT 51 portable tank in chlorine service only. These tanks vary in capacity from 16 to 90 tons of chlorine. The kit is not designed to be used on liquid full tank cars or cargo tanks. (See page 13 section 8 under “Kit Limitations”)

1.1 Training and Safety

Emergency Response and other personnel must be trained in the use of the devices and tools within The Chlorine Institute Emergency Kit “C”. Training must include the use of respiratory equipment and all other safety equipment. Knowledge of the properties of chlorine is a must.

Personnel safety is of primary importance. Emergency response should only be performed by authorized personnel who are trained in the procedures and are equipped with suitable respiratory and personal protective equipment. (See current Chlorine Institute Pamphlet #65, “Personal Protective Equipment for Chlorine and Sodium Hydroxide”)

1.2 Respiratory Equipment

The type of respiratory equipment required will be determined by the severity of the leak and the potential for exposure to chlorine. (See current Chlorine Institute Pamphlet #75, “Respiratory Protection Guidelines for Chlor-Alkali Manufacturing Facilities”)

1.3 Chlorine Tank Inspection

Daily inspection of loaded tank cars or cargo tanks is recommended whether or not they are connected to unloading lines. Through these means a leak usually can be detected in an early stage when it can be corrected or controlled by appropriate procedures.

1.4 Leak Detection

As soon as there is an indication of the presence of chlorine in the air, authorized, trained personnel equipped with suitable personal protective equipment should investigate promptly. All other persons should be kept away from the affected area.

The location of a leak in a chlorine containing system can usually be detected by the reaction of ammonia vapor with the escaping chlorine. The reaction is a dense white cloud. The most convenient way is to use aqua ammonia in a squeeze bottle. Direct the vapors at the suspected leak. Efforts to detect the source of any leak should be carried out with an awareness of the potential hazards and use of necessary personal protective equipment.
1.5 Assistance

Chlorine emergencies should be handled only by trained personnel at the use site. If assistance is required, promptly notify your supplier. If the supplier cannot be reached or respond immediately, then summon help by activating CHLOREP, The Chlorine Emergency Plan. Use the appropriate telephone number for the U.S. or Canada. CHLOREP can also be activated by calling CHEMTREC in the U.S. 1-800-424-9300 or Canutec in Canada 1-613-996-6666.

1.6 Reporting Requirements

Users should be aware of and comply with federal, state and local requirements for the reporting of chlorine releases.

1.7 Emergency Plan

It is recommended that users have an Emergency Plan that complies with federal, state and local requirements.

1.8 Reproduction

The contents of this instruction booklet are not to be copied for publication, in whole or in part, without prior Chlorine Institute permission.

1.9 Approval

The Chlorine Institute’s CHLOREP Committee approved Edition 8 of this instruction booklet on November 12, 1996.

1.10 Revisions

Suggestions for revisions of the Chlorine Institute Emergency Kit “C” or this instruction booklet should be directed to the Secretary of The Chlorine Institute.

1.11 Drawings

The valve drawings used in this booklet represent standard Chlorine Institute valves. The Emergency Kit “C” can be used following similar procedures on other valves approved for chlorine tank car service.
2. IDENTIFYING AND STOPPING LEAKS

Typical Chlorine Leaks Occur Through:

1. Angle Valve Packing
2. Angle Valve Seat
3. Angle Valve Gasket
4. Pressure Relief Device
5. Pressure Relief Device Gasket
6. Manway Cover Gasket

WEAR PERSONAL PROTECTION
2. IDENTIFYING AND STOPPING LEAKS  (Con’t)

2.1 LEAK: Angle Valve Packing Gland

ACTION: A) Close valve by hand or use HANDWHEEL SPANNER DEVICE 216 with
WRENCH SOCKET 114, WRENCH BAR ADAPTER 113B and WRENCH
BAR 113C if additional force is required.  (see Fig. 2.1)

B) Tighten packing gland nuts using WRENCH 110.  Test for leaks.

C) If leak continues, apply DEVICE 6 (Hood and Yoke Assembly Fig. 4.1) (see
page 9 for instructions)

2.2 LEAK: Angle Valve Seat

ACTION: A) Insert valve outlet plug using WRENCH 218.  (see Fig 2.1) Open and close
valve by hand or use HANDWHEEL SPANNER DEVICE 216 with WRENCH
SOCKET 113, WRENCH BAR ADAPTER 113B and WRENCH BAR 113C if
additional force is required.  Test for leaks.

B) If leak continues, apply DEVICE 6 (Hood and Yoke Assembly Fig. 4.1) (see
page 9 for instructions)
2. IDENTIFYING AND STOPPING LEAKS (Con’t)

2.3 LEAK: Angle Valve Gasket

ACTION: A) Tighten stud nuts in an alternating pattern (Fig 2.3.1) using WRENCH 112 and WRENCH BAR 113C. (see Fig. 2.3) Test for leaks.

B) If leak continues apply DEVICE 6 (Hood and Yoke Assembly Fig. 4.1) (see page 9 for instructions)
2. IDENTIFYING AND STOPPING LEAKS (Con’t)

2.4 LEAK: Pressure Relief Device

ACTION: A) Apply DEVICE 24 (Hood and Yoke Assemble Fig. 5.1)(see page 11 for instructions)

2.5 LEAK: Pressure Relief Device Gasket

ACTION: A) Tighten stud nuts in an alternating pattern (Fig 2.4.1) using WRENCH 112 and WRENCH BAR 113C. (see Fig 2.4) Test for leaks.

B) If leak continues apply DEVICE 24 (hood and Yoke Assembly Fig. 5.1) (see page 11 for instructions)
2. IDENTIFYING AND STOPPING LEAKS (Con’t)

2.6 LEAK: Manway Cover Gasket

ACTION: 
A) Immediately report leak to the chlorine supplier. IT IS NOT ADVISABLE FOR PERSONS TO HANDLE THIS CONDITION WITHOUT SPECIAL TRAINING.

B) Tighten manway cover stud nuts using WRENCH SOCKET 113, WRENCH EXTENSION 113A, WRENCH BAR ADAPTER 113B AND WRENCH BAR 113C.

C) Test for leaks.
3. **Supplementary Illustrations**

![Fig. 3.1] Standard Chlorine Angle Valve

![Fig. 3.2] Standard Chlorine Pressure Relief Device
## 4. Hood For Angle Valves – DEVICE 6

### STEPS - See Fig 4.1

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Remove outlet cap from VENT VALVE 6V on HOOD 6A1 and open valve.</td>
<td>WRENCH 200C HOOD 6A1</td>
</tr>
<tr>
<td>2.</td>
<td>Disconnect piping if leaking angle valve is connected, or unscrew valve outlet</td>
<td>WRENCH 218</td>
</tr>
<tr>
<td></td>
<td>plug. <strong>NOTE:</strong> A new shorter valve outlet plug design will be available soon.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>It is designed so that Device 6 can be applied without the need to remove</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the plug.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Place outlet plug against packing gland. If plug chain or cable is in the</td>
<td>BOLT CUTTER C-3</td>
</tr>
<tr>
<td></td>
<td>way, cut it off with BOLT CUTTER C-3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Clean Manway Cover. Use PAINT SCRAPER C-2 if paint is loose or uneven.</td>
<td>PAINT SCRAPER C-2</td>
</tr>
<tr>
<td>5.</td>
<td>Place GASKET 6BMV on HOOD 6A1. <strong>NOTE:</strong> When ambient temperatures are</td>
<td>GASKET 6BMV HOOD 6A1</td>
</tr>
<tr>
<td></td>
<td>low, it is desirable to perform this operation in advance, preferably in a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>heated area.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Place HOOD 6A1 with GASKET 6BMV over the leaking valve.</td>
<td>GASKET 6BMV HOOD 6A1</td>
</tr>
<tr>
<td>7.</td>
<td>Place YOKE ASSEMBLY 11A hooks into port openings of protective housing.</td>
<td>YOKE ASSEMBLY 11A</td>
</tr>
<tr>
<td>8.</td>
<td>Center SCREW 11C over HOOD 6A1, tighten SCREW 11C forcing HOOD BA1 and</td>
<td>YOKE ASSEMBLY 11A HOOD 6A1 GASKET</td>
</tr>
<tr>
<td></td>
<td>GASKET 6BMV against manway cover. Tighten 4 SCREWS 11E in BLOCK 11B</td>
<td>6BMV WRENCH 200C</td>
</tr>
<tr>
<td></td>
<td>alternately using WRENCH 200C forcing HOOD 6A1 and GASKET 6BMV against</td>
<td></td>
</tr>
<tr>
<td></td>
<td>manway. <strong>NOTE:</strong> For additional force use WRENCH 200C on hex of SCREW 11C.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>CAUTION:</strong> Tighten enough to stop leak; overtightening may cut gasket.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>outlet cap.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Test for leaks immediately after installation and at regular intervals if</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the capping is to be kept in place for an extended period.</td>
<td></td>
</tr>
</tbody>
</table>

### DEVICE 6 INCLUDES:

- HOOD ASSEMBLY – 6A1 (with VENT VALVE 6V)
- YOKE ASSEMBLY – 11A
- GASKET – 6 BMV
- WRENCH – 200C

**WEAR PERSONAL PROTECTION**
DEVICE 6
Assembled Over Angle Valve

Fig. 4.1
5. **Hood For Pressure Relief Device – DEVICE 24**

<table>
<thead>
<tr>
<th>STEPS - See Fig 5.1</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Remove outlet cap from VENT VALVE 24 on HOOD 24A1 and open VENT VALVE 24V.</td>
<td>WRENCH 200C</td>
</tr>
<tr>
<td>2. Clean manway cover. Use PAINT SCRAPER C-2 if paint is loose or uneven.</td>
<td>HOOD 24A1</td>
</tr>
<tr>
<td>3. Place GASKET 24BMV on HOOD 24A1.</td>
<td>PAINT SCRAPER C-2</td>
</tr>
<tr>
<td><strong>NOTE:</strong> When ambient temperatures are low, it is desirable to perform this operation in advance, preferably in a heated area.</td>
<td>GASKET 24BMV</td>
</tr>
<tr>
<td>4. Place HOOD 24A1 with GASKET 24BMV over pressure relief device.</td>
<td>HOOD 24A1</td>
</tr>
<tr>
<td>5. Place YOKE ASSEMBLY 11A hooks into port openings of protective housing.</td>
<td>GASKET 24BMV</td>
</tr>
<tr>
<td>6. Center SCREW 11C over HOOD 24A1, tighten SCREW 11C forcing HOOD 24A1 and GASKET 24 BMV against manway cover.</td>
<td>YOKE ASSEMBLY 11A</td>
</tr>
<tr>
<td><strong>NOTE:</strong> For additional force use WRENCH 200C on hex of SCREW 11C.</td>
<td>HOOD 24A1</td>
</tr>
<tr>
<td><strong>CAUTION:</strong> Tighten enough to stop leak; overtightening may cut gasket.</td>
<td>GASKET 24BMV</td>
</tr>
<tr>
<td>7. Close VENT VALVE 24V on HOOD 24A1 using WRENCH 200C.</td>
<td>WRENCH 200C</td>
</tr>
<tr>
<td>Replace VENT VALVE 24V outlet cap.</td>
<td></td>
</tr>
<tr>
<td>8. Test for leaks immediately after installation and at regular intervals if the capping device is to be kept in place for an extended period.</td>
<td></td>
</tr>
</tbody>
</table>

**DEVICE 24 INCLUDES:**

HOOD ASSEMBLY – 24A1  (with VENT VALVE 24V)
YOKE ASSEMBLY – 11A
GASKET – 24BMV
WRENCH – 200C

**WEAR PERSONAL PROTECTION**

**CAUTION:** Prior to installing a Hood Device 24, a pressure reading should be taken to ensure the tank is not liquid full.
DEVICE 24
Assembled Over Pressure Relief Device

Fig. 5.1
6. HANDLING OF CHLORINE REMAINING IN TANK

The containment of leaks by the Chlorine Institute Emergency Kit “C” devices is only an interim measure; the container must be emptied as soon as possible. The preferred method is to use the remaining chlorine in the customer’s process. If this is not possible, it may be passed into and absorbed by a solution of caustic soda or soda ash.

This procedure should be attempted by experienced personnel only.

CONSULT WITH THE CHLORINE SUPPLIER IMMEDIATELY AND ARRANGE FOR ULTIMATE DISPOSAL

If supplier is unknown, see page 2 (section 1.5) “Assistance” for instructions.

7. KIT MAINTENANCE

NOTE All parts of the Chlorine Institute Emergency Kit “C” should be maintained in a ready to use condition.

7.1 After Use

Inspect all parts for damage, wear and corrosion. Clean and dry all parts used. Lubricate moveable parts with a lubricant that is non-reactive to chlorine. Replace all gaskets used.

7.2 Routine

The kit should be frequently inspected by the person responsible for the equipment and checked with the contents list to insure that equipment is complete and ready for use. The box should be sealed after each inspection and such seals should be broken only by authorized persons or in case of accidents. Many owners coordinate routine inspection with training drills.

All Viton® gaskets are stamped with the date of manufacture and should be removed from emergency use after a four-year shelf life. For further guidelines concerning the gaskets made from Viton®, consult the manufacturer or The Chlorine Institute.

7.3 Spare Parts

Spare parts may be purchased by owners of this kit or the Solvay Emergency Kit “C” from the manufacturer. For information on ordering procedures consult the manufacturer or The Chlorine Institute.

8. KIT LIMITATIONS

Kit specifications call for the pressure retaining parts of this kit to be hydrostatic tested to 300 psi by the manufacturer. Emergency Kit “C” does not contain any device to handle leaks in the tank itself.

Viton® is a registered trademark of DuPont Dow Elastomers
Chlorine Institute Emergency Kit “C”

Parts List

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Quantity Per Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A1</td>
<td>Hood Assembly (with 6V Vent Valve)</td>
<td>1</td>
</tr>
<tr>
<td>6BMV</td>
<td>Gasket, molded from Viton®</td>
<td>2</td>
</tr>
<tr>
<td>11A</td>
<td>Yoke Assembly</td>
<td>1</td>
</tr>
<tr>
<td>11B</td>
<td>Block with 4 – 11E Screws</td>
<td>1</td>
</tr>
<tr>
<td>11C</td>
<td>Screw with 11R Retainer</td>
<td>1</td>
</tr>
<tr>
<td>24A1</td>
<td>Hood Assembly (with 24V Vent Valve)</td>
<td>1</td>
</tr>
<tr>
<td>24BMV</td>
<td>Gasket, molded from Viton®</td>
<td>2</td>
</tr>
<tr>
<td>110</td>
<td>Wrench, combination, 12-pt box end, 11/16 &quot; opening</td>
<td>1</td>
</tr>
<tr>
<td>112</td>
<td>Wrench, crowfoot special, 1-9/32&quot; opening x 21&quot; long</td>
<td>1</td>
</tr>
<tr>
<td>113</td>
<td>Wrench, socket, 1-13/16&quot; 12-pt opening, 1&quot; sq. drive</td>
<td>1</td>
</tr>
<tr>
<td>113A</td>
<td>Wrench, extension, 1&quot; sq. drive x 18 &quot; long</td>
<td>1</td>
</tr>
<tr>
<td>113B</td>
<td>Wrench Bar Adapter, 1&quot; round to 1&quot; square</td>
<td>1</td>
</tr>
<tr>
<td>113C</td>
<td>Wrench Bar, 1&quot; dia. X 20 &quot; long</td>
<td>1</td>
</tr>
<tr>
<td>200C</td>
<td>Wrench, 3/8&quot; sq. box x 1-1/4&quot; open end x 7-1/4&quot; long</td>
<td>1</td>
</tr>
<tr>
<td>216</td>
<td>Handwheel Spanner Device</td>
<td>1</td>
</tr>
<tr>
<td>218</td>
<td>Wrench, 15&quot; adjustable</td>
<td>1</td>
</tr>
<tr>
<td>C-1</td>
<td>Hammer, Machinist, 24 oz</td>
<td>1</td>
</tr>
<tr>
<td>C-2</td>
<td>Paint Scraper, 1-1/4 blade</td>
<td>1</td>
</tr>
<tr>
<td>C-3</td>
<td>Bolt Cutter, 18&quot;</td>
<td>1</td>
</tr>
<tr>
<td>C-5</td>
<td>Rings, Vent Valve Packing, 7/8&quot; OD x 15/32&quot; ID x ¼&quot; thick</td>
<td>5</td>
</tr>
<tr>
<td>C-7</td>
<td>Railroad Car Seal</td>
<td>15</td>
</tr>
<tr>
<td>C-9</td>
<td>Gasket Sack</td>
<td>1</td>
</tr>
<tr>
<td>151-C</td>
<td>Kit Tool Box</td>
<td>1</td>
</tr>
<tr>
<td>152</td>
<td>Tool Roll</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Instruction Booklet</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chlorine Manual</td>
<td>1</td>
</tr>
</tbody>
</table>

Viton® is a registered trademark of DuPont DOW Elastomers, Inc.
EMERGENCY CONTACTS

Chlorine Supplier: ________________________________
Address: ______________________________________
Phone: ________________________________________

CHEMTREC * 800-424-9300
CANUTEC** 613-996-6666

Nearest Chlorine Producer or Packager: ________________
Address: ______________________________________
Phone: ________________________________________

Police Department: __________________________________
Fire Department: __________________________________
First Aid: _________________________________________
__________________________________________________
__________________________________________________

* In the UNITED STATES, summon help through CHEMTREC, the Chemical Transportation Emergency Center at the Chemical Manufacturers Association in Arlington, VA.
   48 contiguous states (toll free). . . . 800-424-9300
    If “800” number cannot be reached from your phone, call the “703” number.

   Alaska and Hawaii . . . . . . 703-527-3887
    (telephone advice only)

**In CANADA, summon help through CANUTEC, the Canadian Transport Emergency Centre in Ottawa:
   Canada, All provinces (call collect). . 613-996-6666