

## TIC Categories and Common Examples

**Physical hazards - Flammable/ignitable** fuel gases and liquids: stored as large quantities and may be explosive. Examples: **Propane, Toluene, and Methane.**

**Irritant gases:** cause irritation and swelling and primarily affect the eyes, nose, and respiratory tract. Examples: **Acrolein, Ammonia, Chlorine, Diborane, Fluorine, Formaldehyde, Sulfur Dioxide/Trioxide, and Phosgene.**

- ▶ Short exposures could result in coughing or asthma-like symptoms
- ▶ Severe exposure may cause fluid in the lungs (edema) which can result in death
- ▶ Possible long term effects include damage to lower respiratory tract tissue

**Corrosives:** similar to irritants but will cause immediate cellular damage and cellular death as opposed to just inflammation. Examples: **Nitric Acid, Sulfuric Acid, and Hydrofluoric Acid.**

### Asphyxiants: two types

(1) *simple asphyxiants* displace available oxygen in the air. Examples (includes flammable gases): **Carbon Dioxide, Methane, Propane.**

(2) *systemic asphyxiants* affect the ability of the body to properly transport and use oxygen. Examples: **Acetonitrile, Carbon Monoxide, Cyanides, Cyanogen, Hydrogen Sulfide.**

- ▶ Mild effects: dizziness, weakness, headache, nausea, and fatigue
- ▶ Severe effects: neurological effects, coma, and death

**Cholinergics:** cause an over-stimulation of nerve cells that result in a wide range of mild to life-threatening effects depending on exposure – this is same mechanism used by chemical warfare nerve agents like Sarin which was used in the Tokyo Subway terrorist incident. Examples include pesticides e.g.: **Parathion, Malathion.**

- ▶ Mild effects: runny nose, reduced pupil size, shortness of breath, feeling of tightness in chest
- ▶ Moderate effects: excessive salivation, sweating, nausea, vomiting, abdominal cramps, muscle twitching, involuntary defecation and urination, and confusion
- ▶ Severe effects: seizures, paralysis, coma, and respiratory arrest leading to death

### Other systemic poisons:

- ▶ **Arsine** is a toxic gas that destroys red blood cells and can result in kidney failure
- ▶ Some TICs could be used to contaminate the drinking water supply and cause immediate illness (**Arsenic, Mercury, Sodium Cyanide, and Thallium Sulfate**)



### For more information:

- ▶ USACHPPM Hazardous and Toxic Industrial Chemicals Tables, August 2007; <http://chppm-www.apgea.army.mil/chemicalagent/PDFFiles/TICResponseCharts.pdf>
- ▶ USACHPPM Technical Guide 273 Diagnosis and Treatment of Diseases of Tactical Importance to U.S. Central Command, Part 4 Toxic Industrial Chemicals <http://chppm-www.apgea.army.mil/news/TG273OCTOBER2005FINAL.pdf>
- ▶ USACHPPM Technical Guide 244 - The Medical CBRN Battlebook [https://www.us.army.mil/suite/kc/14521547\(AKO\)](https://www.us.army.mil/suite/kc/14521547(AKO))
- ▶ Prioritizing Industrial Chemical Hazards; JTEH, part A, 68:857-876, 2005, Hauschild V.D, Bratt G.M.
- ▶ USACHPPM Technical Guide 230 Chemical Exposure Guidelines for Deployed Military Personnel: <http://chppm-www.apgea.army.mil/documents/TG/TECHGUID/TG230.pdf>
- ▶ Emergency Response Guidebook (for evacuation distances) <http://phmsa.dot.gov/hazmat/library/erg>
- ▶ NIOSH Pocket Guide to Chemical Hazards (chemical-specific info including guidance on civilian PPE levels) <http://www.cdc.gov/niosh/npg/>

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## Deployment Health Guide: Toxic Industrial Chemicals (TIC) Release Response

USACHPPM

This deployment health guide provides information that can help reduce risk of injury or disease during CONUS/ OCONUS military missions involving a hazardous or Toxic Industrial Chemical (TIC) release. This guide addresses a variety of audiences but is primarily aimed at preventive medicine (PVNTMED) assets who have key responsibilities to help ensure the health and safety of a unit. Additional guidance for PVNTMED assets may be found in the resources listed on the back of this guide. In addition, USACHPPM subject matter experts (SMEs) including industrial hygienists, environmental scientists, engineers, risk assessors, and physicians are available to address specific questions.

### Overview

TICs are common commercially produced chemicals that pose a risk of severe and immediate (acute) adverse health effects from a single release event. The degree of risk is dependent on the severity of effects and the probability that the TIC may be obtained and released in large quantities. The primary event of concern is a TIC used as a weapon, though TIC release due to an industrial accident and/or a natural disaster could also result in a health concern.

## Coordination and Communication

Understand how your mission fits into the overall response effort, what information to report, and the reporting channels. Always ensure proper coordination in accordance with established procedures/doctrine. Key coordination elements may include Personnel, Intelligence Operations, and Surgeon Staff Officers. In the US, other federal, state, and local officials will likely have higher authority than military units, and Defense Support to Civil Authorities (DSCA) rules and policies will apply.

Before any TIC response effort, PVNTMED personnel should coordinate with CBRN staff to determine appropriate safety and health procedures and levels of personal protection. An 'on site' PVNTMED officer should be designated to monitor the situation and ensure risk information is communicated to personnel. After the event, the PVNTMED officer should ensure that the necessary documentation is prepared and submitted for DOD archiving (see **Documentation**).

## Exposure Scenarios

TICs of concern are primarily gases or volatile liquids; the primary hazard is toxic vapors. TIC exposures can result from accidental releases, leaks, explosions or attacks near stored chemicals, or intentional releases, including release with Improvised Explosive Devices (IEDs) (see **USACHPPM Fact Sheet: Chlorine IEDs and Preventive Medicine Actions** [http://usachppm.apgea.army.mil/documents/FACT/36-015-0407\\_Chlorine\\_IEDs.pdf](http://usachppm.apgea.army.mil/documents/FACT/36-015-0407_Chlorine_IEDs.pdf)).

Key areas to anticipate TICs of concern include: industrial production and manufacturing facilities; water and waste water treatment plants; waste storage facilities; laboratory settings; fuel storage areas; and major transportation nodes.

## Health Effects

Effects from exposure to TICs depend on the type of TIC (see **TIC categories**), the route(s) of exposure, exposure concentration, duration and frequency of the exposure and the health condition of the exposed individual. Several of these factors can be minimized/eliminated through proper protective measures. For information regarding chemical specific information see additional sources listed on back cover.

## Detection

Most military detection equipment was not designed to detect TICs. Many commercially available devices used by Hazardous Materials responders are designed specifically for TICs. Some military units have such commercial equipment. However, proper training on calibration, use, and limitations is essential when using any detection equipment.

## Protection

When tasked to respond to a TIC release, the unit PVNTMED should determine appropriate personal protective equipment (PPE) and/or other protective measures.

Military protective equipment [Mission Oriented Protective Posture (MOPP) Gear, JLIST] is not specifically designed for TICs. However, short-term use may be used to minimize risk if commercial PPE is not available.

The M40 mask offers limited protection from TIC vapors and should only be used as an emergency measure such as for evacuations, not deliberate or prolonged response activities.

TIC vapors do not present a significant skin hazard. However, longer-term exposure to vapors or contact with liquid or droplets could result in irritation and skin burns. In forward deployed settings MOPP gear may minimize some TIC hazards, but for anticipated long-term vapor or liquid TIC exposures, levels A-D of commercial PPE (generally required for CONUS settings) should be evaluated.

When required to enter the release area of unknown TIC concentrations, it is best to wear commercial Level A PPE. This includes a positive pressure self-contained breathing apparatus, a fully encapsulated chemical-resistant suit, and chemical-resistant inner and outer gloves. MOPP gear does not equal a fully encapsulated chemical resistant suit; however, it may provide some limited protection for brief exposures. Lower levels of commercial PPE (Levels B and lower) may be used once levels and exposure routes have been evaluated and determined not to require Level A.

## Medical Treatment

- ▶ As a general rule, after being removed from exposure, limit exertion of all exposed personnel and monitor for acute signs and symptoms for up to several hours.
- ▶ For acid gases, observe exposed individuals directly for the first hour and to a lesser extent for 6 hours total before being medically cleared because symptoms may be delayed.
- ▶ Most TIC exposures will be treated symptomatically – only a few have specific antidotes: e.g., cholinergics (like that used for nerve agents), cyanides, arsine/arsenic. See USACHPPM TG 273.

## Persistence and Decontamination (Decon)

As a general rule, any gross contamination of a liquid TIC or unknown substance should be removed from skin as soon as possible by removal of wet clothing and/or rinsing with available water. However, the majority of incidents involving TICs will not require substantial, if any, decon since most TICs of concern are very volatile and will dissipate/degrade

in seconds to minutes (<1 hr). Factors affecting the level/need for decon include: type of chemical (e.g., high vapor pressure/volatile chemical gases/liquids versus low volatility liquids or solids); form of release (e.g., vapor versus liquid); weather conditions (cold versus hot temperatures, wind and rain, etc.).

- ▶ Personnel, materiel, or human remains exposed to TIC vapors normally do not require any decon because chemical vapors will dissipate rapidly on their own, usually in seconds to minutes. However, if heavy/prolonged vapor exposures occur, some vapors may be trapped in clothing extending the presence of the hazard (e.g., hours). Remove external clothing to mitigate immediate post-event hazards.
- ▶ Immediate decon of liquid TIC is especially critical on living persons – this should occur prior to any medical treatment. Surface decon may be necessary if there is TIC liquid residue on items/ remains that must be handled within minutes to a few hours of contamination.
- ▶ If ambient temperatures are cold and/or a VERY large amount of liquid is released, avoid the short-term crosscontamination hazard by avoiding items/ areas during a weathering ("airing") period OF SEVERAL hours or perform active decon.
- ▶ Water or soap and water are generally effective means to decon liquid TIC residue, but not appropriate for all TICs. Prior to using water/other decon solution for decon of a TIC, ensure the TIC is not reactive with the solution.
- ▶ Weathering is often a safe means of decon for large areas or equipment that does not require immediate use (within hours).

## Documentation

DOD policy requires that significant exposures to hazardous substances to military personnel be documented and archived. Record the following information as a medical event or significant action (sigact) and submit through appropriate medical and command channels:

- ▶ Unit name and rosters of involved personnel
- ▶ Summary of medical treatment provided
- ▶ Protective equipment used/effectiveness
- ▶ Sampling results (exposure levels information)
- ▶ Health risk communication materials used

For data archival guidance and regulations visit: <http://chppm-www.apgea.army.mil/ESIP/DataArchival.aspx>