

Response Considerations: Toxic Substances

Related GHS pictograms and UN Regulation



Example of relevant case studies:

- Cavtat (1974, southern Italy) - Tetraethyl lead and tetramethyl lead;
- Burgenstein (1977, port of Bremerhaven) - Sodium cyanide, potassium cyanide;
- Sindbad (1979, North Sea) - Chlorine;
- Testbank (1980, Louisiana) - Hydrogen bromide;
- Rio Neuquen (1984, Port of Houston) - Aluminium phosphide;
- Santa Clara (1991, New Jersey) - Arsenic trioxide

Alert and notification in case of a potential leak:

Depending on the location of the accident, MRCC, site emergency services and public emergency services must be alerted. Ships (crew) and population downwind (vapour cloud) and downstream (spill) have also to be warned in order to prevent complications arising.

Applicability and main risks:

For more information and description of toxic substances, refer to chapter 3 on hazardous substances.

Applicability ¹	Risks for human/responders	Risks for environment
<ul style="list-style-type: none"> - leakage of toxic gas from drum or tank - leakage of toxic chemicals - mixing of reactive chemicals forming gas - evaporation from slicks - gas cloud formed after reaction of chemicals 	<ul style="list-style-type: none"> - Injuries due to direct contact with substance (skin/mucosa contact, ingestion, inhalation) - Carcinogenetic issues 	<ul style="list-style-type: none"> - Direct impact on animals and environment - Chronic impact - Possible indirect impact (e.g. extinguishing water, dissolver in water curtain)

Risk Assessment

- Assess the risks of atmospheric and marine toxicity by gathering data on the substances
- Consider toxic exposure limits (cf. Chapter 3 - Toxicity) to assess the risk for population
- Model the behaviour and movement of the toxic cloud
- Evaluate environmental compartment (atmosphere, water column...) likely to be impacted by the toxic substance or any by-products that may be formed in the scenarios

¹ Events that may lead to a toxic atmosphere

- Assess route of entry of the toxic substances (dermal contact, ingestion, inhalation...)
- Consider (and control) aggravating factors:
 - Weather conditions: wind, current, temperature, rain and fog, atmospheric stability, etc.
 - Reactions between chemicals, reactions due to the increase of temperatures, time of exposure...

Protective measures (human health, environment & amenities)

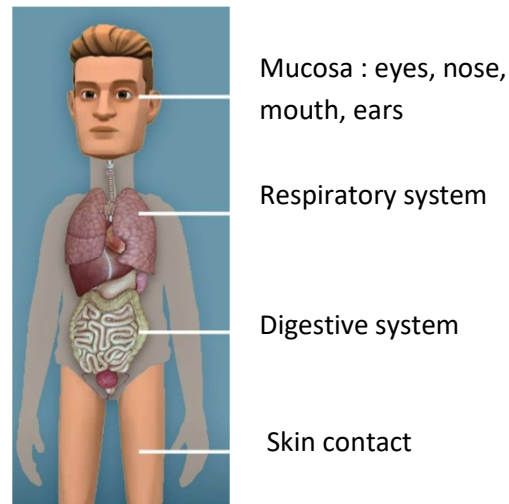
Protective measure has to be tailored regarding the penetration process of the substance involved and its characteristics. Toxicity is not only related to airborne substances, population and responders can also get impacted through contact, ingestion, etc.

→PPE (e.g, Self-Contained

Breathing Apparatus -SBCA for toxic gas, specific protecting clothes for dermal risks...)

→Portable gas detectors for first responders

- Evacuation:
 - The distressed vessel's crew : the helicopter/rescue ship must approach downwind in case of a toxic cloud
 - The population: model has to be used to determine specific areas to evacuate or shelter-in-place measures to implement (in case of a toxic cloud).
- Protection
 - In case of marine toxic substances, resources (e.g. fisheries, water intakes...) likely to be impacted should be assessed along with measure to protect them if required
→ HNS response on the shore
 - Over contamination due to by-products resulting of the response to the accident must be avoided by containing and recovering them (residual water from water-curtain techniques, extinguishing waters...)



Drawing to be revised by Cedre's graphic designer

case

Response measures

- The source of the leakage must be isolated if possible (tank or drum storage) to ease the response
- PACs (see dedicated part on chapter 3) should be used for intervention and to select proper PPE
- Depending on the substances

- Behaviour:
 - **Response Considerations: Gases and Evaporators**
 - **Response Considerations: Floater**
 - **Response Considerations: Dissolvers**
 - **Response Considerations: Sinkers**

- Techniques:
 - **Controlled release / Maintain in natural environment**
 - **Using Water Curtain**
 - **Using Foam**