Response Considerations: Corrosive Substances

Related hazards pictograms

Corrosive	
GHS	UN Regulation
	

Example of relevant case studies:

Unknown lost packages, 1975, on the Swedish West Coast about 100 km north of Gothenburg. Propionic acid (drums lost on sea approximately 30). Cause: probably lost deck cargo;

Puerto Rican, 1984, 8 miles west of Golden Gate Bridge, San Francisco Bay, California. Caustic soda solution 50% (quantity spilled 400-500 m^3). Cause of spill: explosion (reaction of caustic soda with the epoxy coating).

Kenos Athena, 2012, in water adjacent Zheland Island, southern Guangdong Province, China. Sulphuric acid (ship loaded with 7000 tons and 140 tons of residual fuel oil; chemical and bunker-oil removal from sunken ship). Cause: shipwreck , sunk after about a month.

Julie A, 1989, Port of Aarhus, Denmark. Hydrochloric acid (quantity spilled: 1 to 5 tonnes of HCl 31%; quantity transported: 300 tonnes); Cause of spill: structural damage to internal tank coating (reaction of hydrochloric acid with sheet iron with formation of hydrogen gas).

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 (corrosive gases) and downstream (spill) have also to be warned in order to prevent complications arising.

Applicability and main risks:

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

Applicability[1]	Risks for human/responders	Risks for environment	Risks for amenities
- leakage of corrosive liquid or gas from drum or tank - mixing of reactive chemicals forming corrosive gas or compound - evaporation from slicks	- Injuries due to direct contact with substance (dermal necrosis, inhalation, ingestion)	- Direct impact on animals and environment - Acute and chronic impact - Possible indirect impact (e.g. extinguishing water,	- Chemical corroding drums or tanks, leading to a pollution - Corrosion of metals (ship's deck, crane, etc.) (limitation/interference to the legitimate use of

[1] Events that may lead to a corrosive spill or atmosphere

		dissolver in water curtain)	the sea/amenities)

Risk Assessment

For general consideration on corrosive substances, responders have to focus on:

- assessing the risks of atmospheric and marine toxicity by gathering data on the substances
- assessing the risks of exposure to corrosive substances on the base of its physic state and behaviour monitoring pH if applicable;
- assessing associated hazards if present and evaluate the priority for response; corrosive substances are often associated with other hazards such as flammability and/or explosivity and/or toxicity
  - → **Response consideration flammable-explosive substances**
  - → **Response consideration: toxic substances**
  - → **Response consideration: reactive substances**
- analysing weather data and detector measurements;
- modelling the behaviour and movement of the corrosive gas/vapours/fume clouds, if applicable. Consider modelling corrosive floater/dissolved/sinker if spilled in waters column, if applicable;
- assessing measure to protect sensitive areas (environmental, ecological, social, industrial sites) and facilities, including through preventive shutdown, determine the hazards posed by any products that may be formed in the scenarios and assess the associated hazard levels (smoke from fire, reaction with the environment, etc.); □ Sheet Information gathered;
- evaluate location of facilities and equipment to quick response.

Areas to consider for intervention :

- evaluate / model the extent of area affected by dangerous concentration of corrosives substances in water column and/or in atmosphere to limit the legitimate use of the sea and amenities
  - → **Safety Zones**

Consider (and control) aggravating factors:

- reactions between acid and base, reactions due to the increase in temperatures, time of exposure
- possible highly exothermic reaction when certain acids or bases are spilled on water
- maximum precautionary measures must be taken especially in case of in situ response on the vessel (confined space)
- high viscosity values slow down dilution and dispersion processes at sea

Protective measures (human health, environment & amenities)

As corrosive substances gather a large group of chemicals, protective measure have to comply with conclusions of the risk assessment:

- Corrosive liquids (mineral acids, alkali solutions and some oxidizers): eyes and skin are particularly vulnerable due to splashes of the substance and effects on tissues are generally very fast.

- Corrosive gases and vapours: effect is generally related to the solubility of the substances in the body fluids. Highly soluble gases like ammonia or hydrogen chloride causes sever nose and throat irritation, whereas lower solubility vapours (phosgene, sulfur dioxide, etc.) penetrate deep into the lungs

- Corrosive solids: direct contact can cause burns to the skin (phenol, sodium hydroxide…) and dust affects respiratory system. Many corrosive solids may produce highly exothermic reactions when dissolved in water

• In case of a water-reactive product, substance has to be prevented from reaching the water surface and the spill must be contained (construct berms, sand dikes…).

→ **PPE**

→ **Portable detectors for first responders**

On board

• attention should be paid to avoid direct contact with the skin and protect against inhalation of vapours or mists and check atmosphere before entering in confined space; do not operate without self-contained breathing apparatus

→ **PPE**

→ **Portable gas detectors for first responders**

• evacuation must be done immediately downwind area (gas/evaporator/fume);

• attention should be paid to decontaminate clothing washing off with water and then removed;

Population and amenities

• model has to be used to determine specific area to decide on the implementation of evacuation or sheltering in place measures (in case of a corrosive cloud or marine environment contamination).

• evacuation must be done downwind impacted areas (in case of hazardous vapours, gas clouds, fumes);

• zoning: downstream area of the spill (targets of polluted runoff, liquids and solids spill) and evaluate eventually limitations on the use of the sea and amenities

Response measures

On board

• if possible, other chemicals or organic products must be isolated from the leaking substances as long as its reactive potential has not been assessed.

• If the substance is not water-reactive, acids and bases may be neutralized by a dilution process in order to reduce the concentration (overboard washing with indirect water jets if possible). pH should be measured before discharging the diluted mixture in the environment

→ **Maintain in natural environment**

→ **Using Water Curtain**

• water-reactive substances may be treated by compatible sorbent or inert materials

→ **Using Sorbents**

• in case of on board leak appropriate containment and recovery methods and techniques on the base of substances involved and scenarios should be used(Ems , IMO, 2018).

In the environment

Refer to the characteristics, behaviour and fate and of the spilled (or leakage) substances, using specific precautions for the risk of corrosivity

Behaviour:

- → **Response considerations : Gases and Evaporators**
- → **Response considerations : Floaters**
- → **Response considerations : Sinkers**
- → **Response considerations : Dissolvers**
- → **Packaged Goods Response**

Techniques:

See Chapt 563