RESPONSE:

1. Analysis of the situation

a. First steps

Determine the first safety zones
Verify the condition and the behaviour of the container
Verify the stability of the situation
Identify the hazards, the local issues, the potential number of persons that can be affected
Determine quantity involved
Determine the necessary resources

b. Study the behaviour of the product

Obtain the weather forecast (wind speed and direction, temperature, humidity…)
Estimate the flow rate or the extent of the release
Identify precisely affected areas
Modify the safety zones according to results obtained

c. Personal protection

Recommended: level A : unknown concentration
Possible: level B : known concentration and comfortable ambient temperatures to avoid sweat forming on the skin (corrosive, basic, alkaline)
Wear proper respiratory protection

d. Detection equipment

Specific gas detector, combustible gas indicator, multi gas detector, colorimetric tubes, photo ionization detector, flame ionisation detector
Ensure proper calibration of equipment before use. Beware of false interpretation of results. (margin of error of the equipment). Verify possible interferences that can falsify results.

2. Possible response strategies

Never respond alone, approach from an upwind direction
Wear appropriate respiratory protection
Plug the breach
Wash down the cloud (water spray or fog)
Prevent contaminated water from reaching the sewers
Shelter in place the affected population (do not forget to notify the end of the operation) or evacuate if possible according to the amount of the release and the duration
Monitoring

2th EDITION

Technical Popularization Pamphlet 4

CRAIM
MAJOR INDUSTRIAL ACCIDENTS REDUCTION COUNCIL*

AMMONIA

Vision and Mission of the CRAIM

Vision

CRAIM aims to be the benchmark in hazardous substance risk management within the scope of sustainable development by applying rigorous, responsible and concerted methodologies.

Mission

To Develop rigorous tools and methods that provide responsible management of risks related to hazardous substances.
To Promote and support a culture of collaboration between all stakeholders to effectively manage the risks involving hazardous substances.
To Foster, with stakeholders, a reduction in the risks of major industrial accidents through the implementation of appropriate prevention, preparedness, response and recovery measures.

* Conseil pour la réduction des accidents industriels majeurs

Writing: Robert Reiss

Ammonia is widely used. It is found in gas form, liquefied under pressure or mixed with water as an aqueous solution. Ammonia is mainly used as:

Fertilizers, refrigerants, polymer synthesizers, explosives manufacturing and cleaners.

Human health is a main concern in the event of an ammonia release. Spills of ammonia solutions in the environment will have disrupting effects if it reaches streams or lakes as it will greatly increase the pH.

An another concern with ammonia is the possibility of explosion.

Main properties:

- Class: 2, UN 1005
- Colourless gas, pungent, irritant
- Odour threshold: 1 to 53 ppm
- Vapour pressure: 4800 mm Hg at 15.5°C
- Relative density (liquified): 0.68 to -33.5°C (Condensed Chemical Dictionary)
- Boiling point: -33.5°C
- Auto ignition temperature: 650°C (Condensed Chemical Dictionary, Chaineaux 1991)
- Flammability limits:
  – Between 15.5 or 16% and 25 to 28% (LFL can be reduced by 4% if an aerosol cloud of oil and ammonia is formed)
- Very soluble in water above 0°C
  – formation of ammonia solutions (exothermic reaction)
- Ammonia solution : Class : 8, UN 2672, 2073

Some incompatibilities (ref. EnviroTips, Environment Canada)

	CONSEQUENCES
Heat	Fire and toxic fumes
Fire	Explosion
Chlorine	Explosion
Ethylene oxide	Explosion
Fluorine	Fire
Nitric acid	Fire
Potassium	Explosion

Toxicological properties and health effects

- Ammonia gas will severely irritate and may burn all mucus membranes due to its high solubility.
- Suffocation is very probable in high concentration areas.
- Clinical signs observed are :
  Burns at mucus membranes - Coughing – pharyngitis – laryngitis – nausea – vomiting - cephalalgia – hyper-salivation - eventually a bradycardia
- Frostbite on contact (cold burns)

Hazard level that can be used for emergency situation or for planning:

Acute Emergency Guidance Level (AEGL 2016).		
AEGL pour 10 minutes	AEGL pour 30 minutes	AEGL for one hour
AEGL 1 30 ppm	AEGL 1 30 ppm	AEGL 1 30 ppm
AEGL 2 220 ppm	AEGL 2 220 ppm	AEGL 2 160 ppm
AEGL 3 2700 ppm	AEGL 3 1600 ppm	AEGL 3 1100 ppm

The behaviour of the cloud

Initially, anhydrous ammonia will stay on the ground due to its cold temperature and the fact that it is pressurized. The cloud will stay at low elevation over a large distance. Subsequently, due to dispersion and the increase of temperature and the wind effect, the cloud will rise.

Measures to prevent environmental emergencies

(obligation d'inclusion dans le plan d'urgence selon le Règlement sur les urgences environnementales, art. 4. (3)c))

Examples:

Preventive barriers:
- detection devices equipped with alarms
- automated gates
- personnel training
- regular and rigorous maintenance program

Protective barriers:
- walls, impervious fences
- sprinklers, water curtains, ventilation to outside trough a scrubber system
- updated contingency plan, exercises