NEW SOUTH WALES FIRE BRIGADES

Operations Bulletin 2008/11

Chlorine enhanced improvised explosive devices

Issue

Over the past two years there have been numerous open source reports of attacks in the Middle East involving the use of improvised explosive devices (IEDs) combined with a cylinder of liquefied chlorine gas. Detonation usually results in cylinder fragmentation and the immediate release of a cloud of toxic chlorine gas.

The most common method of attack is to place a package or object in the target area, but larger attacks may involve IEDs delivered in vehicles. The explosive component may be a crude homemade device, or may use military ordnance or high powered explosives.

This form of attack highlights that terrorists are seeking to improve the method and effectiveness of terrorist attacks and it is essential that emergency services personnel maintain an awareness of the emerging threats in the response environment.

CAUTION

IEDs may look like ordinary items. Exterior inspection of a suspect device does not necessarily guarantee the safety of emergency services personnel.

Characteristics of chlorine

Chlorine (Cl) is a poisonous corrosive greenish-yellow gas with a distinct, irritating odour.

At room temperature, the gas vapour density is 2.5 times heavier than air. Chlorine gas travels along the ground and will sink into hollows, trenches and low lying areas.

When pressurised liquefied chlorine gas is released at normal atmospheric temperature and pressure, the expansion ratio is 450 - 500 to 1. A small amount of liquefied chlorine will produce a significant vapour cloud.

Although chlorine is not flammable, it is a strong oxidiser and will support combustion.

Exposure hazards

The initial exposure hazard with chlorine is through inhalation.

Chlorine is highly toxic by all routes of entry – inhalation, skin contact, ingestion and injection – and is corrosive to skin and mucous membranes like eyes and lungs.

Symptoms occur rapidly even at low exposures, eg eye, nose and throat irritation, and coughing. High concentrations can result in serious problems including but not limited to respiratory distress, fluid on the lungs, permanent lung damage or death.

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Chlorine gas will mix with body moisture to form hydrochloric acid, causing immediate and dangerous chemical burns. Direct contact with liquid chlorine can cause frostbite.

Safe approach

Approach the scene from upwind and uphill and be mindful of secondary devices targeting emergency services personnel.

First responders should attempt to identify any hazardous material. A dynamic risk assessment should be conducted using available information including the Emergency Response Guidebook, Hazmat Action Guide and ChemData.

Personal protective equipment

Fully encapsulated clothing is the appropriate level of protection when dealing with liquefied chlorine gas.

Strategies and tactics

Life rescue, containment and dispersal strategies should be based on minimising exposure to chlorine.

As chlorine is heavier than air, consider the exposure risk to people in below ground structures such as basements, car parks, underground stations and tunnels.

Do not enter underground environments where victims appear unresponsive unless wearing appropriate personal protective equipment.

Placing a cover such as a salvage sheet over a ruptured cylinder will act as a thermal barrier and will reduce the boil off of liquid chlorine. Consider using large volume fog sprays to absorb chlorine gas. The water runoff will be corrosive.

CAUTION

Water applied directly to escaping liquid chlorine will increase the boil off rate and will produce large quantities of chlorine gas. Water spray should only be used to displace chlorine gas vapour clouds.

Monitoring

Orion gas detectors will not detect chlorine. Hazmat Technicians with specialist detection equipment must be requested to conduct atmospheric monitoring throughout fire, rescue, containment, dispersal and site remediation operations.

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Ventilation

At incidents inside buildings, tunnels or other structures such as underground transport interchanges, all heating, ventilation and air conditioning systems must be isolated.

Ventilate all areas with large volume fans, taking into account the hazards associated with petrol driven equipment in confined spaces. Use electric fans where available.

Patient management

Be prepared for a significant number of casualties from exposure to chlorine and from debris/shrapnel from any explosion.

Remove all casualties to fresh air for triage. In many instances, moving casualties out of chlorine vapours will provide immediate relief.

Severely exposed patients require rapid decontamination. Patients should be thoroughly flushed with water. Remove contaminated clothing.

Further information

Standard Operational Guidelines:

SOG 10.15, *Chemical, biological and radiological incidents*

SOG 10.5, *Land Based Events*

SOG 8.10, *Terrorism - incendiary incidents*

SOG 8.11, *Terrorism - chemical incidents*

SOG 8.12, *Terrorist incidents - explosives*

NSWFB Counter Terrorism Field Operations Guide, Section 13.4, *Chemical incidents,* pp 44-49.

Noted: Station Commander	**A**	**B**	**C**	**D**	**Other**

Contact Officer	**File No**	**Date**
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