Disaster Risk Management for Health
CHEMICAL SAFETY

Key Points

- Prevention of chemical emergencies includes:
  - safe location of chemical facilities away from residential areas
  - reducing the amount of stored toxic and flammable chemicals
  - building in technical controls and redundancy to provide safe use of chemicals and management of waste.
- Preparation for a chemical release includes:
  - scenario analyses and impact assessment
  - planning for, training and exercising the response, including the installation of a public warning system,
  - training and equipping responders to deal with loss of containment.
- Detection and alert includes the development of systems to recognize chemical events as early as possible and scaling up an appropriate incident response.
- Response includes the containment of the chemical release, decontamination, management of health consequences and risk assessment.
- Recovery includes activities such as risk and impact assessment in order to design care, remediation and protective actions, clean-up and investigation of the root cause to prevent recurrence.

Examples
India (1984) & France (2001)

On 3 December 1984, over 40 tons of methyl isocyanate gas leaked from a pesticide plant in Bhopal, India, immediately killing at least 3,800 people and causing significant morbidity and premature death for many thousands more.[1]

A huge explosion ripped through AZF (Azote de France) ammonium nitrate fertiliser factory in an industrial zone on the outskirts of Toulouse, France on 21 September 2001. Thirty-one people died in the event and approximately 2500 were injured. More than 500 homes became uninhabitable.[2]

Why is this important?

A chemical incident is the unexpected release of a substance that is (potentially) hazardous either to humans, other animals or the environment.[3]

Chemical releases arise from technological incidents, impact of natural hazards[4], and from conflict and terrorism.[5]

The International Federation of the Red Cross has estimated that between 1998 and 2007, there were nearly 3 200 technological disasters, including chemical incidents, with approximately 100 000 people killed and nearly 2 million people affected.[5]

The management of chemical incidents requires a multi-disciplinary and multi-sectoral approach - the health sector may play a supporting or a leadership role at various stages of the management.

What are the health risks?

Chemical incidents can cause injury through four basic injury mechanisms which can also be strongly interrelated:

- **Fire** produces injuries through heat and exposure to toxic substances (including combustion products).[6]
- **Explosion** produces traumatic (mechanical) injuries through the resulting shockwave (blast), fragments and projectiles.
- **Toxicity** may result when humans come into contact with a chemical released from its containment, be it from storage or transport, or as reaction or combustion products. Toxicity can cause harm by a wide array of toxic mechanisms ranging from chemical burns to asphyxiation and neurotoxicity.
- **Mental health effects** are not only determined by exposure to the chemical, fire or explosion but also by “exposure to the event” itself.

Severe incidents have the potential to disrupt the lives of casualties through injury, loss of relatives, property or employment and societal disruption.

Risk management considerations

Governments and communities can manage disaster risk related to chemical safety by:

Assessing health risks[7] and impacts in a disaster context including

- **hazard identification** - identifies the chemicals and can then be used to obtain, from available information, their health hazards.
- **hazard characterization (or dose–response assessment)** describes the relationship between exposure or dose and toxic effect. As such, it forms the basis for guidance and guideline values as well as standards (reference values to which to compare actual exposure).
- **exposure assessment** describes in what ways people could come into contact with the chemical and calculates a numerical estimate of exposure or dose.
- **risk characterization** integrates information from the preceding steps to synthesize an overall conclusion about risk.

Considering regulatory action for prevention including:

- Promoting the use of less toxic and flammable chemicals and reducing the quantities stored.
- Safe siting, design and construction of chemical facilities in areas where a release would not harm the public.
- Technical controls, redundancy and back-up measures for operational safety and waste management.
- Protective equipment and training to protect personnel working in chemical facilities, health facilities and other environments.
- Security measures to control access to supply and use of hazardous chemical agents.

In preparedness, considering

- Preparing a national chemical emergency management coordinating group, with trained staff.
- Developing facility, local and national chemical incident response plans (with health involvement);
- Being aware of databases on chemicals, sites, transport routes and expertise.
- Building a mechanism for interagency communication and public communication.
- Developing emergency response guidelines, including environmental protection guidelines.
- Undertaking incident exercises, training, and audits.
- Organising a capacity for chemical incident surveillance.

Developing health system capacities in health facilities to decontaminate and treat casualties.

In emergency response, considering:

- Terminating the release, preventing spread of contamination and limiting exposure.
- Activating the incident management system, including a public health response.
- Providing initial assessment and advice, and alerting the health care services.
- Ensuring coordination and integration of the public health response.
- Conducting a best outcome assessment for both immediate and long-term actions.
- Disseminating information and advice to responders, the public, and the media.
- Registering all exposed individuals and collect samples to eliminate exposure.
- Conducting independent investigations.

In recovery, considering:

- Organisation of health care to treat casualties and support them in regaining control of their lives, including central access to information and assistance.
- Risk and health outcome assessment, including exposure, environmental and human health assessments.
- Implementing remediation and restoration actions.
- Undertaking evaluation, including root cause analysis, response and lessons learned.

References and further reading

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