General principles of chemical hazards and public health

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UK Health Security Agency
• Chemical Hazards and Public Health – what’s the problem?

• International regulation, mechanisms and indicators

• Identifying the problem

• Preventing and preparing

• Interactive questions – please type answers in the chat on Zoom
Why is it important to prevent chemical releases?
A chemical world

- Chemicals are essential components of our lives
- Some chemicals can severely damage our health or the environment
- 50 million known chemicals (70,000 in common use)
- Detailed toxicity data for only a few hundred
- 200 to 1000 new compounds per year
- WHO estimate 13 million deaths could be prevented every year by addressing environmental problems such as air and water pollution
3.6% of all death worldwide attributable to chemical exposures

2.1% of Disability-Adjusted Life Years (DALYs)

WHO, June 2020 10 chemicals of public health concern (who.int)

Waste

Waste production in Africa exceeds available capacity for collection and disposal.

According to the United Nations Centre for Human Settlements (UNCHS), only 0.6% of solid waste is recovered and recycled.

Industrial waste in liquid form is usually discharged into sewerage systems or rivers as effluent, while solid waste is either dumped in landfills or pits within workplace premises.
What are the issues with waste management from your perspective?

Type answers in meeting chat
Chemicals of concern

Heavy metals – mercury, lead, cadmium, arsenic

Fluoride

Cyanide

Air pollutants

Hazardous pesticides – organophosphates and organochlorines

Persistent Organic Pollutants – dioxins & furans, PCBs

Benzene and PAHs
• What are the key chemicals of concern in your country from your perspective?

• Please type answer(s) in the chat
Annex 1 - Core competencies concerning chemical incidents and emergencies should include:

- legislation appropriate for chemical emergency surveillance and response
- national chemical emergency coordinating structure
- national surveillance system for chemical events
- chemical incident and emergency response plan
- coordination and collaboration between all relevant stakeholders
- national risk assessment
- specialist advice on chemical poisonings
- supplies for managing victims of larger scale chemical incidents
What are the challenges with establishing and maintaining these core competences for chemicals?
Example IHR Strengthening Activity: Waste management tool

**STAGE 1. Designing remediation/final disposal**

**STEP 1.** Are final treatment and disposal options currently unavailable? AND/OR Can the need to remediate be reduced or prevented?
- Yes
- No

**STEP 2.** Define remediation objectives with the relevant stakeholders

**STEP 3.** Perform technical options assessment: Will the option(s) achieve effective breakage of the pollutant linkages/final disposal solution?
- Yes
- No

**STEP 4.** Perform sustainability assessment: Will the option(s) achieve a balance between environment, social, and economic net benefit?
- Yes
- No

**STEP 5.** Will the remedial option satisfy all the necessary stakeholder requirements?
- Yes
- No

**STEP 6.** Perform a detailed technology evaluation and develop a remediation/final disposal strategy.

**Implementation:***
- Implement interim secure storage/ protection measures AND/OR Amend the site development plan/ develop a site management plan
- Collect more data, review objectives, implement protection measures

**No feasible option identified**
### Chemical Events – examples of incidents reported under IHR

**Table 1: Examples of chemical events of international public health significance (assessed by applying the decision criteria listed in Annex 2 of the IHR (2005))**

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Description of event (Reference)</th>
<th>Consequences</th>
<th>IHR (2005) Annex 2 criteria*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Côte d’Ivoire</td>
<td>Dumping of waste in the city of Abidjan (UNDAC, 2006; WHO, 2009)</td>
<td>10 deaths, thousands made ill; international assistance was needed</td>
<td>Yes to (i) and (ii) no to (iii) and (iv)</td>
</tr>
<tr>
<td>2006</td>
<td>China</td>
<td>Plant explosion releasing 100 tonnes of pollutants in the Songhua River, which crosses international borders (UN, 2006; WHO, 2009)</td>
<td>Five deaths; millions of people without water for several days</td>
<td>Yes to (i), (ii) and (iii); (iv) unknown</td>
</tr>
<tr>
<td>2006</td>
<td>Panama</td>
<td>Diethylene glycol in a cough syrup (Rentz et al., 2008; WHO, 2009)</td>
<td>At least 100 deaths</td>
<td>Yes to (i), (ii), (iii) and (iv)</td>
</tr>
<tr>
<td>2007</td>
<td>Angola</td>
<td>Sodium bromide poison</td>
<td>At least 150 people ill</td>
<td>Yes to (i) and (ii)</td>
</tr>
<tr>
<td>Country</td>
<td>Chemical event</td>
<td>Period of event</td>
<td>Location</td>
<td>Cases/fatalities</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td>Algeria</td>
<td>Nitrate poisoning</td>
<td>2013</td>
<td>Chief</td>
<td>Unknown</td>
</tr>
<tr>
<td>Angola</td>
<td>Lead poisoning</td>
<td>2012</td>
<td>Luanda</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Bromide poisoning (table salt</td>
<td>2 November to 5 December</td>
<td>Municipality of Cacuaco</td>
<td>467 people poisoned, mostly children</td>
</tr>
<tr>
<td></td>
<td>contaminated with sodium bromide)</td>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poisoning of unknown cause in</td>
<td>2011-2013</td>
<td>Luanda, Hula and Huambo</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>schools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>Occupational exposure to benzene</td>
<td>2002</td>
<td>Caratex locality, Gaborone</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Methanol intoxication in students</td>
<td>2003</td>
<td>Macha Senior Secondary School, Kig</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Inhalation of sodium hypochloride</td>
<td>2010</td>
<td>Poultry in Gaborone North</td>
<td>Unknown</td>
</tr>
<tr>
<td>Burundi</td>
<td>Atrazine poisoning</td>
<td>2003</td>
<td>Bubanza, Bujumbura Rural in Western Burundi</td>
<td>10 fatalities</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Pesticide poisoning</td>
<td>2004</td>
<td>Batcham in Ouest Province</td>
<td>4 fatalities</td>
</tr>
<tr>
<td></td>
<td>Pesticide poisoning</td>
<td>2011</td>
<td>Penja in Littoral Province</td>
<td>No fatalities</td>
</tr>
</tbody>
</table>

WHO, Chemicals of public health concern and their management in the Africa Region, 2014
In September 2006, a Panamanian physician reported an unusual number of patients with unexplained acute renal failure.

Patients typically presented with abdominal symptoms, such as nausea, vomiting, epigastric discomfort and diarrhoea.

Many patients also exhibited a spectrum of neurological effects.

Despite dialysis, 12 out of 21 (57%) patients died.
Case Study: Detection, reporting and alerting of unusual signs and symptoms

- First, an infectious aetiology was suspected.
- Second, an antihypertensive medication was suspected.
- Finally, when two affected patients presented to a specific CSS hospital with bottles of a Panamanian-produced prescription liquid cough syrup, contaminated medication was suspected.
- Diethylene glycol (DEG) was found as a contaminant of raw materials used in the production of pharmaceuticals. DEG is a colourless and odourless liquid and a human toxicant.
Are there any other common chemical incident scenarios?

Type answer(s) in chat
Identifying the problem

<table>
<thead>
<tr>
<th>1. Environmental contamination</th>
<th>2. Health effects following known exposure</th>
<th>3. Health effects of unknown aetiology</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Environmental contamination" /></td>
<td><img src="image2" alt="Health effects known exposure" /></td>
<td><img src="image3" alt="Health effects unknown aetiology" /></td>
</tr>
</tbody>
</table>
Chemicals released into the environment may cause further contamination (whether direct or indirect) to other individuals.

- The public health impact of this will depend on:
  - Toxicity of the chemical
  - Time period and route of exposure (inhalation, ingestion, dermal contact)
  - Physicochemical properties i.e. how it behaves in the environment
  - Degradation properties (may be worse than the original chemical)
  - The presence of protective environment/media (e.g. buildings)

- The risk assessment process can take this into account and prevent further exposures
In the event of a chemical incident, competent risk assessors will apply the risk assessment process to:

- Identify the hazard
  e.g. what is the chemical, is it hazardous to humans?
- Characterise the hazard
  e.g. what properties does the chemical possess?
- Assess the level of exposure
  e.g. how would people come into contact with it, how much are they exposed to?
- Characterize the risk
  e.g. how does the exposure compare to established guidance values for the chemical?
Examples of ways to reduce the likelihood of a chemical incident from occurring:

- legislated environment
- reducing the amount and safer alternatives
- safe location
- technical controls
- public education and awareness

Source: WHO - https://www.who.int/hac/events/drm_fact_sheet_chemical_safety.pdf?ua=1
Preparedness – practical activities

- Risk register
- National all hazards plan
- National chemical plan
- Planning
- being aware of databases on chemicals, sites, transport routes and expertise.
Preparedness – practical activities

- communication
- emergency response guidelines
- Practice
- chemical incident surveillance.
Africa CDC Strategic Objectives

**VISION AND MISSION**

**STRATEGIC PILLARS**

1. Surveillance and Disease Intelligence
2. Information Systems
3. Laboratory Systems and Networks
4. Emergency Preparedness and Response
5. National Public Health Institutes and Research
6. Disease Control and Prevention

**Enablers:** Governance, Ethics, Management, Leadership, Workforce, Finance, Partnership, Innovation

*Figure 1. Pillars of Africa CDC*
Next session – June 29th

Detection for chemical hazards and public health – surveillance, analysis and poisons information

This session will present some introductory level content around:

• methods & capacities for analysis & detection for chemicals
• common surveillance methods for identification of chemical issues of potential public health concern.
• It will also introduce the role of poisons information centres and how they are an important for both detecting and respond to chemical events.
Thank you for listening

Any questions?