



National and Kapodistrian
UNIVERSITY OF ATHENS



Rapid risk assessment

Raquel Duarte-Davidson

Health Protection Agency

Centre for Radiation, Chemicals and Environmental Hazards



Executive
Agency for
Health and
Consumers



NOFER INSTITUTE OF OCCUPATIONAL MEDICINE



FOI



Chemical Incident

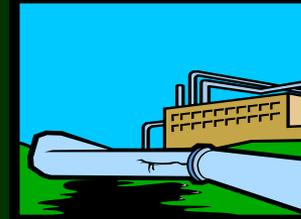


A chemical incident is the uncontrolled release of a toxic substance, resulting in (potential) harm to public health and the environment. Chemical incidents usually trigger a public health response, including, for example, **assessment of exposure and risk** and/or provision of advice to authorities and/or the public. Examples:

- the explosion of a factory which stores or uses chemicals
- during transportation
- contamination of the food or water supply with a chemical
- an oil spill, a leak in a storage unit
- Disruption of chemical containment systems (e.g. tank rupture after flooding).

Events Involving:

Accidental



Natural



Deliberate



Release to the environment of potentially hazardous agents that have the potential to cause injury or harm.

Chemical Incident



Whatever the cause, the chemical incident might be discovered by either knowledge of

- the contamination
- The health conditions likely to have a common chemical etiology

Assessment of risk to human health is

- the process to characterize the nature and probability of adverse effects on the health of humans who may be exposed to chemicals in contaminated environmental media, now or in the future
- the core public health function in the prevention and management of chemical incidents

Source – pathway – receptor linkage



SOURCE

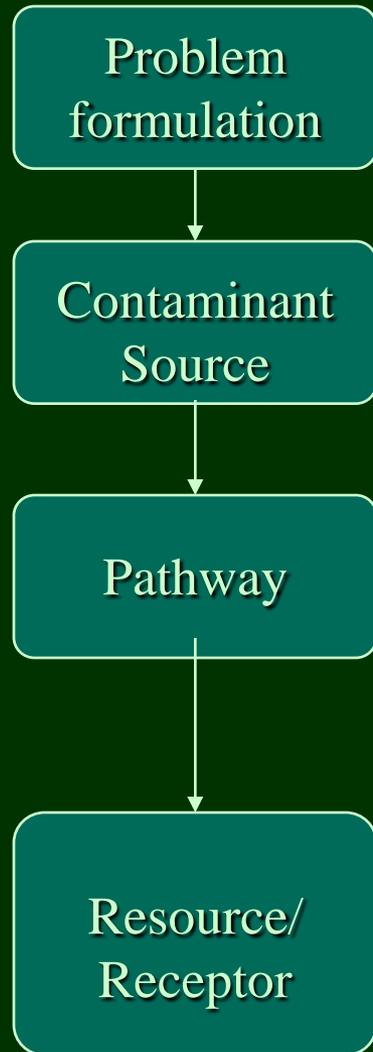


PATHWAY



RECEPTOR





Identify problem and if there are any resource/receptor(s) which could potentially be affected

Hazard Identification: Characterise the contaminant:

- Location
- Amount
- Nature
- Concentration

Exposure Assessment: Characterise the exposure pathway (probability, magnitude and duration of exposure):

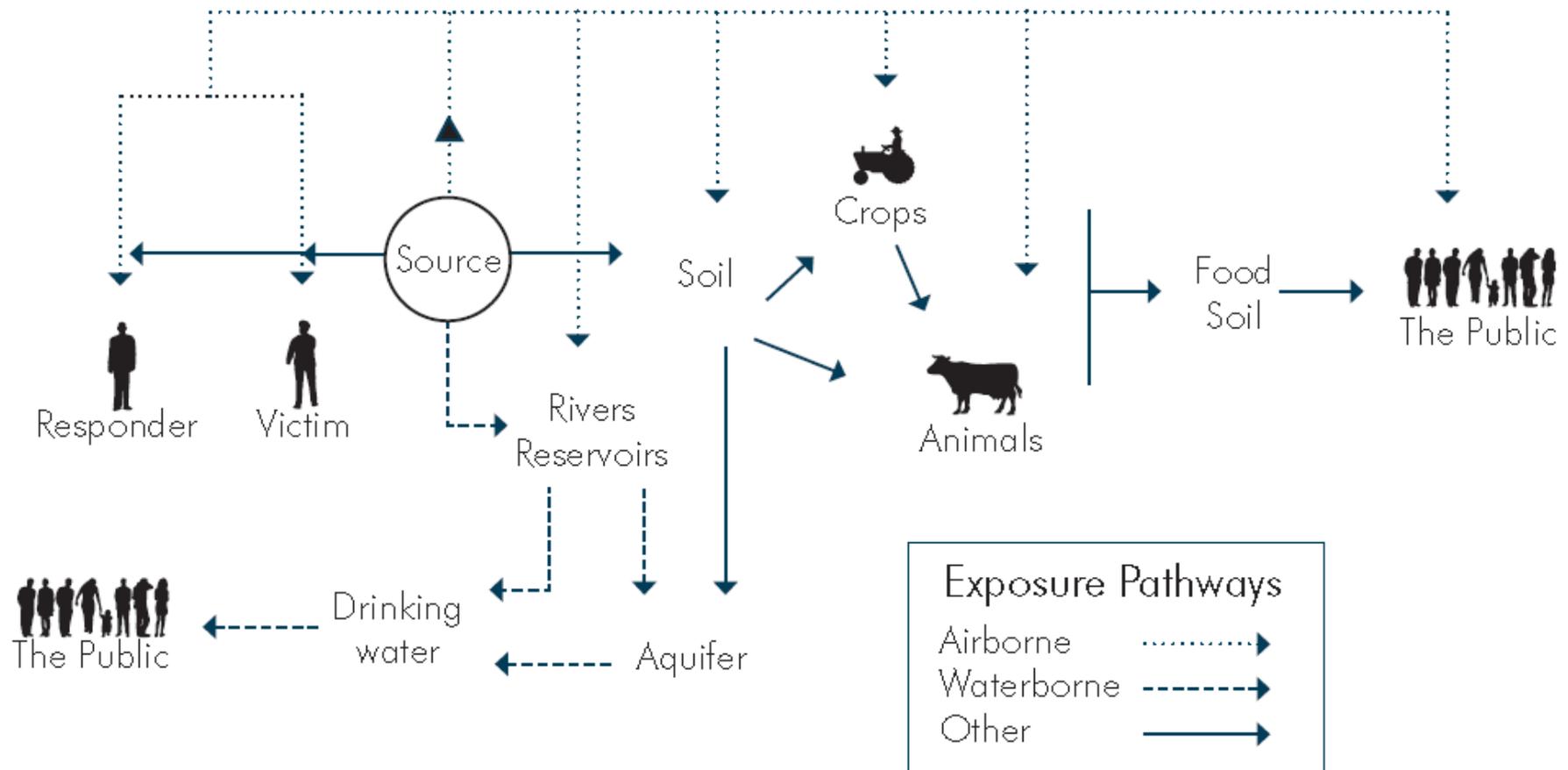
- Direct
- Indirect
- None

Risk Estimation: Assess the magnitude of the risk (i.e probability and scale of harm)

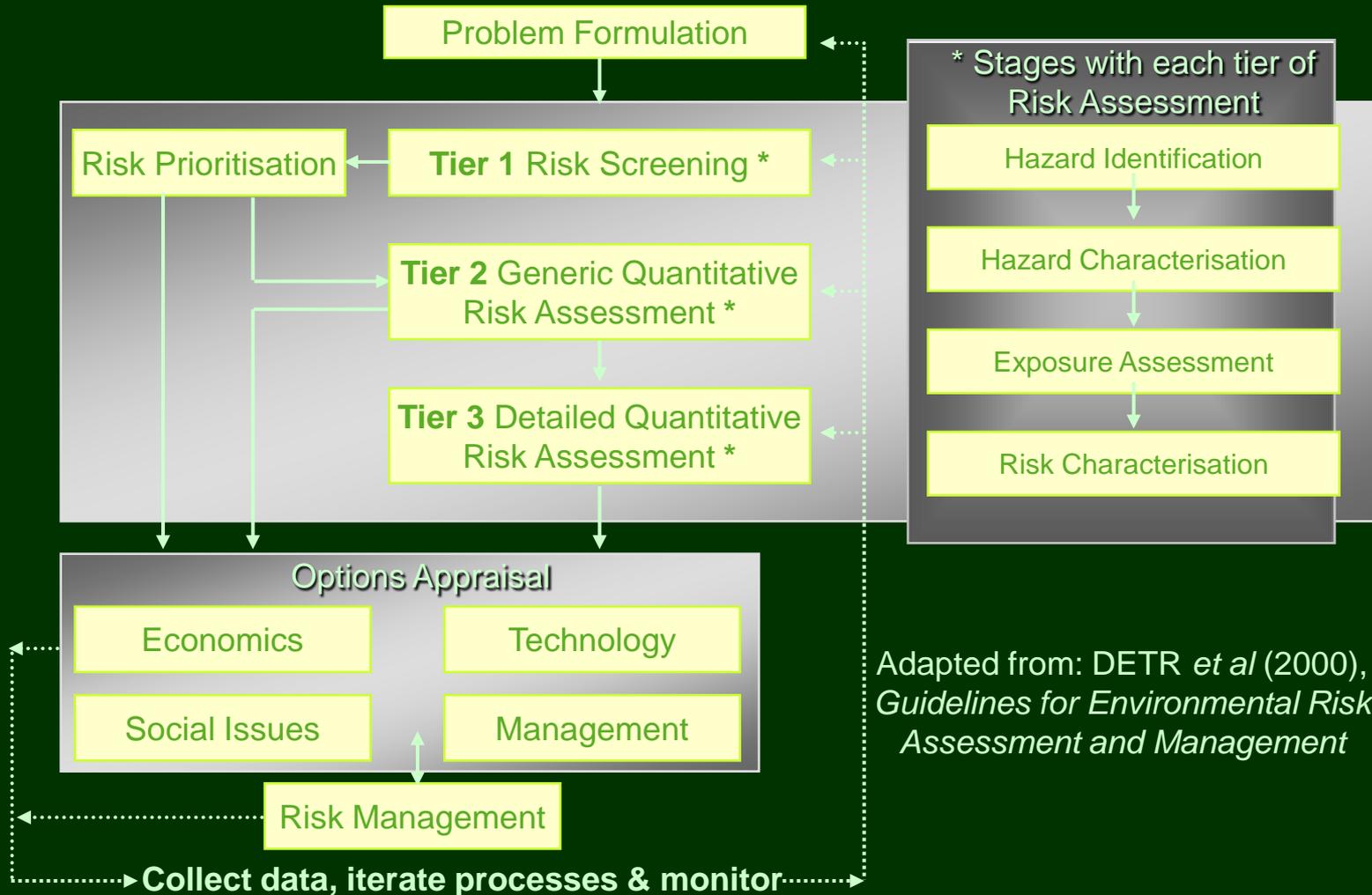
Risk Characterisation: Assess the potential significance of the risk and uncertainties

- Significant
- Not Significant

Exposure pathways

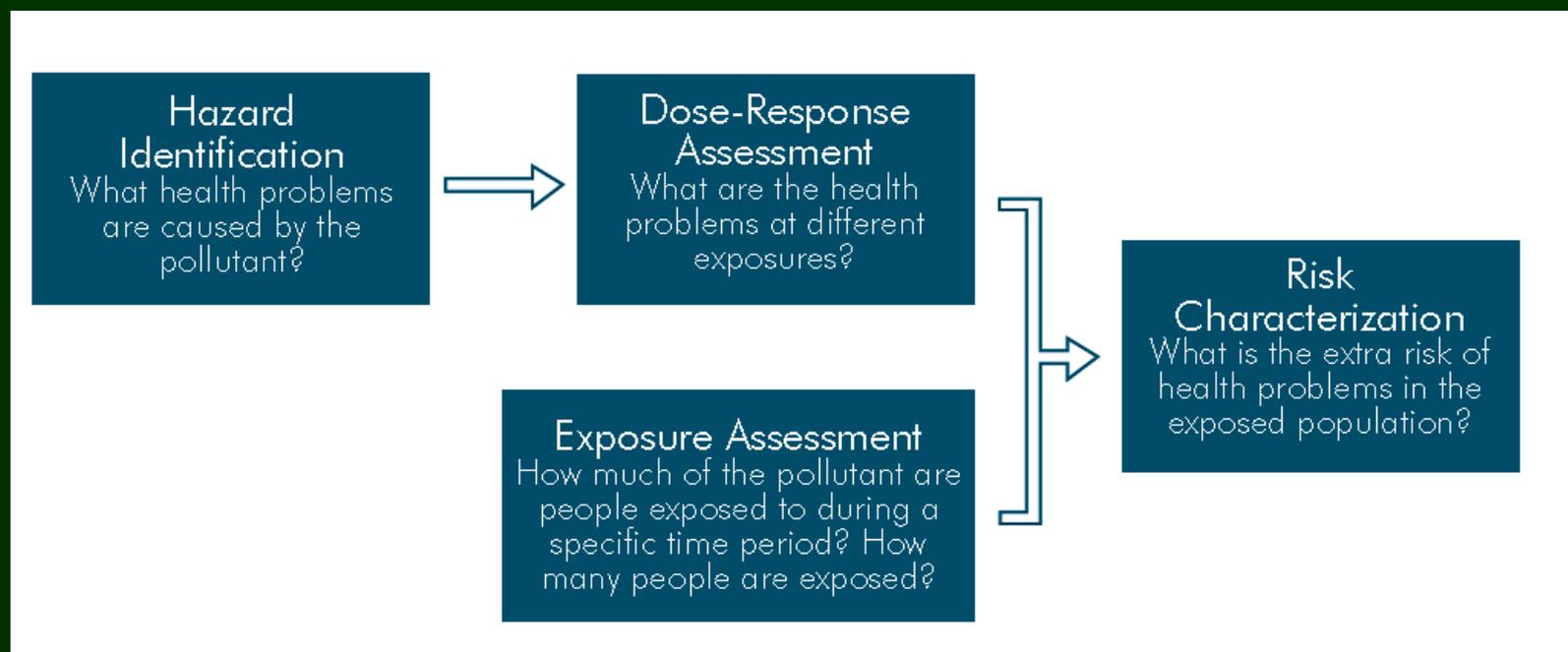


Risk Assessment

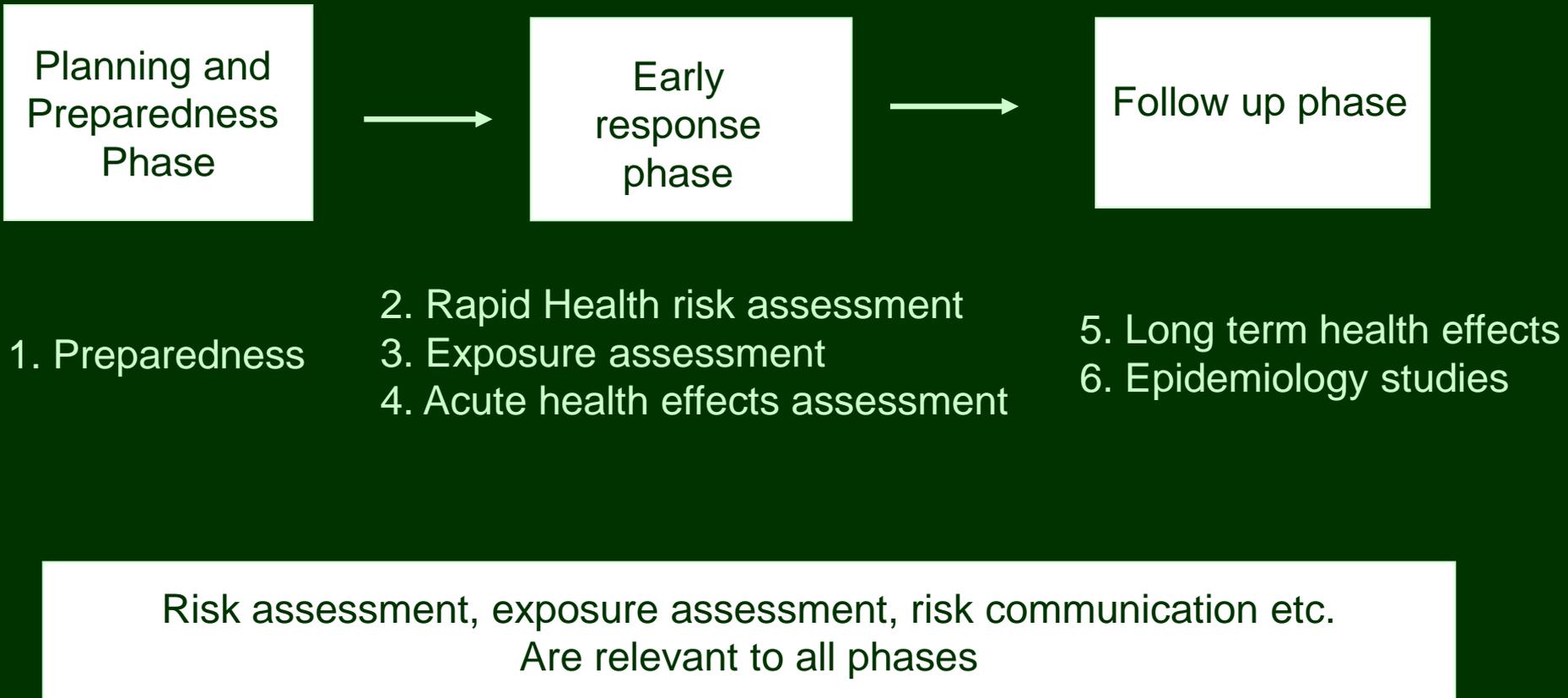


Adapted from: DETR *et al* (2000),
*Guidelines for Environmental Risk
Assessment and Management*

Steps in the risk assessment process



Risk Assessment within the CIE toolkit



Examples of incident scenarios, risk assessment and public health issues



1. Outdoor release of gas or vapour
2. Sudden evident outdoor release of an aerosol
3. Sudden evident release to contact media other than air
4. Fire in a large building
5. Explosion
6. Disease outbreak
7. Silent release

1. Outdoor release of gas or vapour

Incident

- A gas or vapour cloud with an acute time course
- Inhalation exposure downwind / possibility of skin contact on-site
- Odour, respiratory, eye irritation; depending on the nature of the chemical; health effects can be delayed (hours to days)
- Atmospheric conditions determine the dispersion; gas pockets possible, particularly after release of a heavy gas

Rapid risk assessment

- Population at risk determined rapidly from complaints & dispersion modelling
- The 1st environmental monitoring results will rarely come in before 30–45 min following chemical release
- The likelihood of 2ary contamination outside the incident scene is usually low

Public health implications / advice

- Stay indoors, shut all doors & windows
- After the toxic cloud has passed, usually few or no restrictions on outdoor activities

Example

Release of methyl isocyanate in Bhopal, 1984; many deaths

3. Sudden evident release to contact media other than air



Incident

- Immediately detected release of a substance to water, soil or directly into food (e.g. during food processing) or other media (e.g. sediments)
- Often easier to avoid primary human contact with the chemical - often possible to discontinue exposure through these media at least for a short time
- Secondary contamination of food, drinking-water and consumer products can occur as well following release of a chemical to surface water or soil
- The time to respond to this type of incident – hours rather than minutes

Risk assessment

- Pathways for human exposure and health risk depend on the physico-chemical properties & environmental fate; if volatile – will evaporate and be detected by their odour or taste; low vapour pressure – partition between water and soil/OM

Public health implications / advice

- Warning the public to take immediate action rarely required (exception odour)
- A well-conducted exposure study focusing on all possible routes of exposure and subsequent risk assessment will be very helpful.

Example

- Benzene release in the Songhua river, China, 2005 (millions of people without water for several days)

6. Disease outbreak

Incident

- In this case an increase in the number of people with similar syndromes and symptoms will be detected (instead of detecting the release of the chemical)
- Detection usually through surveillance systems and/or watchful clinicians
- Takes days - months depending on specificity of clinical syndrome & geographical spread; common source may not be known for a long time

Rapid risk assessment

- All exposure routes should be considered; possible chemical hazards, exposure and reported effects should be investigated simultaneously
- Need to assess and verify clinical presentation and search for the chemical hazard and a possible common source of exposure using toxicological and epidemiological tools
- After identification of the hazard and source, a detailed exposure assessment will verify acute effects and predict possible delayed or residual effects and the populations affected

Public health implications / advice

- Most outbreaks will initially be a suspected outbreak of an infectious disease

Example

- Angola, 2007, food contaminated with table salt containing >80% sodium bromide (tiredness, blurred vision, difficulties in speaking and walking)

Any Questions?

2. Sudden evident outdoor release of an aerosol

Incident

- Sudden emission of liquid or solid aerosol into the outdoor and/or indoor air
- Material deposits on soil & infrastructure, will remain until removed (clean up or by wind or rain)
- Exposure oral (via inhalation during the emission); skin routes possible

Rapid risk assessment

- Composition of emitted material and particle size usually unavailable in the acute stage
- Quantitative assessment of exposure with modelling and monitoring difficult
- Children vulnerable group – exposure whilst playing & hand-to-mouth behaviour

Public health implications / advice

- Restriction on access to the outdoor area and clean-up is critical
- Compliance with health advice generally high in areas where contamination is visible
- Concern about delayed effects (e.g. for carcinogenic substances) needs to be communicated clearly

Example

- Release of dioxin in Seveso, Italy, 1976

7. Silent release

Incident

- Release of chemical not detected until after the release, but before it is detected as a disease outbreak
- The occurrence of an incident may be brought into the open after some time, or when a release is more serious than anticipated at the time of the initial release

Rapid risk assessment

- The first steps are verification of the chemical, an analysis of all possible exposure pathways and populations, and a quantitative risk assessment with focus on delayed or residual effects

Public health implications / advice

- Grey area between response to a chemical incident and "regular" environmental health provision
- Need to establish a link between observed & anticipated delayed health effects & exposure
- Challenge: people who know about or have been close to the event, but have NOT been exposed, may attribute signs and symptoms to the incident

Example

- Angola, 2007, food contaminated with table salt containing >80% sodium bromide (tiredness, blurred vision, difficulties in speaking and walking)