# Cross-border Exposure Characterisation for Risk Assessment in Chemical Incidents

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## Introduction

Chemical incidents do not respect national borders, and can affect communities a significant distance from the incident site. An accurate and timely assessment of risks to human health is a cornerstone of an effective response strategy. The Cross-border Exposure Characterisation for Risk Assessment in Chemical Incidents (CERACI) project aims to strengthen the public health assessment for the acute phase of a chemical incident by assessing the response to chemical incidents in European (EU) Member States, focusing in particular on the interoperability of exposure assessment guidelines, tools and practices.

The key questions which the project will address are:

- How do Member States undertake exposure assessment and risk characterisation during the initial phase of a chemical incident?
- How do Member States organise environmental modelling and monitoring and how is this used to inform the health risk assessment during the acute phase of a chemical incident?
- Which Member States collaborate nationally and cross-border on environmental modelling and monitoring?
- Which best practices, technical or organisational, can be further developed?
- Will harmonisation and collaboration improve Member States' capabilities and capacities to respond to acute chemical incidents (national and cross-border)?

The partners in the project are the Dutch National Institute for Public Health, and the Environment (RIVM), the Nofer Institute of Occupational Medicine (NIOM) of Poland and the UK Health Protection Agency (HPA). This paper discusses some of the findings of the information-gathering phase of the project. Later phases of the project will evaluate best practice for responding to cross-border incidents through the organisation of workshops. European Commission project databases[1,2] were reviewed to identify projects relevant to exposure assessment in chemical incidents, paying particular attention to incidents where environmental modelling and monitoring data was used to inform a health risk assessment. The review also identified projects undertaken by established networks of experts employed in roles encompassing exposure assessment, and those which have run workshops using acute chemical incident scenarios to inform their work.

The primary methods for collecting information to contribute to the risk assessment model were considered to be: observation; field monitoring; laboratory analysis; emergency plans; modelling; risk mapping/geographical information systems; and risk characterisation and communication. As expected, there is diversity in responding agency types, capabilities, risk assessment protocols and strategies. Some of the key areas of diversity are summarised below.

## Information gathering

In each Member State, the primary sources of information about a chemical incident are typically provided by the emergency services responding to the incident and the site operators, with emergency plans, e.g. COMAH Plans, confirmed to be invaluable to risk assessors for obtaining relevant information.

## Cross-border arrangements

A number of overarching European cross-border initiatives and arrangements have been identified at national level within Member States. These arrangements include the exchange of scientific and technical information; training; common research; logistical support; and exchange of relevant data on a regular basis. Bilateral and multilateral agreements to provide mutual assistance in civil protection or disaster and accident operations on EU territory exist between a number of Member States. For example:

- The Convention on the Transnational Effects of Industrial Accidents[3] aims at protecting humans and the environment against industrial accidents, promoting active international cooperation between the contracting Parties, before, during and after an industrial accident
- The Civil Protection Mechanism[4], established in 2003, facilitates cooperation in civil protection assistance interventions in the event of major emergencies
- The Major Accident Hazards Bureau[5] provides research-based scientific support to the European Community on the formulation, implementation and monitoring of EU policies for the control of major accident hazards, chiefly the Seveso II Directive, 96/82/EC, concerning the processing and storage of hazardous substances.

## Monitoring

The European Commission funds a number of projects that are developing chemical technologies to detect contaminants in food, water and air. Technological advances in field and laboratory monitoring, and information communication have the potential to improve the European capacity for exposure assessment, particularly where the validated methodologies are simple, inexpensive and rapid. Monitoring capability (including sensitivity and selection of monitoring equipment) and the rationale for deployment varies. The rationale for monitoring will affect how readily equipment is deployed, how quickly the data is obtained, and defines its usefulness from the perspective of exposure characterisation.

Monitoring capability was found to vary across the EU; however, a number of Member States were found to be well prepared, with the capability to deploy mobile laboratories to the scene of a chemical

incident or to the location of sensitive receptors to provide real-time data to inform human health risk assessments. A number of countries were also identified to have satellite software systems for automatic detection of fires. For example, the Bulgarian Aerospace Monitoring Centre has a system for automatically detecting forest fires using satellite data in near real-time and sends email alerts to responders, providing information about the affected area and intensity of the fire[6].

## Modelling

On-scene observations undertaken by fire and rescue services may be supported by chemical or meteorological modelling information provided by meteorological agencies. Ideally, the model should predict air concentrations, water concentrations or deposition rates with time such that sensitive receptor exposure can be estimated, based on the following inputs: release flux; meteorological conditions; physical and chemical properties of the released substance; and topography.

A number of specialist environmental meteorological sections and organisations have been identified, with the capability to model the transport and deposition of pollutants during a chemical incident. These include the Department of Environmental Meteorology, Austria, and the Environmental Monitoring and Response Centre (EMARC), UK. For cross-border incidents differences in mapping or dispersion modelling capabilities can lead to difficulties. For example, if the country where the incident occurs does not have accurate mapping knowledge of other countries affected, dispersion modelling will be difficult, highlighting that it is essential to have close cross-border working.

Ideally validation/correction of modelling results using monitoring results will provide greater accuracy and reassurance. Additionally many countries use geographical information systems (GIS) to map at-risk sensitive receptor populations and ideally this should be integrated with dispersion modelling.

## Risk assessment and characterisation

The WHO Human Health Risk Assessment Toolkit: Chemical Hazards[7], considers the criteria required for undertaking appropriate exposure assessments and presents a generic road map for use in the exposure assessment process. An accurate and timely assessment of human health risks resulting from an acute chemical release is at the core of chemical incident preparedness and response[8], irrespective of the scenario or its underlying cause (accidental, intentional or geographical situation).

For cross-border incidents, information sharing can be hindered by: language barriers; differing operating procedures; training and preparedness; lack of informal or formal networks for communication; poor awareness of other countries' response structures and capabilities; differing availability of monitoring equipment and sampling rationales; use of differing dispersion models; and use of different risk assessment guidelines.

It is not always clear which organisation within a Member State's health structure takes the lead for exposure assessment and risk characterisation during an acute chemical incident or what guidance or trigger values – for example, to shelter or evacuate – it uses during decision making. For example, during emergencies there is an urgent need for responsible agencies to quickly decide which actions to take. Acute Exposure Reference Values (AERVs) can be useful in making these decisions, providing a rapid indication of the potential health consequences of specific chemical exposures in the population. However, at present, there are several sets of acute guidance values available within the global arena for use during health risk assessment. Each set has different methodologies for its derivation. With no internationally accepted set of values, neighbouring countries may issue differing public health guidance based on the AERVs used. Projects have been identified which are looking at addressing this issue.

## Progress

The CERACI project will be completed in 2012. The next phase of the study is a survey of experts to complete the information gathering phase for each Member State. For further information on the project, please see the project website www.rivm.nl/ceraci.

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Project website: http://www.rivm.nl/ceraci

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*For a full set of categorised references, please contact the author.*