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The impact on maritime transport of health threats due to biological, chemical and radiological agents, including communicable diseases

SHIPSAN Guidance

D7

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Dealing with chemical and radiological incidents on ships

Work Package Leader:

Public Health England

Contents

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1. Introduction

These are guidelines for dealing with chemical and radiological incidents on ships composed in the frame of Work Package 6, of the EU SHIPSAN ACT Joint Action. The EU SHIPSAN ACT Joint Action has received funding from the European Union, in the framework of the Health Programme (2008-2013).

SHIPSAN ACT Joint Action objective

The general objective of this action is to strengthen an integrated strategy and sustainable mechanisms at EU level for safeguarding the health of travellers and crew of passenger and cargo ships and preventing the cross-border spread of diseases, improving citizens' health security. Actions have focused on prevention, identification, assessment and link with existing mechanisms for response coordination to serious cross border threats to health caused by CBR agents. Actions will facilitate the implementation of EU legislation: a) Decisions 2119/98/EC, 2000/57/EC, linking SHIPSAN communication platform with existing systems, b) Directive 2010/65/EU, by supporting EMSA to implement Maritime Declaration of Health (MDH), c) Directive 2009/13/EC, by developing an outline of a risk assessment tool for occupational health on ships, d) the IHR, by supporting core capacities Annex 1 b by training, inspections, contingency planning guidance and IHR provisions for vessels and vessel operators including SSC.

The duration of the Joint Action was 45 months and 30 partners from 23 countries participated.

Guidance for dealing with chemical and radiological incidents

The Guidance has been developed to assist public health professionals, port health officers and other relevant agencies that may be notified of an incident of public health concern involving chemicals and/or radiation.

The document is intended to work alongside and complement arrangements that may exist within Member States (MS). Organisations and agencies responsible for responding to incidents involving chemicals and radiation may differ depending on the nature and location of the event, for example whether they occur at sea or at a port. The arrangements for assessing and managing the public health risk associated with these events will depend on the responsibilities assigned to different agencies and the operational arrangements that exist within each MS. The reader should refer to the relevant operational plans and arrangements within their own MS.

Structure

Section 1: General introduction

Section 2: Planning, preparedness and response

Section 3: Chemical Events

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Objectives

The guidance has been developed as a reference document to meet several inter-related objectives:

- To generate awareness amongst port health officers and other relevant agencies and those who might be notified of a chemical/radiological incident.
- To promote constructive dialogue between all stakeholders tasked with planning, preparing and responding to incidents.
- To identify under non-crisis conditions specific issues that could arise and to find practical solutions.

Application

The guidance can be considered solely as a reference document containing generic information on scientific, technical and other aspects relevant to dealing with chemical and radiological incidents. Examples of the most likely applications of the guidance are:

- In the preparation and pre-planning phase, under non-crisis conditions, to engage with public health agencies and other relevant stakeholders who are responsible for the development of local, regional and national plans.
- For training purposes and contingency planning.

Case studies are provided in annex A which describe events at sea or port where a public health risk assessment has been undertaken. The document includes a series of guidance notes (GN) in Annex B and C which provide additional supporting information and resources to assist in the planning, preparedness, response and recovery from chemical and radiological events.

Context

The strengthening of health security in Europe as well as at global levels is of paramount importance. Events involving chemicals and radiation can occur on land or at sea. The International Health Regulations 2005, inter alia EU Decision on Serious cross-border threats to health (1082/2013/EU) and EURATOM Treaty provide a public health framework that enables countries to better prevent, prepare and respond to public health events and emergencies, including those of potential international concern.

Chemical incident definition

A chemical incident may be defined as "an unexpected uncontrolled release of a chemical from its containment". A public-health chemical incident has been defined as "where two or more members of the public are exposed (or threatened to be exposed) to a chemical" (1).

Radiation incident definition

Any unintended event, including operating errors, equipment failures, initiating events, accident precursors, near misses or other mishaps, or unauthorized act, malicious or non-malicious, the consequences or potential consequences of which are not negligible from the point of view of protection or safety (2).

Public health framework

International Health Regulations 2005

The International Health Regulations 2005 represent an agreement between State Parties to work together for global health security. The Regulations provide a unique public health framework that enable countries to better prevent, prepare for and respond to public health events and emergencies of potential international concern. The IHR 2005 is not limited to any specific disease or manner of transmission, but covers all diseases and events of international public health concern, including those linked to biological, chemical and radiation hazards. The Regulations cover not only persons but also baggage, cargo, containers, goods, postal parcels, and human remains that are contaminated or carry sources of contamination, so as to constitute a public health risk (Article 1, IHR 2005 (3)).

Countries are required to strengthen their ability to detect, assess, notify and respond to public health threats, including those involving chemicals and radiation. IHR capacity requirements are defined in Article 5 as "the capacity to detect, assess, notify and report events"; in Annex 1A on "Core capacity requirements for surveillance and response"; and in Annex 1B on "Core capacity requirements for designated airports, ports and ground crossings". The requirements are described in guidance, and monitoring tools for example, Assessment tool for core capacity requirements at designated airports, ports and ground crossings (4) and more specifically for chemical events in IHR Chemical Events (5).

The IHR 2005 regulations permit countries to utilize existing national structures and resources to meet these requirements in relation to surveillance, reporting, notification, verification, response and collaboration activities; and activities concerning designated airports, ports and ground crossings. These arrangements should be documented in relevant national, provincial and / or local policies and plans (3).

A report published by WHO in 2012, described implementation of IHR 2005 and includes a regional analysis for Europe (6) (IHR implementation). The analysis of strengths and weaknesses are based on self-reported data submitted by States Parties. Specific country contexts and other sources of information, if available, may also need to be considered in identifying priorities within Member States.

Points of Entry

The IHR 2005 also includes specific measures required at ports, airports and ground crossings to limit the spread of health risks to neighbouring countries, and to prevent unwarranted travel and trade restrictions so that traffic and trade disruption is kept to a minimum.

The IHR 2005 define a point of entry as "a passage for international entry or exit of travellers, baggage, cargo, containers, vessels, goods and postal parcels, as well as agencies and areas providing services to them on entry or exit". Under the IHR 2005 countries are requested to maintain effective public health measures and response capacity at designated points of entry in order to:

- protect the health of travellers and populations;
- ensure that ports, airports and ground crossings as well as ships, aircrafts and ground transportation are in a sanitary condition; and
- contain risks at source, respond to emergencies and implement public health recommendations while limiting unnecessary health-based restrictions on international traffic and trade.

Based on a public health risk assessment, countries are required to designate Points of Entry (PoE). The number of designated points of entry varies from country to country. Whilst a certain level of capacity is desirable for all national points of entry, capacities outlined in Annex 1B of the IHR only apply to designated points of entry (3, 5).

At designated airports, ports and ground crossings, capacities are required at all times to:

- provide access to appropriate medical services, including diagnostic facilities, located so as to allow the prompt assessment and care of ill travellers, and adequate staff, equipment and premises;
- provide access, equipment and personnel for the transport of ill travellers to an appropriate facility;
- provide trained personnel for the inspection of vessels;
- ensure a safe environment for travellers using point-of-entry facilities, including potable water supplies, eating establishments, flight-catering facilities, public washrooms, appropriate solid and liquid disposal services and other potential areas, by conducting inspection programmes, as appropriate;
- provide as far as practicable a programme and trained personnel for the control of vectors and reservoirs in and near points of entry.

IHR 2005 requires countries to identify the competent authorities to carry out: (i) development of core capacities at designated points of entry; (ii) implementation at points of entry of appropriate levels of hygiene and sanitation as well as ensuring effective vector, rodent and environment control measures and procedures; and (iii) application of health measures at points of entry in affected areas (3).

Public Health Incidents of International Concern

Each country is required to assess events occurring within its territory and notify WHO by the most efficient means of communication available, by way of their National Focal Point, and within 24 hours of assessment of public health information, of all events which may constitute a public health emergency of international concern as well as any health measures implemented in response to these events. The responsibility of determining whether an event is within this category lies with the WHO Director-General and requires the convening of a committee of experts – the IHR Emergency Committee (7).

The term Public Health Emergency of International Concern is defined in the IHR 2005 as an extraordinary event which is determined to:

i. constitute a public health risk to other States (countries) through the international spread of disease; and
ii. potentially require a coordinated international response.

This definition implies a situation that: is serious, unusual or unexpected; carries implications for public health beyond the affected country's national border; and may require immediate international action. There is guidance available to assist national authorities to assess public health events that may require notification to WHO (7) (Guidance on IHR Annex 2).

National Focal Point

IHR 2005 requires a country to designate a National Focal Point (NFP), which is a national centre that is accessible at all times (7/24/365) for communication with the WHO IHR Contact Points. The structure and organization of the NFP is specific to each country (8). (Guidance on NFP)

Health security in Europe

The strengthening of health security in Europe as well as at global levels is of paramount importance. Protection of human health is an obligation under Article 168 of the Treaty on the Functioning of the European Union (9). Improving safety and security and protecting citizens against health threats is at the heart of European Union (EU) health policy.

Within the European Union there are arrangements in place for addressing serious cross border threats to health. These are outlined in EU Decision 1082/2013 (10) and the EURATOM Treaty (11). These provisions support the implementation of IHR 2005. Guidance notes describing the arrangements for the notification of chemical GN04 and radiation GN03 events of international concern can be found in Annex B.

Summary and Conclusion

- The strengthening of health security in Europe as well as at global levels is of paramount importance.
- IHR regulations cover all diseases and events of international public health concern, including those linked to biological, chemical and radiation hazards.
- IHR define core capacities for strengthening the capability of countries to detect, assess, notify and respond to public health threats, including those involved with chemicals and radiation.
- IHR regulations include specific measures at ports, airports and ground crossings to limit the spread of health risks to neighbouring countries, and to prevent unwarranted travel and trade restrictions so that traffic and trade disruption is kept to a minimum.
- Protection of human health is an obligation under Article 168 of the Treaty on the Functioning of the European Union (TFEU). Improving safety and security and protecting citizens against health threats is at the heart of European Union (EU) health policy.
- Countries can utilize national structures and resources to undertake surveillance, reporting, notification, verification, response and collaboration activities.
- Countries are required to designate national centres (NFPs) to communicate with European Commission and WHO. The structure and organization of the NFPs is specific to each country.

- Each country is requires to assess events occurring within its territory and notify the European Commission, as defined by the EU Decision on serious cross-border threats to health (1082/2013/EU) and the EURATOM Treaty and WHO by the most efficient means of communication available, by way of their National Focal Points, and within 24 hours of assessment of public health information, of all events which may constitute a public health emergency of international concern as well as any health measures implemented in response to these events.
- This guidance has been developed to generate awareness amongst port health officers and other relevant agencies of the need within Member States to plan, prepare and respond to incidents involving chemical and radiological hazards. The guidance document is intended to act as a repository of links and resources to signpost the reader onto articles, documents and legislation, relevant to the obligations of member states under the IHR and relevant EU legislation. The intention of the guidance is not to make the reader an expert, but is designed to provide an overview of dealing with chemical and radiological incidents and encourage further reading of more specific information.

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2. Planning, preparedness and response

Planning and preparedness

Planning and preparedness activities are key elements of IHR 2005 and are supported by requirements set out in EU legislation. These require the setting up and maintenance of an effective emergency response infrastructure (1, 2).

At the national level, procedures are required to ensure that the public health management of any incident is effective and comprehensive. At the local level, public-health authorities need to identify situations where incidents may occur, and assess the likely health risks to exposed people, property and the environment. The public health sector needs to be fully involved in the planning and preparedness process, including emergency plan development and implementation. Many organizations will be involved in the planning and response phases to an incident.

A list of organizations involved in the planning and management of chemical incidents are described in the WHO document Environmental Health in Emergencies and Disasters (chemical incidents, chapter 12, (3)).

In relation to chemical events, Article 4(2) of the European Decision 1082/2013/EU (2) on serious cross border threats to health, lays down the information on preparedness and response planning at a national level and requires that Member States provide this information to the European Commission every three years. Member States are also required to inform the Commission of substantial revisions of their national preparedness and response planning (Article 4(3)).

There is a template used to provide information to the Commission on preparedness and response planning in relation to serious cross-border threats to health, this information is defined in Implementing Decision 2014/504/EU. In order to avoid duplicate reporting, the information already provided by Member States to the World Health Organization (WHO) in relation to implementation of the core capacities for preparedness and response planning should be used for the purpose of reporting (4).

Planning at designated Points of Entry

IHR (2005) compliance requires that a public health emergency contingency plan (PHECP) is developed and maintained in designated Points of Entry (PoE), for responding to events that may constitute a public health emergency of international concern (PHEIC). WHO has developed a guidance document to assist the National Public Health Authority responsible for driving IHR (2005) compliance (5) (IHR 2005: A guide for public health emergency contingency planning at designated points of entry).

Public health emergency contingency plan

Public health emergency contingency plans for designated POE should:

- be flexible and adaptable to match a wide variety of public health contingencies, especially emerging diseases;
- ensure broad consideration of existing national and local plans, including public and private sector plans, laws, regulations and policies;
- plan to develop surge capacity on an "as required" basis so that it can be engaged when needed, rather than as a "permanent" function;
- ensure full respect for the dignity, human rights and fundamental freedoms of persons as per IHR (2005);
- place equal focus on readiness, response and recovery; and
- ensure budgeting for regular exercising, refreshing and maintenance of plans.

Planning and preparedness activities are key elements of IHR 2005 and EU legislation and require the setting up and maintenance of an effective emergency response infrastructure (1, 2).

Surveillance and detection

The effective collection of relevant information can inform and guide the public health response to all acute public health events including: unknown, unusual or unexpected disease or disease patterns as well as hazards that could potentially pose a risk to human health. All Member States have surveillance systems that detect outbreaks of infectious diseases. As a result of the emphasis in the IHR on strengthening this core capacity, many Member States have expanded these systems to include public health events caused by other hazards (5). Surveillance systems detect public health events through:

• Indicator-based surveillance: The routine collection of pre-defined information about diseases using case definitions.
• Event-based surveillance: The rapid collection of *ad hoc* information about acute public health events.

Guidance has been developed to provide national health authorities, and stakeholders supporting them, with information for implementing or enhancing the all-hazards early warning and response EWAR within national surveillance systems (6).

Poisons centres can play a particularly important role in the detection and response to a chemical event. A sudden high frequency of enquiries reporting a specific set of clinical features, and/or associated with a specific product or location, could be the signal of a chemical event. Most poisons centres engage in toxicovigilance, which is the active process of looking for emerging toxicological problems, where a link may be established between observed signs and symptoms and a specific chemical (7).

Organisations and agencies operating at PoE collect information relating to their respective duties. Some of this information is of interest to human public health, whilst other information related to hazards that are not known to adversely affect human health may be of lesser interest. It is therefore necessary to have clear criteria for defining the type of events that must be communicated to public health surveillance systems. The key guiding concept is the public health risk. The selection criteria for identifying events to be covered by surveillance should consider the requirements set out in IHR 2005, EU legislation and also the local context.

Guidance has been developed to strengthen communications and coordination between points of entry and the national health surveillance system (8). This identifies sources of information common to most PoE and also lists those sources available at ports, which include:

Source	Description
Maritime Declaration of Health	For ships on international voyages, the master of the ship, before arrival at its first port of call in territory of a State Party, shall ascertain the state of health on board, and, except when that State Party does not require it, the master shall, on arrival, or in advance, complete and deliver to the competent authority a maritime declaration of health (IHR article 37, IHR annex 8).
Ship Sanitation Certificates	Ships should be inspected regularly to certify that they are free of infection and contamination, including vectors and reservoirs (IHR article 39).
Ship's illness medical log	For each voyage, a standardised illness medical log recording all illnesses should be maintained daily by a designated crew member. It should include all cases of communicable diseases, syndromes, or other events that occurred during the voyage.

In accordance with IHR 2005, officers in command of ships, or their agent are required to inform the port control as early as possible any cases of illness indicative of a disease of an infectious nature or evidence of public health risk on board. This information must be immediately relayed to the competent authority for the port. In urgent circumstances, such information should be communicated directly by the officers or pilots to the relevant port authority (IHR article 28). Vessel operators are required to facilitate the provision of relevant public health information requested by the State Party (IHR annex 4, (6)).

If evidence of a public health risk is found on board a vessel and the competent authority is not able to carry out the control measures required, the affected vessel may nevertheless be allowed to depart, on condition that, at the time of departure, the competent authority informs its counterpart at the next known PoE of the evidence found and of the control measures required. In the case of a ship, this information shall be noted in the Ship Sanitation Control Certificate (IHR article 27). The next PoE must also be informed if any travellers have been placed under public health observation but allowed to continue their international voyage (IHR article 30, (6)).

States Parties are obliged to collect and handle health information containing personal identifiers in a confidential manner. However, States Parties may disclose and process personal data when it is essential for the purposes of assessing and managing a public health risk, subject to particular conditions (IHR article 45, (6)).

Public health response

Annex 1 of the IHR 2005, asks countries to utilize existing national structures and resources to meet their core capacity requirements for response and coordination.

- At the local community level and/or primary public health response level, the necessary capacities include those: (i) to detect events involving disease or death above expected levels; (ii) to report all available essential information immediately to the appropriate level of health-care response; and (iii) to implement preliminary control measures immediately.
- At the intermediate public health response levels, the necessary capacities include those to: (i) confirm the reported events and to support or implement additional control measures and (ii) to assess reported events immediately and, if found urgent, to report all essential information to the national level.
- At the national level, the necessary capacities are those required to: (i) assess all reports of urgent events within 48 hours and (ii) to notify WHO immediately through the IHR (2005) National Focal Point (IHR/NFP) when the assessment indicates the event is notifiable (Annex 2 of the Regulations). European reporting for the notification of a serious cross border threat to health is documented in GN03 and GN04.

At the national level, capacities are also required: i) to determine rapidly the control measures needed to prevent domestic and international spread; ii) to provide support through specialized staff, laboratory, analysis of samples and logistical assistance; iii) to provide on-site assistance as required to supplement local investigations; iv) to provide a direct operational link with senior health and other officials to approve rapidly and to implement containment and control measures; v) to provide direct liaison with other relevant government ministries; vi) to provide links with hospitals, clinics, airports, ports, ground crossings, laboratories and other key operational areas for the dissemination of information and recommendations received from WHO/EU; vii) to establish, operate and maintain a national public health emergency response plan; and viii) to provide the foregoing on a 24-hour basis.

Summary and conclusion

- IHR (2005) compliance requires that a public health emergency contingency plan (PHECP) is developed and maintained in designated Points of Entry (PoE), for responding to events that may constitute a public health emergency of international concern (PHEIC).
- Planning and preparedness activities are key elements of IHR 2005 and EU legislation and require the setting up and maintenance of an effective emergency response infrastructure (1, 2).
- Annex 1 of the IHR 2005 asks countries to utilize existing national structures and resources to meet their core capacity requirements for response and coordination.

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3. Chemical Events

Introduction

A chemical incident may be defined as "an unexpected uncontrolled release of a chemical from its containment". A public-health chemical incident has been defined as "where two or more members of the public are exposed (or threatened to be exposed) to a chemical" (1).

Events affecting Member States may arise from technological incidents, accidents, natural disasters, conflict and terrorism, polluted environments, and contaminated foods and products. (2, 3). Chemical incidents that have the potential to affect communities are described in the Manual for the Public Health Management of Chemical Incidents (4). These include:

- Sudden event involving outdoor release of gas or vapour
- Sudden event involving outdoor release of an aerosol
- Sudden evident release to contact media other than air
- Fire in a large building
- Explosion
- Disease outbreak

Examples of incidents on ships and at ports may include:

- Fires on ships and at ports
- Explosions on ships and at ports
- Damage to the ship including mechanical and structural failures that have caused pollution to enter the environment or the loss of cargo
- Collisions between ships causing pollution to enter into the environment or loss of cargo
- Impaired vessel stability can cause the vessel and cargo to sink and pollute the environment
- Grounding can damage a vessel, impair the vessel stability and pollute the environment.
- Silent release

Table 1 provides examples of chemical incidents of public health significance that have occurred on ships and at port. These are described as case studies in Annex A.

Table 1. *Examples of chemical events of public health significance*

Case study		Date
1	MSC Flaminia – public health assessment and contribution to the place of refuge assessment.	**July 2012**
2	MSC Napoli - Beached after a heavy storm, the cargo including oil and hazardous and noxious substances (HNS) spilled into the sea	**January 2007**
3	Tanjin, China - Events at port: Explosion and large-scale chemical release	**August 2015**
4	Port Santos, Brazil - Explosion and chemical release at port	**January 2016**
5	Exposure at port: Incident involving fumigants used during a voyage	**December 2012**

When assessing the risk posed by chemical hazards consideration should be given to sources of chemicals on ships and at port.

At port and points of entry (PoE)

The ARCOPOL 'HNS Prioritisation Toolkit' described in GN07 enables users to determine the highest risk chemicals, prioritise potential acute public health risks associated with incidents involving maritime transport of hazardous and noxious substances[1] (HNS)(5) in terms of their behaviour, human health impact and the quantities and frequency shipped.

A tool has been developed in GN08 to allow public health authorities working in collaboration with colleagues at ports and Point of Entry to prepare an inventory of significant chemical hazards at a port. Some ports may have a number of individual businesses operating at the port with some having transit storage of potentially hazardous and flammable materials within warehouses. Although there are regulatory frameworks that manage the storage, usage and transport of materials if there is an incident at the port having information about these facilities, collated in one document, and could inform any public health risk assessment.

Having identified the potential chemical hazards of concern, the chemical recovery tool described in GN09 can be used as a planning tool. This will help to determine what resources may be required to limit the spread of contamination and recover from an incident.

[1]Any substance other than oil which, if introduced into the marine environment, is likely to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

These tools and resources set out in GN07, 08, and 09 can be used in a non-crisis situation to assist with contingency planning as outlined in Chapter 2, within Member States and at port and Points of Entry.

Chemicals on ships

Estimates suggest that around 2000 types of chemicals are regularly transported by sea either in bulk or packaged form (5, 6). Cargo is transported on a variety of different vessels types, as described in the SHIPSAN Guidance on Transport of Different Cargo Types (7).

The international mechanism regulating the transport of HNS at sea is derived from legal instruments, which have been developed within the framework of the International Maritime Organisation (IMO). These include the International Convention for the Safety of Life (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). The maritime response to an oil and HNS incident requires specialised, trained personal and equipment. Port state control routinely responds to these events. These are described in the EMSA Action Plan for HNS Pollution Preparedness and Response (8).

In addition, chemicals may also be used on some vessels for fumigation; this is to ensure that cargo transported by sea arrives in good condition. The type of fumigant used will depend on the cargo being shipped, but a range of products may be fumigated to protect them from pests, for example food, wood, medicines, textiles, mattresses, shoes and furniture. The types of fumigants used vary according to the product being fumigated. Guidelines published by the International Maritime Organization (IMO) make recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo transport units. However, if fumigants are not handled safely, they may pose a health threat to those handling the cargo and those conducting the fumigation process as well as to the environment and persons in the country where the products are imported. The use and risks of fumigants on cargo ships is described in SHIPSAN Newsletter article 15 (July, 2015).

Ships are required to provide various forms of information prior to arrival and/ or departure from a port, as agreed under the International Maritime Organization Convention on the Facilitation of International Maritime Traffic (FAL Convention, 1965). These provide information about the HNS transported on the vessel such as the Dangerous Goods Manifest. Information about this and other FAL documents are detailed in GN06.

When a chemical incident, on a ship or at port, presents a potential or actual risk to public health there is a need to engage with the public health authority within Member States. This is to ensure that a public health risk assessment is undertaken and measures identified to protect public health are implemented. The assessment will allow the national public health authority to consider whether an incident represents a serious cross border threat to health or public health emergency of international concern (PHEIC), and act accordingly as outlined in Chapter 1.

Public Health Risk Assessment

In the event of a chemical incident risks to human health and the environment need to be evaluated, this involves identifying the source of contamination and the pathways how a chemical can come into contact with people or other potential receptor(s). For many incidents the cause may be obvious and the incident can be described by what actually happened such as a fire, spill or explosion. However, for other incidents the event may not be quite so apparent or the contamination may be the result of more than one event.

The physicochemical properties of a chemical, described in GN05 can be used to define the behaviour of chemicals and are a useful aide in the risk assessment of chemical releases. Contaminants released into the environment may be subject to a complex set of processes, which include various forms of transport and cross-media uptake. For example, when one environmental media (e.g. air) is contaminated there is always the potential for secondary (indirect) contamination of another medium (e.g. water) if the contaminant source is not contained or mitigated in a timely manner.

Different chemicals may share similar physiochemical properties, which may allow a broad strategy with a concise number of options to be considered for dealing with chemical incidents, even for a mixture of chemicals.

Chemical incidents affect people in a number of ways, for example the effects of explosion or fire as well the toxic effects of chemicals. Chemicals may enter the body through the skin (dermal contact), eyes, lungs (inhalation) or digestive tract (ingestion). The rate of absorption via these paths is different for different chemicals, for example it can be affected by the concentration of the chemical involved, the length of time that the chemical is in contact with the body etc. Within the body itself, the effect depends upon the actual toxicity of the chemical and on the biologically effective dose. The way the dose is accumulated in the target tissue can make a difference to its impact. The toxicity and toxicological properties of a chemical and its reaction or degradation by-products will influence the response and will need to be assessed on a site and incident-specific basis (1).

Source, pathway, receptor

For an individual to be exposed to a substance there must be a pathway linking the source to the person. This is often described as the **Source – Pathway – Receptor** model.

Information about a substance (source), its fate and behaviour in the environment (pathway), and the population at risk (receptor) will need to be gathered, analysed and assessed to determine the risk to human health and the environment.

- What is the **source** of the contamination? E.g. Chemical cargo on a ship, transporting chemicals, fumigants.
- How have people been exposed (**pathway**)? E.g. Air, water, food, soil, consumer products.
- Who is likely to be affected (**receptor**)? E.g. Ship crew, workers at port, nearby communities, visitors.

Incidents associated with the release of chemicals may develop quickly and require inter-agency liaison, public health risk assessment and evidence-based decision making. A chemical event in one country can lead to health consequences in another country; for instance, the release of a chemical plume in one country could travel across borders and affect the population of a neighbouring country. Any event requiring a public health risk assessment should be evaluated on a site and incident specific basis.

The prevention and mitigation of chemical incidents and their impact on health requires specialists from many backgrounds. In the event of a chemical incident it will be necessary to access relevant expertise, for example to assess public health risk and determine the fate and transport of chemicals in the environment (2). Further examples of expertise include exposure modelling, biological and environmental monitoring, clinical toxicology, diagnosis and treatment and health surveillance, as described in section 3 of IHR Chemical Events, 2015 (9)

Rapid Risk Assessment

A manual has been developed to assist Member States undertake a rapid risk assessment of acute public health events from any type of hazard. The Rapid Risk Assessment of Acute Public Health Events (10), is aimed primarily at national departments with health protection responsibilities, National Focal Points (NFPs) for the IHR. It may also be useful to others who join multidisciplinary risk assessment teams, such as clinicians, field epidemiologists, veterinarians, chemists, food safety specialists.

This systematic approach outlined in the document to helps to:

- identify evidence-based control measures
- rank the suitability and feasibility of control measures
- ensure that control measures are proportional to the risk posed to public health

Because risk is assessed repeatedly during an event, risk assessment offers authorities an opportunity to adapt control measures as new information becomes available.

Risk Assessment

The risk assessment process generally begins with problem formulation and includes four additional steps: i) hazard identification, ii) hazard characterization, iii) exposure assessment and iv) risk characterization. This process is described by the World Health Organisation (11). The four key stages of risk assessment are outlined below:

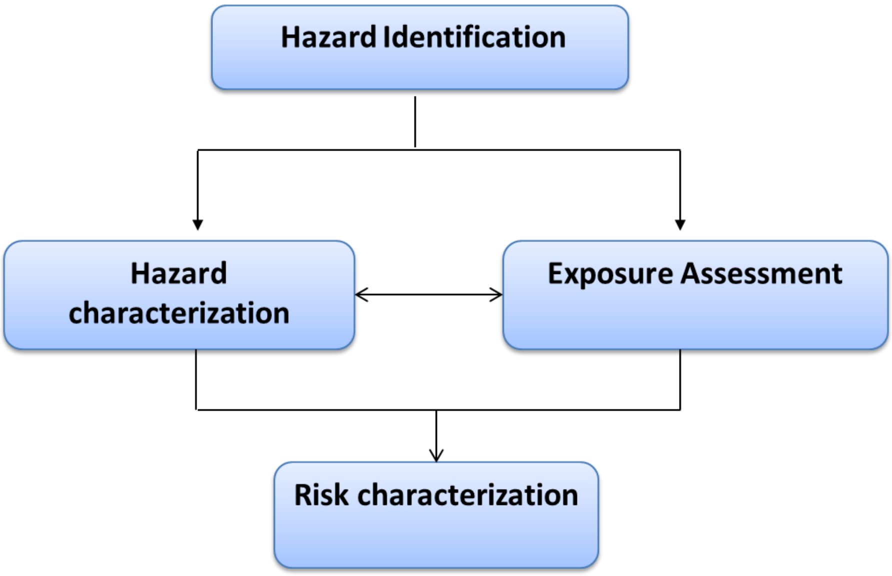

Figure 1. The risk assessment process. Source: WHO Risk Assessment Toolkit (11).

Risk assessment informs risk management and risk communication (e.g. advice to the public to reduce the burden of disease); therefore, exposure assessment is important to subsequent risk management and risk communication efforts. From a public health perspective, the priorities are to protect people from harm and ensure treatment is provided to those potentially exposed or at risk. During cross-border incidents it is important to be aware of the similarities and differences in approaches to exposure assessment between Member States. Incident plans within Member States should be consulted to determine the preparedness, resilience and response arrangements, including the risk assessment of chemical events of public health significance. The European Commission has established a mechanism to ensure the rapid exchange of information in instances where it is assessed that there may be a wider health impact to neighbouring countries as defined by Decision 1082/2013/EU and the International Health Regulations (4) .

A risk management platform (Early Warning and Response System, EWRS) is used to communicate alerts for all public health hazards (excluding radiation), which meet a specific threshold which indicates that they present a serious cross border threat to health, as defined by Decision 1082/2013. These reports are made by the designated competent public health authority at the national level responsible for alert notification and determining risk management measures. Following an alert made via the EWRS platform, the EU Health Security Committee (HSC) or EC may request an independent rapid risk assessment, as outlined in GN04. In addition, a risk assessment tier, the Rapid Alerting System for Chemicals (RASCHEM), which is owned and run by the European Commission, has been developed for use by poison control centres and public health authorities so that they can rapidly communicate technical information on chemical incidents and poisonings. See GN04 for further information.

Further Resources

ECHA - chemical classification database	https://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
CDC NIOSH pocket guide to chemical hazards	https://www.cdc.gov/niosh/npg/
WHO International Programme on Chemical Safety (IPCS) - INCHEM inventory	http://www.inchem.org/
Compendia of chemical hazards: composed of i) general information on chemicals ii) a toxicological overview iii) Incident management	https://www.gov.uk/government/collections/chemical-hazards-compendium
WHO Human Health Risk Assessment Toolkit: Chemical Hazards (2010).	http://www.who.int/ipcs/methods/harmonization/areas/ra_toolkit/en/
Rapid Risk Assessment of Acute Public Health Events (2012)	http://apps.who.int/iris/bitstream/10665/70810/1/WHO_HSE_GAR_ARO_2012.1_eng.pdf
UK Recovery Handbook for chemical incidents.	https://www.gov.uk/government/collections/recovery-remediation-and-environmental-decontamination

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3. Duarte-Davidson R., Orford R., Wyke S., Griffiths M., Amlôt R., Chilcott R. Recent advances to address European Union Health Security from cross border chemical health threats. *Environ Int*. 2014 Nov; 72:3-14. Available from: http://www.sciencedirect.com/science/article/pii/S0160412014000075

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5. IMO - Protocol on preparedness, response and co-ordination to pollution incidents by hazardous and noxious substances (OPRC - HNS), 2000. Available from: http://www.imo.org/en/KnowledgeCentre/ShipsAndShippingFactsAndFigures/TheRoleandImportanceofInternationalShipping/IMO_Brochures/Documents/4%20page%20flyer%20-%20OPRC-HNS.pdf

6. IMO (2010) – Are HNS spills more dangerous than oil spills? http://www.imo.org/en/OurWork/Environment/PollutionResponse/Documents/White%20paper%20Interspill%202006%20R%20and%20D%20Forum.pdf

7.SHIPSAN WP9 report - Transport of Different Cargo Types.

8. EMSA (2007) - Action Plan for HNS Pollution Preparedness and Response, available from: http://www.emsa.europa.eu/hns-pollution/123-hns-pollution/260-action-plan-for-hns-pollution-preparedness-and-response.html

9. WHO (2015) - International Health Regulations and Chemical events, available from: http://apps.who.int/iris/bitstream/10665/249532/1/9789241509589-eng.pdf

10. WHO (2012) - Rapid Risk Assessment of Acute Public Health Events, available from: http://apps.who.int/iris/bitstream/10665/70810/1/WHO_HSE_GAR_ARO_2012.1_eng.pdf

11. WHO (2010) - WHO Human Health Risk Assessment Toolkit: Chemical Hazards. Available from: http://www.who.int/ipcs/methods/harmonization/areas/ra_toolkit/en/

4. Radiation Hazards

There are two types of radiation: non-ionising radiation such as visible light, signals from a mobile phone and radio waves; ionising radiation such as cosmic rays, radiation emissions from uranium ore and other radioactive material and high frequency waves in the electromagnetic spectrum, e.g. X-rays and gamma rays. When passing through matter ionising radiation deposits sufficient energy to be able of removing an electron from stable atoms and molecules. This process, called ionisation, can cause damage to living matter which may cause harm to people's health depending on the radiation dose received. For more information on the basic concepts of radiation see GN01 (basic concepts of radiation).

Radiation or radioactive material is used in various facilities and activities including agriculture, general industry, electricity production, medicine and research, as well as for military purposes. In addition to radioactive material produced in the nuclear industry, a great number of radioactive sources are produced around the world for use in other industrial sectors, medicine and research (1, 2). Radiation events, both involving the civil and military nuclear industry and radioactive sources have occurred over the years; these have resulted in significant exposure and loss of life in a number of countries.

The transport of radioactive material by sea is rigorously regulated to ensure that potential risks from radiation events are minimised. Any shipments of radioactive material by sea must comply with international, European and national regulations of the originating country and also the country of destination see GN02 (international legislation for carriage of dangerous goods on ships). The occurrence of radiological incidents on a ship leading to the exposure of individuals to radiation which has the effect of causing a public health threat is rare. The probabilities and severities of ship collisions and ship fires are small and any radiation doses that might be received as a result of an accident would be lower than normal background doses due to the regulations ensuring the safe transport of any radioactive material (3).

Planning and preparedness activities are key elements of IHR 2005 and IAEA transport regulations (2) require the setting up and maintenance of an effective emergency response infrastructure, should a radiation event occur during the transport of radioactive material by sea. IHR (2005) compliance requires that a public health emergency contingency plan (PHECP) to be developed and maintained in designated Points of Entry (PoE), for responding to events that may constitute a public health emergency of international concern (PHEIC) including radiation incidents. In addition WHO has developed a guide document to assist a National Public Health Authority responsible for driving IHR (2005) compliance, but the document can also be used as a reference document (4) (IHR 2005: A guide for public health emergency contingency planning at designated points of entry).

The number of radiation events on board ships has been very low and because of the impact and interest normally raised by radiation events, emergency and preparedness plans are usually kept under review to take account of lessons learned.

IHR Annex 1 core capacity requirements for ports

For responding to events that may constitute a public health emergency of international concern, designated airports, ports and ground crossings should have the capacities to:

- provide appropriate public health emergency response by establishing and maintaining public health emergency contingency plan, including the nomination of a coordinator and contact points for relevant points of entry, public health and other agencies and services;
- provide assessment of and care for affected travellers or animals by establishing arrangements with local medical and veterinary facilities for the isolation, treatment and other support services that may be required;
- provide appropriate space for the assessment and if required, quarantine or suspected traveller, to interview suspect or affected persons;
- provide for the assessment and if required, quarantine of suspected travellers, preferably in facilities away from points of entry;
- apply recommended measure to disinsect, derat, disinfect, decontaminate or otherwise treat baggage, cargo, containers, conveyances, goods or postal parcels including, when appropriate at locations specially designed and equipped for this purpose;
- apply entry or exist controls for arriving and departing travellers; and
- provide access to specially designed equipment and to trained personnel with appropriate personal protection for the transportation of travellers who may carry (infection or) contamination.

In the event that a ship carrying a radioactive source is concerned about exposure or potential exposure to radioactive contamination, the primary objective will be to contact the nearest competent Port Authority or emergency services for assistance. Owing to the nature of adverse health effects that may arise following exposure to radioactive sources, it may not be immediately apparent to the Medical Officer on a ship or Master of a vessel responsible for notifying competent authorities that any observed public health effects are the result of exposure to a radioactive source on the ship.

IHR surveillance capabilities

The IHR states that each State Party shall develop, strengthen and maintain the capacity to detect, assess, notify and report events in accordance with the IHR Regulations. In relation to radiation incidents, in some countries at certain ports of entry systems for detecting radioactive materials have been installed.

Notification about health effects arising from radiation incidents may therefore be reported using the same procedures as that described for the notification following chemical incidents on a ship, i.e. notification through the Maritime Declaration of Health (MDH) or by the indirect notification of competent authorities from other relevant agencies or organisations. Unless there is an obvious reason for a ship to suspect the exposure or potential exposure or contamination from a radioactive source (e.g. deliberate or accidental damage to the integrity of a clearly marked/packaged radioactive source), any potential illness of passengers or crew on board a ship that has been caused by exposure to a radioactive source should be declared in the MDH in compliance with Article 37 of the IHR (5). The MDH presented by a ship includes radiological hazards as well as threats of unknown origin.

Once a ship carrying a radioactive source notifies a Competent Authority about the threat or potential threat of radiation exposure to the passengers or crew of a ship, the response to the event will be coordinated at a national, European or international level depending on the pre-defined roles and responsibilities and location and severity of the accident, see GN 03 (notification of radiation incidents of international concern).

Depending on the nature of a radiation incident (in cases where it has been confirmed to be the source of contaminant by the ship), various factors should be considered by the competent authority to aid their determination of the seriousness of the incident and the need for notification to National Public Health Authorities. These factors include the number of fatalities that have resulted from the incident, number of hospitalised cases, the need for evacuation, potential disruption of essential utilities or the consideration of the incident spreading to immediate or cross border territories.

IHR requires member states to have developed national core capacities to respond to radiation emergencies. Competent Authorities will notify relevant Public Health Authorities who will provide radiation experts to investigate and manage any risks posed by the incident reported. Where these experts have assessed the situation to be a PHEIC, the incident will be reported by the National Focal Point within that Member State to WHO. Once the notification has been received by WHO if it is considered that the incident "involves the competency of the IAEA, WHO shall will immediately notify the IAEA" (5).

The International Atomic Energy Agency (IAEA) facilitates systems of notification, warnings and assistance (6, 7). The IAEA can be called upon to provide assistance if the country does not have the infrastructure to deal with the emergency. In order to provide support to a country to deal with an emergency a number of networks that can assist in a radiation emergency situation have been set up; these would deal with emergencies on land or sea.

References

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http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1570_web.pdf

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7. IAEA (1986b). Convention on assistance in case of a nuclear accident or radiological emergency. IAEA, Vienna. Available from:
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Annex A

The case studies below are actual events involving chemical, radiation and other hazards. They include a variety of events on ships and ports and at points of entry.

Cases study

Title: MSC Flaminia – public health assessment and contribution to the place of refuge assessment.

Description of event:

On 14 July 2012 the cargo vessel MSC Flaminia was mid-Atlantic on its way from the US to Antwerp, Belgium, when an explosion and fire occurred on board. The crew attempted to tackle the blaze but were forced to evacuate. The incident resulted in three injured crew and two fatalities. A Dutch salvage team was appointed to deal with the vessel, which brought the fire under control by 24 July, and proceeded to tow the casualty towards Germany, which would involve passage through the English Channel.

The vessel, nearly 300 m long and 40 m wide, was almost fully laden at the time of the accident, including 149 containers of dangerous goods. The EU Directive 2009/17/EC1 requires the Secretary of State's representative (SOSREP) to nominate possible places of refuge (PoR) for vessels in need of assistance along the English coast when necessary. Due to the nature of the cargo on board, the process of identifying PoR required assessments of the risks not only to the marine environment, but also to public health, should the vessel come near the shore.

Human health implications

Once the ship was stabilised the greatest concern was to the shoreline human population due to the emissions to air of HNS from damaged containers on board. MSC Flaminia was originally laden with 149 containers of dangerous goods, the initial explosion destroyed some of the cargo and therefore details of the remaining hazardous goods on board and their containment were uncertain. Some containers only held residues rather than being full of the toxic substances.

A rapid assessment was performed using the cargo manifest, by initially sorting substances by quantity and considering air quality thresholds of effects where available. However there were also broad generic groupings that could not be screened in this manner.

Environment Agency undertook dispersion modelling of hazardous emissions from a theoretical worst case release (entire release in pure form) and concluded that the vessel should not be brought closer than 8 nautical miles to ensure chemical concentrations in air did not exceed toxicity thresholds for populations on land.

A more realistic release scenario was requested by the Secretary of State Representative (SOSREP) and therefore when it was deemed safe to board the vessel, short term air sampling was undertaken by the salvers and provided reassurance that there were no significant emissions at that time despite being limited sampling time and sample numbers.

Key points:

- A rapid dynamic public health risk assessment based on the list of available chemicals (manifest) assisted communication and informed recommendations.
- Shoreline receptors were mapped and information was fed into the risk assessment and communicated to multi agency partners.
- Environmental monitoring results were assessed and comparisons made with Acute Exposure Guideline Levels (AEGLS) or Environmental Assessment Levels (EAL).
- Tools are available to support the gathering of information and undertaking the assessment (e.g. see GN07)

Reference and sources:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/348826/CHaP_report_24_2.pdf

Cases study

Title: MSC Napoli

Description of event:

MSC Napoli suffered flooding to the engine room during a force 8 gales in the English Channel on Thursday, 18 January 2007. The 26 crew abandoned ship and were safely rescued from their lifeboat by helicopter. The ship began to break up due to heavy seas. This created a significant risk of pollution and could have affected some of the UK's coastline. There were over 3,500 tonnes of heavy fuel oil on board and 1,500 tonnes of diesel together with a very mixed cargo, some of which was highly toxic.

A multi-agency strategic coordinating group was established, led by UK maritime agency (Maritime Coastguard Agency). A risk assessment of ship cargo was undertaken by UK maritime agency using the ships manifest obtained from Rotterdam port. Meanwhile, the oil was contained with booms, which were also placed at the mouths of local rivers. Fishermen were excluded from the area. Models were created of the dispersal of spilled chemicals and released containers. Beaches were closed, staff informed to stay away from broken containers and report any identified hazardous material. There was continued contact with Public Health in case of any public exposure.

Key points:

- There were a wide range of chemicals on board the vessel. This presented a high risk of exposure to the public if washed ashore, and could impact on the environment and food chain. Obtaining information about the cargo, via the ship's manifest allowed a risk assessment to be undertaken.

- Mixtures of chemicals are harder to deal with especially when some are unknown.
- It is important to ensure a coordinated response and maintain communicating between land and sea-based agencies particularly if pollution impacts on the shoreline.

Reference and sources:

PHE Chemical Hazards and Poisons Report Issue 14

https://www.gov.uk/government/publications/chemical-hazards-and-poisons-report-issue-14

Cases study

Title: Tanjin, China - Events at port: Explosion and large-scale chemical release

Description of event:

On 12th August 2015, two explosions took place at a warehouse in the port of Tianjin, northern China. Tianjin is a significant industrial port near Beijing and is a gateway for goods (including metals and steel) to and from the capital and China's industrial north.

The warehouse contained hazardous and flammable chemicals include calcium carbide, sodium cyanide, potassium nitrate, ammonium nitrate and sodium nitrate. However, as it was a transit point and records were destroyed, it was unclear what was present at the time of the incident and custom records had to be used. Firefighting at the port was underway before the explosions occurred. Responders were not unaware that the chemicals stored on the site could they react with water.

The blast occurred late at night and was felt several kilometres from the port. The area next to the port was densely populated and the closest residential properties were 600m away and unaware of the hazards at the nearby site.

Investigations into the incident concluded that warehouses were located closer to homes than permitted, they stored much more hazardous material than authorised and that there were a number of failures by management and regulators. The investigation concluded that the accident was caused by spontaneous combustion of a container of dry nitrocellulose. The second larger explosion was estimated to involve 800 tonnes of ammonium nitrate.

Within the community, toxic gases were detected in the atmosphere and in the sewers and with the first rains 6 days after the incident white chemical foam covered the streets and the public reported burning sensations and rashes. Eight days after the incident a massive fish kill was reported and concerns were raised about water contamination. There was no consistency in messages to the public from agencies.

165 people died and 798 were injured and 8 remain missing. More than 720 people were taken to hospital with 60 either critical or seriously injured and several thousand people living near the port had to leave their home and stay in evacuation centres.

Key points:

- Explosions and fires can be devastating and demonstrate the potential impact of a chemical incident.
- There is a need to secure information about chemical hazards. Tools are available to support the collection and collation of information at ports in a non-crisis situation. This can be used to support an emergency response (e.g. see GN08).

Reference and sources:

http://www.bbc.co.uk/news/world-asia-china-35506311
http://www.bbc.co.uk/news/world-asia-china-33844084
http://shanghaiist.com/2016/02/05/tianjin_explosions_report_released.php

Case Study

Title: Port Santos, Brazil - Explosion and chemical release at port:

Description of event:

On the 15th of January, 2015, an explosion occurred in the port of Santos, Brazil, resulting in fires and the release of a toxic chemical plume which hospitalised close to 200 people with breathing difficulties. The explosions and fires were thought to have been started when containers of chemicals, including chloric acid and dichloroisocyanurate (used as a cleaning and disinfecting agent), which came into contact with rainwater and caused an explosive reaction. The resulting fire then spread and damaged further containers.

The smoke produced by the fires covered the whole port of Santos, in Sao Paolo state, which is the country's largest and busiest container port. In addition to Santos, the smoke also spread to neighbouring cities Guaruja, Cubatao and Sao Vicente, putting thousands more at risk. The port and areas of the city were evacuated and nearby residents were told to stay inside with the windows and doors closed while the fires were extinguished. Residents were also warned to stay out of the rain, due to the risk of burns from the chemicals released into the atmosphere.

As a precaution the port's operations were temporarily suspended, halting ship movements while the fires were extinguished. The incident led to the owner of the storage facility where the fire occurred, being fined for over $2.5 million.

Key points:

- Chemical events have to the potential for widespread public health impacts and disruption to port activities.
- Knowing which chemicals were involved allowed a rapid response, including timely public risk communication (staying indoors, close windows, avoid going out into the rain).

Reference and sources:

http://www.bbc.co.uk/news/world-latin-america-35336700 http://www.newsmaritime.com/2016/chemical-explosion-at-container-terminal-closed-port-of-santos/ http://www.joc.com/port-news/south-american-ports/port-santos/warehouse-operator-where-santos-port-fire-began-fined_20160127.html http://www.upi.com/Top_News/World-News/2016/01/17/Brazil-chemical-fire-containing-chloric-acid-extinguished-after-two-days/3421453039414/

Cases study

Title: Events at port: Fumigants (incident involving chemicals used during a voyage)

Description of event:
On 5 December 2012, a fumigated cargo of maize was being discharged from a general cargo vessel Arklow Meadow, whilst at port. It became apparent that the fumigant was still active; fumigant retainers that had been removed from the cargo holds started to smoke. Cargo operations were immediately stopped and the crew were evacuated to the quayside. The local fire service was quickly on the scene and established a 50 metre cordon around the vessel. Houses and retail premises surrounding the port area were also evacuated by the police as a precautionary measure. The fumigant was identified as aluminium phosphide. Eight of the 11 crew members and a dock worker, who had potentially been exposed to phosphine gas, were taken to hospital for observation and decontamination. The recovered fumigant retainers were neutralised by immersing them in water. It took 5 days for the level of phosphine gas in the vessel's cargo holds to reduce to a safe level.
Reference and sources: Marine Accident Investigation Branch (MAIB) report - https://assets.digital.cabinet-office.gov.uk/media/547c6f42ed915d4c0d000023/ArklowMeadowReport.pdf

Cases study

Title: Radiation: Yeoman Bontrup

Description of event
On 2 July 2010, after arrival at Glensanda Quarry on Loch Linnhe, Argyll and Bute, Scotland, a major fire broke out on board a self-unloading bulk carrier whilst the cargo hopper was being repaired. The crew tackled the fire but it quickly spread to the cargo handling area and into the accommodation area. From there it spread to the engine room, by heat transfer through the bulkheads and via an

open door, and into the steering gear compartment which held oil, grease and chemicals. Here it caused a large explosion that blasted the entire poop deck into the air which landed on the funnel deck.

Fitted to the cargo hopper were silometer devices that contained cobalt-60; the devices were used to detect excessive build-up of cargo in the self-unloading system. These had not been used for 10 years and the outer steel shells of the source containers were in extremely poor condition, there were no padlocks fitted but the operating levels were in the "off" position. The sources inside were still active. During the fire, the lead shielding around the port side detector melted exposing the radioactive source container inside.

Onboard were 31 crew, one superintendent and three visitors. There were two cases of minor smoke inhalation, one of which also suffered bruising. The damage to the ship was significant fire damage and severe distortion to areas of the ship, including the self-unloading system.

The Glensanda Quarry harbourmaster was informed.

Key actions taken

- Ship's master ensured that all fire pumps were running.
- Ship's master contacted key quarry personnel and the harbourmaster to alert them of fire.
- The Glensanda Quarry harbourmaster was asked to request fire-fighting assistance.
- The harbourmaster contacted Clyde Coastguard who alerted the Highlands and Islands Fire and Rescue Service (HIFRS) and the ambulance service.
- The master advised the Designated Person of the situation.
- When it became apparent that the fire was out of control, the master evacuated the ship.
- Some of the crew were suffering from smoke inhalation and one had sustained injuries from a fall.

Key points of incident

- Immediate priority is the preservation of life - all crew were safe
- Potential risk of contamination or direct irradiation of crew from exposed radioactive sources.
- Initial priority was to remove the radioactive sources

Responsibilities of the relevant authority

- The Highlands and Islands Fire Rescue Service (HIFRS) Silver Command was set up
- The HIFRS Incident Command at Inverness was set up
- The Incident Command requested advice from the HIFRS Marine Incident Response Group
- The Northern Constabulary Gold Command was established to support Silver Command.
- Links were made to the Highland Council Emergency Planning Officer, Scottish Ambulance Service and the Secretary of State's representative for salvage and counter pollution.

Silometers

- Two radioactive silometers were used to monitor the cargo in the hopper.
- They were mounted on 'D' deck level close to the hopper.

- Both the port and starboard silometers were fitted with a cobalt-60 radioactive source surrounded by lead encased in steel.
- A lever was turned to open an internal shutter allowing uni-directional measuring gamma radiation to be emitted through a narrow ray path through the hopper to the detector for processing by the electronic controller.
- Following the fire, both source containers were still fixed to their supporting brackets. There was evidence of build-up of surface corrosion. The starboard silometer source container was intact following the fire. The port silometer source container was heavily corroded leading to widespread corrosion to the steel casing. The fire had apparently melted the lead shielding.
- Subsequently, the source containers were removed from the ship.

References

Report on the investigation of the fire and explosion on board ***Yeoman Bontrup***, Glensanda Quarry, Loch Linnhe, Western Scotland, 2 July 2010. MAIB, Report No 5/2011.
https://www.gov.uk/maib-reports/fire-and-explosion-on-bulk-carrier-yeoman-bontrup-at-glensanda-quarry-loch-linnhe-scotland

Cases study

Title: Radiation: Potable water from ships around Japan

Description of event:

Following the earthquake and tsunami that hit Japan in March 2011, SHIPSAN received an enquiry in August 2011 from the company of a cruise ship about the safety of producing potable water from sea water in the coastal areas of Japan. The cruise ship had a capacity of 3,138 passengers and 1,181 crew and was sailing towards the coastal area of Japan. While sailing ships needs to produce potable water from sea water through desalination processes including evaporation and reverse osmosis.

SHIPSAN contacted UK's Public Health England (PHE) with a request to provide advice on this topic. The response from PHE was as follows:

- To establish the safety of potable water produced on board of the cruise ship it was necessary to carry out an assessment of the potential doses received by passengers and crew or compare activity concentrations of radionuclides measured in the water with the levels established by the Japanese authority. The intervention levels for activity concentrations of ^{134}Cs and ^{137}Cs in drinking water recommended by the Japanese authority were 10 Bq/kg. The dose criterion used to derive these values was 1 mSv/y.
- No measurements of activity concentrations were provided by the cruise ship company or were available from the Japanese authorities or from open literature. However some measurements of activity concentrations within the 20 km radius exclusion zone around the Fukushima plant were found from monitoring carried out by the Japanese government. The activity concentrations were 0.027 Bq/l for ^{134}Cs and 0.055 Bq/l for ^{137}Cs, more than 100 times lower than the intervention levels recommended by the Japanese government. PHE

estimated that these activity concentrations would lead to maximum doses from ^{134}Cs of 3.1 10^{-4} mSv/y and 4.3 10^{-4} mSv/y for ^{137}Cs, which are more than 1000 times lower than the dose criterion recommended by the Japanese Government.

- In addition it should be noted that activity concentrations in the water of the areas visited by the cruise ship were likely to be much lower than those measured in the exclusion zone and that reverse osmosis has a removal efficiency of >70% for caesium.
- On the basis of this assessment PHE's advice to SHIPSAN was that the radiation risk from ingestion of potable water produced on the cruise ship was negligible.

Key actions taken

- Cruise ship company contacted SHIPSAN.
- SHIPSAN passed request to a national competent authority, in this case UK's Public Health England.
- Public Health England provided necessary advice and reassurance.

Key points of incident

- Safe levels of radioactivity in drinking water and other environmental media had been established by the Japanese government. It is important to note that the Japanese government had established an exclusion zone in the sea around the Fukushima power plant that would have prevented any ship from accessing radioactively contaminated areas if it considered that the contamination posed a threat to public health.
- There are organisations at a national level similar to Public Health England with the necessary expertise to assess potential doses from exposure to radiation and provide advice on the radiation safety of a radiation event.

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Annex B

Guidance Note 01

Basic Concepts of Radiation

What is radiation?

Radiation is the emission and propagation of energy in the form of electromagnetic waves or particles. With regard to its interaction with matter radiation can be classified as:

non-ionising radiation such as visible light, signals from a mobile phone and radio waves;

ionising radiation such as cosmic rays, radiation emissions from uranium ore and other radioactive material and high frequency waves in the electromagnetic spectrum, e.g. X-rays and gamma-rays.

What is ionising radiation?

Ionising radiation is radiation which has sufficient energy to be able to remove an electron from stable atoms and molecules when passing through matter causing them to have an imbalance of charge (ionisation). This process, called ionisation, can cause damage in living matter which may cause harm to people's health depending on the radiation dose received. There are three main types of ionising radiation: alpha (α), beta (β) and gamma (γ). Alpha and beta radiations are particles, while gamma radiation is a wave similar to X-rays. These forms of radiation differ in their ability to penetrate into the body or other materials and also in their ability to cause harm to people.

Alpha particles As they are relatively large, heavy and slow, alpha particles are not able to penetrate very far through materials. They are stopped by a few centimetres of air or a sheet of paper and even by the dead layer of skin on the outside of our bodies. As they usually cannot penetrate into the body, alpha particles do not pose a significant hazard from outside the body. However, radioactive materials emitting alpha particles can get into the body by inhalation, ingestion or through open wounds. They can then damage tissue and have a greater potential to cause cancer than beta particles and gamma rays.

Beta particles These are relatively light, small and fast, so they may travel several metres in air and can penetrate through exposed skin. Consequently, beta particles can present a hazard from inside or outside the body. They can be stopped by thin sheets of aluminium or Perspex.

Gamma rays These rays have no weight and can penetrate through the body, depositing some of their energy on the way and so causing harm. Gamma rays are therefore a hazard both inside and outside the body. They can be stopped or exposure can be reduced by the use of thick, heavy shielding.

Ionizing radiation is generated through a number of processes, such as nuclear reactions, radioactive decay and acceleration of charged particles in electromagnetic fields. There are both natural sources of ionising radiation (eg the sun) and artificial (eg nuclear reactors, particle accelerators and x-ray tubes). Radioactivity is the phenomenon by which unstable atoms undergo a spontaneous disintegration giving out ionising radiation in the process. This process is also known as radioactive decay and a material that emits ionising radiation by radioactive decay is said to be **radioactive**. As the unstable atoms in a radioactive material decay they are transformed into different atoms. The time taken for half the unstable atoms, which are also called radionuclides, in a material to decay and change is known as the half-life. Each radionuclide has its own half-life, which can vary from less than a fraction of a second to more than millions of years.

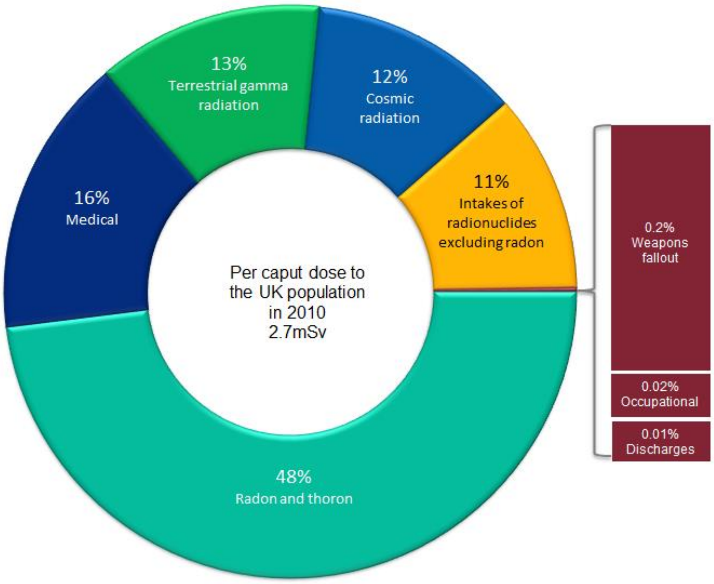
How radiation affects people

The term 'radiation dose' is used to describe the amount of energy absorbed by a material from ionising radiation passing through it. There are different quantities associated with the term dose; the most commonly used is the effective dose, measured in units called Sieverts. Effective dose takes account of the different sensitivities of organs in the body and the effects of different types of radiation. A Sievert is a large dose of radiation and in most cases radiation dose will be described in microsieverts (μSv, one-millionth of a Sievert) or millisieverts (mSv, one-thousandth of a Sievert).

At low levels (less than about 100 mSv) radiation causes no immediate perceptible damage to people. However, any exposure to radiation is considered to be capable of increasing the lifetime risk of cancer and of passing on hereditary illnesses to children. Individuals exposed to very high doses of radiation (of the order of 1 Sv) may receive burns to the skin, damage to the gastrointestinal, cardiovascular or nervous systems, and exceedingly high doses can cause death.

Average radiation exposure levels

People are exposed to low levels of radiation from natural sources, as well as artificial . On average, people in the UK receive an annual dose of 2.7 mSv from all sources. Natural sources make up 84% of this dose, with the remainder coming from a variety of artificial sources.



Natural radiation sources include gamma rays from the natural radioactivity in the Earth and in building materials, the small amounts of natural radioactivity in food and drink, and cosmic rays which bombard the Earth from space. However, by far the greatest contribution comes from breathing radon gas which is given off by natural radioactive materials in the Earth. Inhalation of radon leads to alpha-particle irradiation of the lungs and has been shown to cause lung cancer.

Artificial (man-made) sources are dominated by medical exposures (16%). All other artificial sources contribute in total less than 0.3% of the average annual exposure. Doses from radioactive discharges to the environment from the nuclear and non-nuclear industry contribute about 0.01% to the total average dose.

Guidance Note 02

International legislation for the carriage of radioactive material on ships

The occurrence of radiological incidents on a ship (i.e. the exposure of individuals to radioactive material) which has the effect of causing a public health threat is rare.

The transport of radioactive material by sea is rigorously regulated to ensure that potential risks are minimised. Any shipments of radioactive material by sea must comply with international and national regulations of the originating country and also the country of destination. The figure depicts the flow from international to national legislation that governs the transport of radioactive material and explained in the text below.

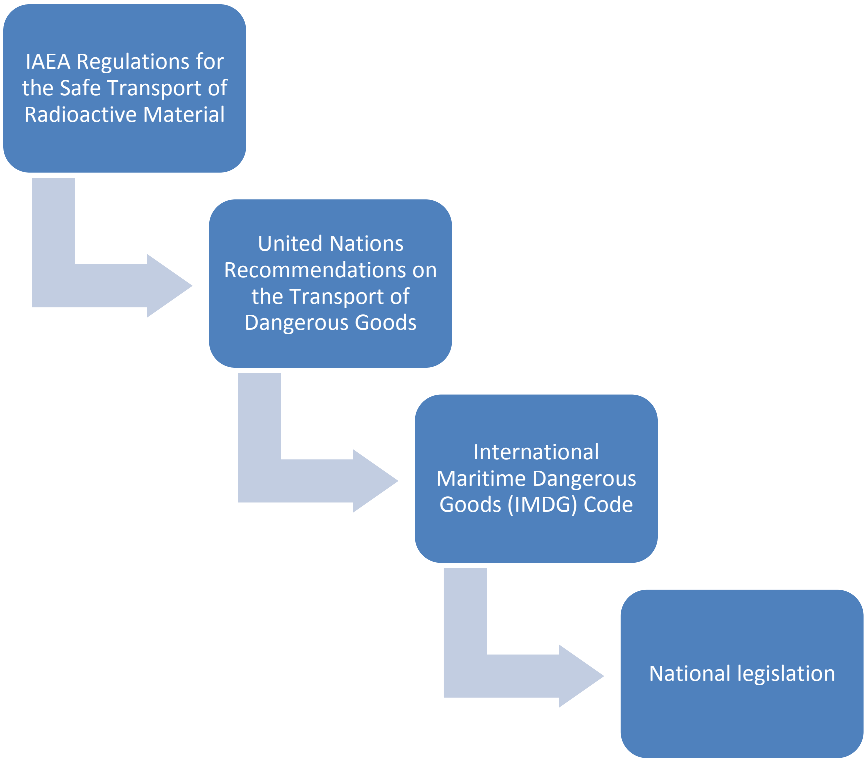
The main international regulations for the control of radioactive material during transport are the Regulations for the Safe Transport of Radioactive Materials issued by the International Atomic Energy Agency (1). The IAEA regulations establish standards of safety for all modes of transport (air, sea, road and rail) such that hazards to people and the environment are controlled to an acceptable level. They set out requirements for activity levels and classification, requirements and controls for transport, packaging, consignors shipping documents and give guidelines on segregation and stowage. The United Nations (UN) has also issued Recommendations on the Transport of Dangerous Goods (2), which give model regulations on the transport of dangerous goods aimed at providing a basic scheme for the development of national and international regulations governing the various modes of transport. For the transport of radioactive material the UN recommendations adopt the safety requirements as given in the IAEA regulations. The regulations also require that emergency response planning and preparedness is established (3).

The Convention on the Physical Protection of Nuclear Material (4) treaty sets out guidelines and recommendations for the physical protection of nuclear material while in transit.

The International Maritime Organisation (IMO) has also established codes for the safe transport of packaged hazardous materials by sea. The principal code issued by IMO is the International Maritime Dangerous Goods (IMDG) Code 2014 (5). This code set standards for shipping papers, marking, labelling, placarding, stowing, segregation and other handling requirements. The IMDG also incorporates the IAEA regulations for the safe transport of radioactive material. A ship transporting radioactive material must also comply with the requirements of the *International Convention for Safety of Life at Sea* (6).

National legislation is developed from these regulations. For example, in the UK The Dangerous Substances in Harbour Areas Regulations (7) and the Merchant Shipping

(Dangerous Goods and Marine Pollutants) Regulations, (8) make provisions for the carriage of dangerous goods based on the IAEA and IMO codes and standards.



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Guidance Note 03

Notification of radiation incidents of international concern

International, European and national emergency arrangements exist to enable countries to prepare for and respond to radiation incidents. The figure shows the flow of information that should be followed once an incident has been declared on a ship either at sea or in a port. The ship's master would notify the competent authority, this may be the Port Health Authority or the emergency services. Once it was established that the incident involved radioactive material, the appropriate public health authority should be notified who will provide radiation experts to assess the situation. International, European and national legislation and regulations regarding emergency arrangements for radiation incidents will then apply, and some of these have been described below.

The International Health Regulations, 2005 (1) apply to incidents involving radiological materials and obliges countries to notify the World Health Organization (WHO) of potential public health effects if certain criteria are met. It is the responsibility of the national focal point in each member state to notify the WHO IHR contact point of all events that may constitute of public health emergency of international concern. If these criteria are met, then the event is classified as a Public Health Emergency of International Concern (PHEIC) by the WHO Director General in consultation with the member state and the IHR emergency committee. In addition, the regulations state that at designated points of entry public health emergency contingency plans should be developed. Competent Authorities, defined under the IHR as "an authority responsible for the implementation and application of health measures under these Regulations" would notify relevant national Public Health Authorities who will provide radiation experts to investigate and manage any risks posed by the incident reported (1).

At the European level the current EC Basic Safety Standards Directive supports radiation protection through national legislation and states that Member States should be prepared in the event of a radiological emergency in their own or/ and other countries (2). A new revised Directive (3) which was adopted by the Council and Member States, will be brought into force by 2018. At the national level, each country should therefore establish emergency preparedness and planning to protect the population, property and the environment. National services and experts in radiation protection should be identified and roles and responsibilities assigned.

In the event of a radiological incident in which a Member State intends to take countermeasures to protect their population against the effects of any release of radioactivity, that Member State must notify the European Commission (EC) and member states that are, or are likely to be, affected by the measures to be taken and the reasons for taking them. The notification provided must include information relevant to minimising the foreseen radiological consequences, if any, in those States. The EC will forward this notification to all its member states, which are then required to inform the EC at appropriate intervals of measures taken and radioactivity levels measured in their country.

In addition, the International Atomic Energy Agency (IAEA) facilitates systems of notification, warnings and assistance (4, 5). The IAEA can be called upon to provide assistance if the country does not have the infrastructure to deal with the emergency. In order to provide support to a country to deal with an emergency a number of networks that can assist in a radiation emergency situation have been set up; these would deal with emergencies on land or sea.

A number of initiatives have been set up at EU and international level to facilitate the exchange of information or to provide support to countries affected by a radiological event. The most important are described below.

The European Radiological Data Exchange Platform (EURDEP) (6) makes radiological monitoring data from most European countries promptly available in close to real-time in emergencies. To achieve this, EU Member States, and other European countries which are members of EURDEP, send their data to EURDEP from their territorial radiation-monitoring networks. Participation of EU member states is regulated by the Council Decision 87/600 (7) and the Recommendation 2000/473/Euratom (8).

The ECURIE system is the European Communities Urgent Radiological Information Exchange network, created following the Chernobyl accident in 1986 (7). Member States that have signed the ECURIE Agreement form a network of contact points and competent authorities officially nominated by each Member State. The main responsibility of the contact points is to make all notifications through the ECURIE network.

The IAEA's Response and Assistance Network (RANET) provides international assistance and advice in the event of a nuclear or radiological emergency (4, 5, 9) Countries that are willing to provide assistance in the event of an emergency register their capabilities with RANET. As of February 2016 RANET has 28 member countries who have registered their capabilities under 8 categories: source search and recovery; radiation survey; environmental sampling and analysis; radiological assessment and advice; medical support; dose assessment; decontamination; and nuclear installation assessment and advice.

The Radiation Emergency Medical Preparedness and Assistance Network (REMPAN) (10) was established in 1987 in order to fulfil WHO's responsibility under the two international conventions on Early Notification and Assistance (4, 5). Currently there are forty medical and research institutions signed up. The network is designated to provide medical and public health assistance in an emergency to people exposed to radiation. It also facilitates a long-term care and follow-up of radiation accident victims and conducts research in radiation emergency medicine, radiotherapeutics, bio-dosimetry and radiation epidemiology.

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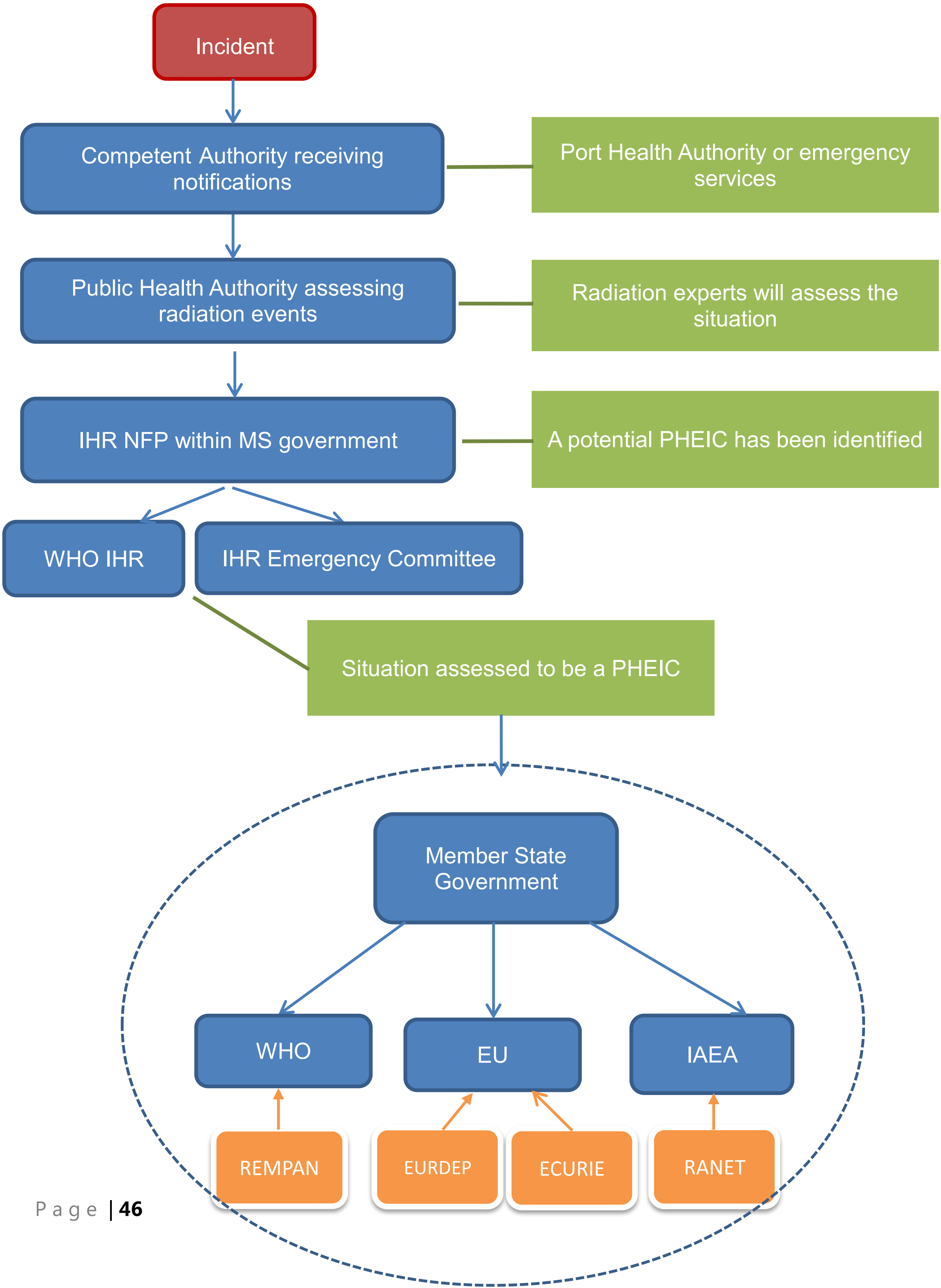

Guidance Note 04

Notification of chemical incidents of international concern

Chemical incidents can impact on society in a number of ways; these effects can be further confounded if the event involves more than one country. The European Parliament and the Council of the European Union adopted a Decision on serious cross border threats to health, which came into force on the 6 November 2013 (1). The Decision sets provisions on notification, ad-hoc monitoring and coordination of public health measures following serious cross border threats to health from biological, chemical and environmental hazards (not radiation) as well as events that have an unknown origin. It applies to all European Union Member States.

In accordance with the Decision, EU Member States (MSs) are required to:

- Designate a competent public health authority at the national level responsible for alert notification and determining risk management measures.
- Have a contact point at National Level to generate an alert, post a notification in the Early Warning Response System (EWRS) and receive notifications from other Member States.
- Ensure consistency of approaches and measures taken to alert are communicated to the Commission and other Member States as well as consistency in communicating the risks.
- Consulting with other MSs with a view of co-ordinating their efforts on preparedness and response planning within Health Security Committee (HSC).
- Report to the Commission on their national preparedness and response planning
- Make information available from national monitoring systems related to chemicals and environmental hazards events following a cross border event by formalising links with regulatory agencies, monitoring networks and governmental departments to gather information at national level for environmental events.

Incident plans within Member States should be consulted to determine the preparedness, resilience and response arrangements, including the risk assessment, of chemical events of public health significance.

Timely notification and alerting of member State Authorities is an important facet of response coordination. Two IT platforms are able to support the risk assessment and risk management of cross border chemical public health threats. A risk assessment tier, the Rapid Alerting System for Chemicals (RASCHEM), which is owned and run by the European

Commission, has been developed for use by poison control centres and public health authorities so that they can communicate technical information on chemical incidents and poisonings The RASCHEM system became operational in 2014 (2, 3). Further information on RAS-CHEM, including rules and user guides, can be found here:

- RAS-CHEM quick start guide
- RAS-CHEM Risk Assessor Guidance
- RAS-CHEM business rules
- RAS-CHEM user guide

The EU Commission has established a mechanism to ensure the rapid exchange of information in instances where it is assessed that there may be a wider health impact to neighbouring countries as defined by Decision 1082/2013/EU (1) and the International Health Regulations (4) .

A risk management platform (Early Warning and Response System, EWRS) is used to communicate alerts for all public health hazards (excluding radiation), which meet specific threshold which indicates that they present a serious cross border threat to health, as defined by the Decision (1). These reports are made by the designate competent public health authority at the national level responsible for alert notification and determining risk management measures.

The system also serves to link other sectors in the Commission (e.g. Food and Feed), as well as other union agencies and international bodies (e.g. World Health Organization) via co-notification features. Other relevant European alert systems such as , Rapid Alert System for Food and Feed (RASFF), Rapid Alert System for Consumer Products (besides food, pharmaceutical and medical products, RAPEX are linked to avoid duplication and overlap of activities in Member States.

Following an alert made via the EWRS platform, the EU Health Security Committee (HSC) or EC may request an independent rapid risk assessment. The EC Scientific Committee on Health, Environmental and Emerging Risks (SCHEER) can provide a rapid public health assessment of chemical hazards, where the incident falls, either wholly or partially, outside the mandate of other authorities (e.g. European Food Standards Agency, etc).

Resources that can be developed to support Member States

- Hazard Statement – short half page document to be produced in 1-2 hours on key aspects of hazard or threat to consider
- Case Definition – short half page document to be produced in 1-2 hours providing a summary of key features of injuries related to the threat that may help MSs identify those affected.

- Chemical Emergency Risk Management Monograph (CERM) – longer document that help inform the hazard statement, case definition and RRA. Aimed at all levels of responder from crisis manager to emergency physician.
- Rapid Risk Assessment (RRA) – rapid assessment of emerging threat using data derived from Hazard Statement, Case Definition, CERMs and expert opinion
- Further information on RASCHEM/ECHMENET can be found at: http://ec.europa.eu/chafea/documents/health/leaflet/echemnet-leaflet.pdf

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Guidance Note 05

Physicochemical properties

In the event of a chemical incident, the risks to human health and the environment need to be evaluated; this involves identifying the source of contamination and the pathways by which a chemical can come into contact with people or other potential receptor(s), which is crucial for tailoring an effective response. The precise public health risk and hazard to humans will depend on the toxicity, dose, route, duration of exposure and the potential for toxic degradation products.

Other important considerations include distance from the source of the contamination or incident and understanding how the chemical behaves in the environment, as the physicochemical properties (i.e. the physical and chemical properties) are of key importance in influencing decisions on assessing the risks. A summary of important physicochemical properties are listed below. Further information can be found in SHIPSAN newsletter 22 (September, 2016) and in Wyke *et al.* 2014 (1)

Physicochemical property	Description
Physical form	Whether the chemical is a solid, liquid or gas will influence how it will behave in the environment. Gases will spread out until they are evenly distributed, liquids will flow with gravity and solids are relatively easy to contain. However, care must be taken with fibres, dust or smoke, which can be rapidly dispersed. Temperature and weather conditions may affect the behaviour of a chemical, for example if water temperature decreases, oils may solidify rather than spread across the surface of water, or move in dense patches travelling under the influence of waves/tides. Or if air temperature increases, this may vaporise a chemical with a low boiling point, changing the contaminant into a gas.
Persistence	This depends heavily on the environment that the chemical is released into, with factors such as the local microbial population, sunlight exposure, temperature and pH affecting the half-life of a chemical. Chemicals with a low persistence may be left to disperse naturally, whereas highly persistent chemicals are more likely to require removal from the environment.
Vapour Density	This is of particular importance to chemical spills on the water, as the density of the chemical relative to that of seawater will dictate whether the chemical is a 'sinker' or a 'floater', which would change the method of remediation. Density can be temperature dependent, so the behaviour of chemicals may change with the weather. Volatile gases which are also heavier than air can collect in low-lying spaces such as basements, cellars, or in holds of ships and are more likely to lead to exposure to the public in inhabitable areas

Water solubility	The ability of a material (solid, liquid or gas) to dissolve in water. Materials can be insoluble, sparingly soluble or insoluble. Water soluble materials (such as acids) may be more easily dispersed in water and have a greater potential to pollute water environments. Many water insoluble materials (such as petrol) may be spread by the movement of the sea. Water-based decontamination of surfaces may be more effective if a chemical is water soluble; whereas removal options or active decontamination may be more appropriate for non-water soluble chemicals. Also of note is that the hydrophobicity of organic compounds is higher in seawater than in freshwater.
Bioavailability/ bioaccumulation	Bioavailability refers to the amount of chemical which can enter local organisms, while bioaccumulation refers to the extent that a chemical can build-up and remain in an organism over time. Bioaccumulation depends on the water solubility of the chemicals, as highly soluble chemicals will be rapidly excreted from animals while chemicals with low water solubility (lipophilic) are harder to excrete and remain inside animals for longer. This can have impacts on the food chain as chemicals which bioaccumulate can persist in e.g. plankton, which are eaten by small fish and in turn eaten by larger fish. This has the effect of concentrating the chemical up the food chain (biomagnification).
Vapour pressure	This is how readily a chemical will evaporate and volatilise in the environment. This is particularly important when dealing with chemicals that will float on seawater, as highly volatile chemicals will be rapidly evaporated and dispersed whereas those of low volatility may be more likely to persist on the water surface, increasing the chances of exposure.
Toxicity	One of the most important properties when evaluating public health risk toxicity is the degree to which a substance can damage a living organism. Toxicity needs to be assessed based on the site and specifics of the chemical incident, as incidents e.g. at sea, involving mildly toxic chemicals may not require any intervention. However, if the same chemical was released in an enclosed space (e.g. on board a vessel), the response would be quite different. Another factor to take into account is the potential for breakdown products from a chemical, which may be more or less toxic than the original chemical released. This process may occur naturally or as a result of remediation and can drastically change the response required e.g. a rapid response to a release of a fairly non-toxic chemical may be demanded, if the by-products are highly toxic.

A summary of important physicochemical properties of chemicals relevant to a release (1).

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Annex C

Guidance Note 06

Facilitation of International Maritime Traffic

(FAL Convention)

Ships are required to provide various forms of information prior to arrival and/or departure from a port (1). The information required from ships was agreed under the International Maritime Organisation Convention on the Facilitation of International Maritime Traffic (2) (FAL Convention, 1965) which aimed to simplify and minimise the formalities and agree upon the procedures and data requirements associated with the arrival, stay and departure of ships that are involved in international travel. The main output of the FAL Convention was the introduction of standardised forms which are now required to fulfil various reporting formalities upon arrival or departure from ports.

The standardised form were devised by the IMO are commonly referred to as FAL forms. They include:

- IMO General Declaration (FAL form 1),
- Cargo Declaration (FAL form 2),
- Ship's Stores Declaration (FAL form 3),
- Crew's Effects Declaration (FAL form 4),
- Crew List (FAL form 5),
- Passenger List (FAL form 6)
- and the Dangerous Goods (FAL form 7).

As well as being adopted under the FAL Convention, the FAL forms are now formally required under various European Directives (3, 4, 5, 6), Regulations (7) and International agreements (8) which all serve to strengthen the legal requirements initially laid down in Chapter III of the SOLAS Convention (9).

Although the initial aims of these forms are to reduce the administrative burden and to facilitate maritime traffic so to reduce the amount of time that ships are detained at a port for administrative purposes (1); the information provided within these standard forms also serve as a crucial source of information for various stakeholders in the event of a maritime incident.

In the unfortunate event of a maritime incident, competent authorities require timely information from shipping vessels about the passengers and crew on board a ship and in cases involving the deliberate or accidental release and/or exposure to hazardous materials and information about any cargo being transported by the ship particularly if they happen to be carrying dangerous goods. Such information is not only vital to search and rescue efforts by competent authorities, they also support the handling of the aftermath of an incident such as the identification of persons involved, aid the legal efforts, provide appropriate medical care for rescued persons and help prevent the unnecessary anxiety of relatives concerned about persons on board.

In 2010 the EU adopted Directive 2010/65/EC on reporting formalities for ships arriving in and/or departing from ports of the Member States. This Directive requires Member States to accept all reporting/notification formalities required from ships prior to arrival and/or departure from ports to be submitted in electronic format.

The introduction of the single window for the submission and transmission of electronic data provides a link for various electronic systems and therefore make information more accessible to various competent authorities and different Member States particularly in the event of an incident.

References

1. EC 2010. Directive 2010/65/EU of the European Parliament and of the council of 20 October 2010 on reporting formalities for ships arriving in and/or departing from ports of the Member States. Official Journal of the European Union. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:283:0001:0010:EN:PDF

2. International Maritime Organisation (IMO) Convention on the Facilitation of International Maritime Traffic (FAL), 1965.

3. Directive 200/59/EC on port reception facilities for ship-generated waste and cargo residues. Analytical note available from:
http://cor.europa.eu/en/events/Documents/COTER/TIA/port-reception.pdf

4. Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system. Available from:
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002L0059&from=EN

5. Directive 2009/16/EC on Port State control. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:131:0057:0100:EN:PDF

6. Directive 2010/65/EU on reporting formalities for ships arriving in and/or departing from ports of the Member States and repealing Directive 2002/6/EC. Available from: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0065&from=en

7. Regulation (EC) No 725/2004 on enhancing ship and port facility security. Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:129:0006:0091:en:PDF

8. International Maritime Dangerous Goods Code, 2006 edition. Available from: https://law.resource.org/pub/us/cfr/ibr/004/imo.imdg.1.2006.pdf

9. SOLAS (1974). International Convention for the Safety of Life at Sea. IMO. Available from: https://treaties.un.org/doc/Publication/UNTS/Volume%201184/volume-1184-I-18961-English.pdf

Guidance Note 07

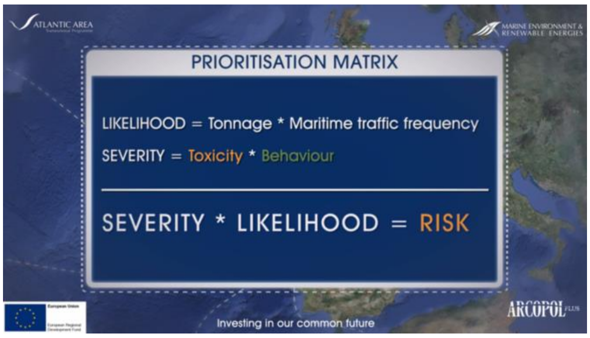
HNS Risk Prioritisation Tool for Ports (ARCOPOL)

Source: Extract from SHIPSAN Newsletter 16

ARCOPOL (Atlantic Region Coastal Pollution Response), a European funded project framed in the EU Atlantic Area aims to enhance shoreline planning and response to maritime incidents through technology transfer, training and innovation. Key outputs from ARCOPOL have been a range of freely available tools and guides aimed at improving incident management and response. In effect collectively providing a "tool-kit" for planning and preparedness, covering a number of themes including contingency planning, hazardous and noxious substances (HNS), communication, training and awareness and decision making (modelling and monitoring).

ARCOPOL includes partners from the UK, Ireland, France, Portugal and Spain and is led by Centro Tecnológico del Mar (CETMAR) and overseen by a Steering Group including the UK Maritime Coastguard Agency, Irish Coast Guard and EMSA. CRCE Wales has led on the health aspects which have included input from academic, health and local authority partners. Much of the work has focussed on HNS, due to their increasing transport by sea and the potential to impact the environment and public health. Incidents such as the *Cason* and the *MSC Napoli* clearly illustrate their potential impact (1).

While the project is principally aimed at shoreline response, many of the resources can equally apply to ports, where there are legal requirements to plan for incidents. This is illustrated by the HNS risk prioritisation tool which enables users to quickly and easily prioritise potential acute public health risks associated with incidents involving maritime transport of hazardous and noxious substances (HNS) in terms of their behaviour, human health impact and the quantities and frequency shipped (see Figure 1). The tool allows users to prioritise the risks of greatest concern within their local and national emergency plans (2). The tool has been successfully piloted at ports in Spain and plans are underway for trials in several UK ports in 2015.



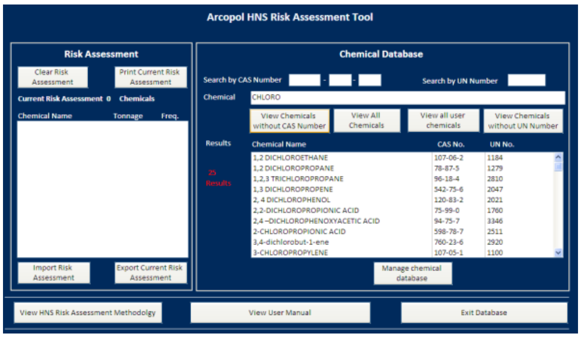


Figure 1. Illustration of ARCOPOL HNS Risk Prioritisation tool.

ARCOPOL also provides a range of free e-learning materials and has delivered a series of workshops to stakeholders, including port authorities enabling operators to be trained in key incident management and response principles. Workshops have been very successful and are further supported by a web forum available via the ARCOPOL website enabling a sustainable global contribution to maritime, shoreline and port safety.

Further information

- All resources can be obtained via www.arcopol.eu
- Chemical Hazard and Poisons Report Issue 24, available from: https://www.gov.uk/government/publications/chemical-hazards-and-poisons-report-issue-24
- Chemical Hazards and Poisons Report Issue 22, available from: https://www.gov.uk/government/publications/chemical-hazard-and-poisons-report-issue-22

References

1. ARCOPOL Case Studies.
http://www.arcopol.eu/?/=/section/resources/sub/r_hns/resource/97

2. P.D. Harold, A.S. de Souza, P. Louchart, D. Russell, H. Brunt Development of a risk-based prioritisation methodology to inform public health emergency planning and preparedness in case of accidental spill at sea of hazardous and noxious substances (HNS) *Environment International*. 72 (2014) 157–163. Available from:
http://www.sciencedirect.com/science/article/pii/S016041201400155X

Guidance Note 08

Port Initial Reference Sheet

The Port Initial Reference Sheet (IRS) has been developed to collate information on the hazards that exist at a port and can provide local information for responders who are not at the scene and are being asked to undertake a risk assessment and make decisions.

Ports can have a number of individual businesses operating at the port with some having transit storage of potentially hazardous and flammable materials within warehouses. Although there are regulatory frameworks that manage the storage, usage and transport of materials if there is an incident at the port having this information collated in one document could be critical during the acute phase. Incidents in this guidance document have demonstrated the importance of having accurate information on the source and receptors.

This resource which is in development by Public Health England (PHE), has been prepared to allow ports to consider the hazards and how to reduce or manage the risks of an incident causing an on and off site impact.

It would be recommended to share this information with front line responders as part of preparedness as opposed to during an incident. For example, there are 16 standing environment groups (SEGs) around the UK, which are responsible for a particular area of coastline and provide information and advice to the Secretary of States' Representative (SOSREP) on:

- conservation
- fisheries
- human health
- best environmental practice to dispose of wrecked ships and spoilt cargo
- how to deal with oiled wildlife and environmental monitoring

SEG members may include representatives from:

- Marine Management Organization
- Environment Agency
- Public Health Agency
- Conservation groups or councils
- Local Authority

<table>
<tr><th colspan="2">Port Initial Reference Sheet</th></tr>
<tr><td>Name of Port</td><td></td></tr>
<tr><td>Address</td><td></td></tr>
<tr><td>Grid Reference</td><td></td></tr>
<tr><td>Port description</td><td>Briefly describe the nature of the site and port activities (commercial, passenger, military, other)
Add any other relevant information such as whether the site has any on site meteorological equipment, environmental monitoring or dispersion modelling capabilities, fire – fighting and containment capabilities
Briefly describe other industries/commercial uses that operate within the port boundary (manufacturing, storage facilities, SEVESO sites
Briefly describe transport within the port (rail stations, bus, parking for commercial vehicle and parking for the public)
Number of people operating within the port boundary, any day/night or weekday/weekend variability</td></tr>
<tr><td>Nearby receptors</td><td>Briefly describe the surrounding location and identify any of the following in the vicinity of the port
Distance/direction of any industrial/commercial uses that operate nearby including manufacturing, storage facilities and SEVESO sites
Off-site population # of people, any day/night or weekday/weekend variability.
Distance/direction of transport infrastructure such as transport infrastructure such as railways, major roads etc.
Distance/direction of environmental receptors (lakes, rivers, aquifers), and the local topography (e.g. flat/hilly)
Distance/direction of holiday facilities including camping and caravan sites
Distance/direction of any community use activities (e.g. marina, recreational open space, tourist attraction, public beaches, sea water swimming pools, leisure activities (boat trips)
Distance/direction of any vulnerable fishing areas, fisheries, commercial shellfish beds around the port</td></tr>
<tr><td>Principal chemical hazards</td><td>Add a short paragraph describing each individual chemical or chemical mixture known to be stored on the site. Prioritise those that pose the greatest potential off site danger and those held in</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">the highest quantity. Details to be included
Chemical name and CAS number
Material Safety Data Sheet (MSDS)
Acute Exposure Guideline levels (AEGLs) – if exist
Physical properties
Acute health effects</td></tr>
<tr><td>Initial risk assessment and public health actions</td><td><u>Incident Scenarios</u>

Briefly describe the most likely scenario(s).
scenario could be a (fire/release/spill)
Chemical name
Consequences
On site containment
<u>Public communication & risk management</u>
Explain how stakeholders would be informed
Explain how public would be warned on and off site
Describe any other protective action(s) that will be taken (e.g. cordons, targeted evacuation, decontamination etc)</td><td>Any on site plans that exist should be hyperlinked here</td></tr>
<tr><td>Key Contacts</td><td>Contact agencies should be listed with contact numbers both in and out of hours</td><td>Summarise arrangements for off-site command and control structure meeting

Are there any rendezvous points identified in the port that emergency services should be aware of</td></tr>
</table>

Further information

THE SEVESO directive was created in response to major industrial accidents in Europe involving hazardous chemicals, which can pose a major threat to public health. Under SEVESO, measures are taken on major industrial sites to minimize the risk to the general population, which include:

- Notification of all concerned establishments (Article 7);
- Deploying a major accident prevention policy (Article 8);
- Producing a safety report for upper-tier establishments (Article 10);
- Producing internal emergency plans for upper tier establishments (Article 12);
- Providing information in case of accidents (Article 16).

http://ec.europa.eu/environment/seveso/

http://ec.europa.eu/environment/seveso/legislation.htm

Guidance Note 09

Recovery

Recovery is defined as the process of rebuilding, restoring and rehabilitating the community following an emergency. There are no exact boundaries between the emergency response to an incident and the recovery and remediation phase, as the latter usually lasts as long as the effects of the incident can be expected to persist and continues until the area is returned to normal living. It is vital therefore that decisions and actions taken during the acute or emergency response phase considers an early return to normal living and facilitate recovery, remediation and rehabilitating the community following an emergency to return to normal.

Remediation, recovery or decontamination of the environment is the process of removing, neutralising or limiting exposure to a hazardous substance from: structures, articles and equipment; the environment and people following exposure to that substance. Understanding the issues associated with recovery of inhabited areas (urban or rural areas and different surface types), food production systems and water environments (public or private drinking water supply, recreational waters) has underpinned a series of Recovery Handbooks developed by Public Health England (PHE) for Chemical, Biological and Radiation (CBR) Incidents.

The Recovery Handbooks have evaluated the evidence base for recovery options that should be considered following a CBR incident or accident, reviewing and examining historical and recent CBR incidents that have required remediation in order to gain a better understanding of:

- What procedures and protocols (recovery options) are used for decontamination, remediation and recovery
- Problems or constraints associated with the implemented recovery options

Including:

- public health/ health protection (including psychological effects)
- technical (i.e. specialist equipment)
- waste
- social (i.e. disruption)
- cost

Recovery Handbooks

The Chemical, Radiation and Biological recovery handbooks are aimed at national and local authorities, central government departments and agencies, environmental and health protection experts, emergency services, industry and others who may be involved in developing a recovery strategy following a CBR incident. The handbooks focus on environmental decontamination and provide guidance and checklists on how to manage the recovery associated aspects of CBR incidents.

The Recovery Handbooks are all similar (to aid user operability) and contain scientific and technical information on different procedures and protocols (recovery options) for decontamination, remediation and recovery. The Handbooks are based on an extensive evaluation of the evidence base for all recommended recovery options and an analysis of the factors influencing recovery. The Handbooks also contain a compendia of comprehensive recovery option sheets; guidance on planning in advance of an incident; decision-aiding frameworks for each environment, decision trees; look-up tables and several worked examples. Sources of CBR release considered in the Recovery Handbooks include industrial accidents and can be applied to deliberate release. The Handbooks can be used as preparatory tools, under non-crisis conditions to engage stakeholders and to develop local and regional plans. It is recommended that the Recovery Handbooks are used as part of the decision-making process in developing a recovery strategy following an incident. In addition, the Handbooks may be useful for training purposes and during emergency exercises.

Steps to consider when developing a recovery strategy (using the Recovery Handbooks) include;

Table 1: Steps for developing a recovery strategy	
1	Obtain information relevant to the incident, identify environment/area contaminated and properties of the contaminant
2	Identify potentially applicable recovery options for the contaminated environment/areas/ surface type. Some options can be eliminated at this stage based on common sense (i.e. snow and ice removal is a recovery option that wouldn't necessarily be applicable during summertime)
3	Consider applicability of options for the contaminant in the affected environment/ surface type. Some recovery options may be eliminated at this stage if they are applicable for persistent contaminants (years) and the agent involved in the incident has a short persistence (days).
4	Consider key considerations and constraints. Some recovery options may be eliminated during this step if the constraints outweigh the benefits of implementing the option.
5	Consider effectiveness of options. Some recovery options may be eliminated during this step if there is limited efficacy for the agent involved.
6	Consider detailed information on remaining options, including information on waste produced. Some recovery options may be eliminated at this step as the generation of waste is an important factor to consider. The potential volume of waste produced by implementing a recovery option needs to be carefully considered as disposal and treatment of the contaminated waste would also incur costs. Volumes of waste produced by implementing a recovery option would need to be considered carefully as disposal and treatment of contaminated waste will also incur costs.
7	Consider all information in the recovery options datasheet and determine if the recovery option is still applicable (on a site and incident specific basis)
8	Select and combine options to develop recovery strategy
Steps 4-6 are combined in the decision-aiding framework for the Chemical and Biological recovery handbooks.	

Interactive support tools for Recovery

To complement the Recovery Handbooks, interactive support tools (for chemical and radiation incidents) have been developed to help with the decision-making process for developing a recovery strategy. Guidance and templates for recording and reporting decisions on recovery are also available. These resources are intended to assist the recovery working group in their evaluation of recovery options (remediation techniques) that are likely to be the most appropriate, applicable and effective on a site- and incident-specific basis:

- chemical recovery navigation tool
- chemical recovery record form
- radiation recovery navigation tool (Inhabited areas; Food; Drinking water)
- radiation recovery record form
- e-learning module: principles of recovery and remediation
- guidance on recovery after a chemical, biological or radiation (CBRN) incident, including HazMat

References

The UK Recovery Handbook for Chemical Incidents
(https://www.gov.uk/government/publications/uk-recovery-handbook-for-chemical-incidents-and-associated-publications)

The UK Recovery Handbook for Radiation Incidents
https://www.gov.uk/government/publications/uk-recovery-handbook-for-radiation-incidents-and-associated-publications

The UK Recovery Handbook for Biological incidents
https://www.gov.uk/government/publications/uk-recovery-handbook-for-biological-incidents