International Health Regulations (2005) and chemical events

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Contents

1. Introduction

In 2005, the World Health Organization (WHO) Member States adopted the revised International Health Regulations (IHR) (2005). The Regulations provide a unique public health framework in the form of obligations and recommendations that enable countries to better prevent, prepare for and respond to public health events and emergencies of potential international concern, including chemical events.

The first IHR were adopted by the World Health Assembly (WHA) in 1969, having been preceded by the International Sanitary Regulations adopted by the WHO in 1951. The 1969 Regulations, which initially covered six "quarantinable diseases", were amended in 1973 and again in 1981, primarily to reduce the number of covered diseases from six to three (i.e. yellow fever, plague and cholera) and to mark the global eradication of smallpox.

In consideration of the growth of international travel and trade, and the emergence or re-emergence of international disease threats and other public health risks (including those related to chemical exposure), the WHA in 1995 called for a substantial revision of the Regulations. After extensive negotiation, the IHR (2005) were finally adopted by the WHA in 2005 and entered into force on 15 June 2007 (WHO, 2008a).

The purpose of the revised IHR (2005) is to prevent, protect against, control and provide a public health response to the international spread of disease. Their scope is not limited to any specific disease or manner of transmission (as with the previous Regulations), but covers illness or medical conditions, irrespective of etiology, that present or could present significant harm to humans, including outbreaks of chemical origin. The IHR (2005) obligate States Parties to develop certain minimum core public health capacities (especially for early event detection and response) and to notify WHO of events that may constitute a public health emergency of international concern according to defined criteria.

The previous Regulations were designed to control selected communicable diseases, and historically the responsibility for their management was with the health sector. In other words, representatives of the ministry of health negotiated and adopted the IHR at WHAs, and it was the responsibility of the health sector to establish capacities to manage and notify about specific diseases. In the case of the revised IHR (2005), however, implementation is not the responsibility of the ministry of health alone. It is the responsibility of the State; all relevant sectors must play their part.

The revised IHR (2005) now cover all diseases and events of international public health concern, including those linked to biological, chemical and radiation hazards. In addition, the IHR (2005) 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)). It is recommended that countries consider following all-hazard and multisectoral approaches when putting in place the IHR (2005) minimum core capacities, in order to utilize available resources as effectively and efficiently as possible.

The chemical industry is one of the largest economic sectors worldwide and it is growing particularly quickly in non-OECD (Organisation for Economic Co-operation and Development) countries (OECD, 2001, Sigman et al., 2012; UNEP, 2012). Many countries have laws and regulations governing chemical production and use. In addition, many countries have signed international agreements (e.g.

Basel, Rotterdam, Stockholm and Minamata Conventions) aimed at controlling the use, trade, movement and disposal of certain chemicals. Furthermore, the international community has agreed on the Strategic Approach to International Chemicals Management (SAICM), which provides the international policy framework to foster the sound management of chemicals and to promote multisectoral and multi-stakeholder approaches in achieving this objective.

The implementation of chemical-related national and international laws, agreements and approaches in countries is the responsibility of a number of sectors, including environment, labour, agriculture, health, civil protection, transport and customs. However, many of the capacities needed to implement these laws and agreements are relevant to the preparedness, prevention and response to public health events and emergencies under the IHR, e.g. capacities for chemical risk assessment and for chemical event response. It is therefore important for health authorities to reach out to, and collaborate with, the authorities that are responsible for chemical control laws when identifying or establishing the core capacities for chemical events under the IHR.

The concept of building and strengthening capacities common to different, but related, instruments and sets of legislation is also central to IHR implementation. Annex 1 of the Regulations, for example, requests countries to utilize existing structures to meet their core capacity requirements, including those outside the health sector. In addition, Article 14 requests WHO to cooperate and coordinate its activities with other competent organizations and international bodies in the implementation of the Regulations. These include international organizations that have a role in the management of chemical events, such as some of the Participating Organizations of the Inter-Organization Programme for the Sound Management of Chemicals (IOMC, 2015a) and the Environmental Emergencies Section of the Joint UNEP/OCHA (United Nations Environment Programme and Office for the Coordination of Humanitarian Affairs) Environment Unit (UNEP/OCHA, 2015).

The goals of this document are: (i) to provide information about building IHR (2005) core capacities for chemical events; (ii) to assist National IHR Focal Points (NFPs) to identify national institutions having a role in the management of chemicals; (iii) to raise awareness about the IHR (2005) in professionals who have a role in the management of chemicals under various regulatory contexts but who are not familiar with the IHR (2005); and (iv) to provide information to facilitate an inter-ministerial approach for the management of chemical events, including building synergies in the implementation of relevant international agreements.

2. Types of chemical events and notification under IHR (2005)

Chemical events arising from technological incidents, natural disasters, conflict and terrorism, polluted environments, and contaminated foods and products are common and occur worldwide. Table 1 provides examples of chemical events that have been identified through WHO surveillance and response activities. To give an idea of the potential scale of the problem, the International Federation of Red Cross and Red Crescent Societies (IFRC) has estimated that between 2003 and 2013 there were 7298 disasters worldwide, 2923 of them “technological incidents” (e.g. industrial and transport accidents) that affected nearly 1.5 million individuals (IFRC, 2015).

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

Year	Location	Description of event (Reference)	Consequences	IHR (2005) Annex 2 criteria*
2006	Côte d'Ivoire	Dumping of waste in the city of Abidjan (UNDAC, 2006; WHO, 2009)	10 deaths, thousands made ill; international assistance was needed	Yes to (i) and (ii); no to (iii) and (iv)
2006	China	Plant explosion releasing 100 tonnes of pollutants in the Songhua River, which crosses international borders (UN, 2006; WHO, 2009)	Five deaths; millions of people without water for several days	Yes to (i), (ii) and (iii); (iv) unknown
2006	Panama	Diethylene glycol in a cough syrup (Rentz et al., 2008; WHO, 2009)	At least 100 deaths	Yes to (i), (ii), (iii) and (iv)
2007	Angola	Sodium bromide confused with table salt (WHO, 2009)	At least 460 people ill, mostly children; international assistance was needed	Yes to (i) and (ii); unknown to (iii) and (iv)
2008	China	Milk and infant formula adulterated with melamine (WHO, 2008b; Gossner et al., 2009)	Approx. 300 000 victims, with six infants dying from kidney stones and other kidney damage; more than 50 000 children hospitalized	Yes to (i), (ii), (iii) and (iv)
2010	Nigeria	Lead from informal gold mining of lead-containing ore using crude, dust-generating technology (MSF, 2012; Yi-Chun et al., 2012)	More than 400 children died; many communities affected; international assistance was needed	Yes to (i) and (ii); no to (iii) and (iv)
2010	Hungary	Burst of sludge reservoir at aluminium plant; pollutants released into nearby villages and the Danube River, which crosses international borders (Reliefweb, 2010)	At least 150 injuries and 9 deaths from the corrosive effect of the sludge	Yes to (i), (ii) and (iii); no to (iv)
2010	USA	Explosion of the Deepwater Horizon oil rig in the Gulf of Mexico (King & Gibbins,	11 deaths from explosion; fishing communities affected;	Yes to (i), (ii), (iii) and (iv)

Year	Location	Description of event (Reference)	Consequences	IHR (2005) Annex 2 criteria*
		2011)	risk of international spread; minor injuries and health effects in health workers, volunteers and people living close to the affected shorelines; possible long-term effects	
2011	Ecuador	Methanol intoxication (PAHO, 2011)	177 affected; 29 deaths	Yes to (i), (ii) and (iii) – potentially (iv)
2011	Republic of Korea	Humidifier sterilizers (Kim et al., 2014)	17 cases of interstitial lung disease	Yes to (i) and (ii); (iii) and (iv) unknown
2012	Czech Republic	Methanol poisoning from alcoholic beverages (WHO, 2013; Zakharov et al., 2014)	23 deaths and 35 people hospitalized with methanol poisoning.	Yes to (i), (ii) and (iii); and possible (iv)

* (i) The public health impact of the event was serious; (ii) The event was unusual or unexpected; (iii) There was a significant risk of international spread; (iv) There was a significant risk of international travel and/or trade restriction.

The worldwide production, trade and use of chemicals are predicted to increase further. This is particularly true in developing countries and those with economies in transition, where chemical production, extraction, processing and use are closely tied to economic development. For these countries, the OECD projects a six-fold increase in chemical production by 2050 (Sigman et al., 2012).

Despite the omnipresence of chemicals worldwide and their predicted increase in production and use, many countries lack adequate capacities to deal with the health aspects of chemical events and emergencies. Even where these exist, crisis situations may occur, overwhelming national response capacities and requiring international assistance to be provided.

A chemical event in one country can lead to health consequences in another country. An example would be the release of chemicals into a river that crosses international borders. This can result in contaminated drinking-water and food (e.g. fish, or vegetables if polluted river water is being used for irrigation) in another country downstream. Actual examples of such events include the explosion at a chemical plant on the banks of the Songhua River in China in 2006 (WHO, 2009) and the rupture of a sludge reservoir at an aluminium plant in Hungary in 2010 (Reliefweb, 2010). Another kind of chemical event is one where chemically unsafe food, consumer products or drugs produced in one country are traded internationally, leading to health problems in other countries. Examples include cough syrup containing diethylene glycol in Panama in 2006 (Rentz et al., 2008; WHO, 2009) and milk and infant formula adulterated with melamine in China in 2008 (WHO, 2008b; Gossner et al., 2009).

Under the IHR, countries are required to notify WHO of all events, chemical or otherwise, that are assessed as possibly constituting a public health event of international concern, taking into account the context in which an event occurs (e.g. an event that occurs in a setting with inadequate response capacities). Notifications must be made within 24 hours of assessment by the country using the decision instrument provided in Annex 2 of the Regulations. This decision instrument identifies four criteria by which countries should assess events within their territories and decide whether an event is notifiable to WHO. These criteria are: (i) if the public health impact of the event is serious; (ii) if the event is unusual or unexpected; (iii) if there is a significant risk of international spread; and (iv) if there is a significant risk of international travel and/or trade restriction. Countries that determine that an event meets any two of the four criteria above, should notify WHO under the Regulations through the National IHR Focal Point.

3. Core capacities required under the IHR (2005)

The IHR (2005) require countries to establish core capacities for surveillance and response at all administrative levels in a country (national, intermediate and local) and at designated airports, ports and ground crossings (see Annex A). This requires effective coordination and collaboration of multiple authorities within a country and would need to involve the ministry of health or IHR NFP and other ministries responsible for important elements of chemical surveillance and response. To facilitate the flow of information, relevant ministries should designate contact points for IHR implementation to communicate with the ministry of health.

Legislation in countries aimed at the control of chemical production and use, including the management of chemical accidents (e.g. at chemical plants), should reflect the requirements of the IHR (2005), whenever appropriate.

In general the core capacities needed for chemical events can be grouped into four strategic areas, as shown in Table 2. Strategic areas are made up of a number of capacity-building elements that countries have started to monitor in the process of assessing their readiness to implement the IHR (2005)[1]. Important capacity-building elements are discussed in the following sections.

Table 2: IHR (2005) – Core capacities for chemical events

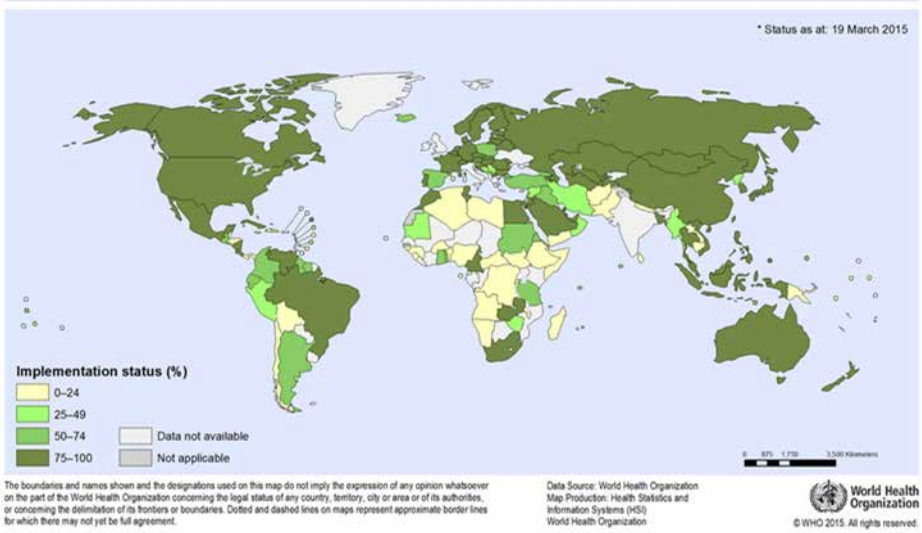
Strategic area	Important capacity-building elements
Policy coordination and communication	· Designated Focal Points for the IHR in all authorities that have an important role in the management of chemical events, for coordination and communication
Event detection, verification and risk assessment	· Tested surveillance system for the detection, verification and risk assessment of chemical events of (potential) international health concern as part of a multi-hazard surveillance strategy
Preparedness and emergency response	· Tested response plans taking into account possible event scenarios, addressing priority chemicals, hazardous sites and vulnerable populations (e.g. development of risk maps)
Capacity-building	· Access to expertise, i.e. maintaining an updated list and roster of experts and specialized centres, including for: - risk assessment

[1] The Table is based on the IHR Monitoring Tool: Questions related to chemical events listed in Annex B

	- exposure modelling - chemical fate and transport assessment - biological and environmental monitoring - (clinical) toxicology - diagnosis and treatment - health surveillance. · Access to specialized drugs and equipment to be used by experts and/or specialized centres and to be placed strategically to ensure national coverage, including: - antidotes - personal protective equipment (PPE) - decontamination equipment - equipment for biological and environmental monitoring. · Access to toxicological and environmental laboratories, i.e. laboratories are prepared to accept and analyse human and environmental samples at the time of a chemical emergency and arrangements are in place to ship the samples

The implementation of core capacities is monitored through annual self-reporting by countries to WHO and progress is then reported by WHO to the WHA annually. As of 31 March 2015, 160 States Parties from a total of 196 had reported on the implementation of the Regulations in 2014. The data show countries reported relatively low capacities for handling chemical events. The global capacity score for chemical events in 2014 was 56%, with large variations between WHO regions[2] ranging from 28% in AFR to 79% in EUR. The scores for the other regions were AMR 54%, SEAR 50%, EMR 53%, and WPR 62% (WHA, 2015).

Figure 1: International Health Regulations (IHR) monitoring framework. Implementation status – IHR chemical core capacity, 2014



[2] WHO regions: African Region (AFR), Region of the Americas (AMR), Eastern Mediterranean Region (EMR), European Region (EUR), South-East Asia Region (SEAR), Western Pacific Region (WPR)

Under Articles 5 and 13 of the IHR (2005), States Parties may request extensions to meet the core surveillance and response capacity requirements set out in Annex 1 of the Regulations. By 2014, 64 States Parties had informed the WHO that they had achieved these core capacities, 81 had requested extensions and 48 did not communicate their status or intentions.

Of the 81 countries that requested a second extension of two years for the implementation of IHR (2005) core capacities, 46 proposed actions to strengthen core capacities for chemical events, including eight countries in AFR, 16 in AMR, 11 in EMR, one in EUR, five in SEAR and five in WPR.

A number of WHO Regional Offices have held workshops to assist countries identify and prioritize the activities needed to build capacities to detect, assess and respond to public health events involving chemicals. Discussions during these meetings suggest some countries may have underreported their capacities, particularly if the capacities available in some non-health sectors were not reflected when reporting to WHO. This may arise in particular if links between the IHR NFPs and other relevant ministries have not yet been established.

In any case, the relatively low capacity scores reported for chemical events point to the need for an accelerated effort to strengthen capacities within a relatively short period of time, taking into full account those capacities that can be utilized outside the health sector.

3.1 Policy coordination and communication

A key action to manage and coordinate the differing activities undertaken by the many actors involved in the management of all types of chemical events is to establish a national chemical emergency coordinating structure. This should include the health sector and all other relevant sectors at the various administrative levels (national, intermediate and local). Other ministries and agencies responsible for important elements of surveillance of, and response to, chemical events should be involved, such as those for labour, environment, agriculture, transport and security. Other possible actors, depending on the nature of the event, include operators (e.g. of fixed chemical facilities, transport), emergency services, workers, customs, food authorities, consumer protection organizations, academia and the public. The coordinating body should be hosted by whichever agency is considered most suitable for a given country.

The health sector plays an important role in each phase of the chemical event management cycle. It is, therefore, necessary to ensure adequate capacity for health-sector preparedness if prompt and adequate response to chemical events is to be provided and the negative health impact thereof prevented or minimized (WHO/EURO, 2013).

Other sectors that can work with the health sector to support chemical event surveillance and response need to be identified and their roles defined. Meteorological services, for example, may have the capacity to run dispersion models of chemical plumes, thereby contributing to exposure and risk assessment, while the agricultural, mining and industry sectors contribute to developing hazard and vulnerability maps. Occupational and environmental services could provide laboratory analysis of human and environmental samples.

3.2 Event detection, verification and risk assessment

A key IHR requirement to ensure effective event detection, verification and risk assessment is the establishment of an all-hazards surveillance system. For chemical events, there are several sources of notification and alert that can be used, both within and outside the health sector. Within the health sector, poisons centres, hospital emergency departments, primary health-care facilities and toxicology laboratories can carry out surveillance for intoxications and outbreaks of possible or known chemical etiology. Non-health sector sources include the following:

- Agencies for consumer protection and food safety could provide alerts about chemically unsafe consumer products and foods.
- Environmental agencies could provide information about unusually high levels of chemicals found in (routine) monitoring of environmental media, such as surface water, air and soil, and could signal that a chemical release has occurred.
- First responders may provide an alert of an event.
- Plant operators may notify about a chemical release at their facility.
- The public can be a source of information about an overt release, such as an explosion, a chemical plume, contaminated drinking water, dirty surface water or dead wildlife.

Furthermore, information about events might be available in the media and on web sites. By screening this information, public health authorities might also learn about a chemical event (Table 3).

Poisons centres can play a particularly important role in the detection of 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. Indeed, most poisons centres engage in toxicovigilance, which is the active process of looking for emerging toxicological problems resulting from, for example, the reformulation of a product or a change to its packaging or labelling, the emergence of a new drug of abuse, or an environmental contamination. In addition, toxicological experts working in poisons centres may be able to establish a link between observed signs and symptoms and a specific chemical.

An integrated surveillance system should link these important sources of information about chemical events together and be supported by a surveillance plan. This plan should include arrangements for the training of health-care providers, public health authorities and other public service providers in the recognition of chemical events. It should provide case definitions for diseases of chemical etiology, establish a reporting mechanism, a mechanism for screening sources of information, such as the media, and establish a system for evaluating and verifying reports of events. At national level the surveillance plan should define the roles and responsibilities of the ministry of health, the IHR NFP and other agencies and organizations involved. It is advisable to avoid building parallel surveillance and reporting structures for different hazards, as this is resource-demanding and counter-productive. Efforts should be concentrated on strengthening a multi-hazard system, i.e. chemical event surveillance should form part of a wider surveillance system, including also radiological and biological hazards. This would allow for the efficient and effective use of resources and coordination and collaboration of experts, especially in the case of an event of unknown cause.

Table 3: Examples of surveillance[3] by service/sector

Service/Sector undertaking surveillance activities	Principle surveillance activity	Example of surveillance system (Reference)	Example of chemical event detected (Reference)
Health	Disease-based surveillance, including the analysis of data from poisons centres, toxicological laboratories, emergency departments and cancer registries		Increase in number of children with kidney failure in China (WHO, 2008b); sudden influx of patients with sedation in Angola (WHO, 2009); methanol poisoning in Czech Republic (Zakharov et al., 2014)
Environmental	Routine environmental monitoring of air and water; sporadic monitoring, e.g. as part of a research project; wildlife deaths (e.g. fish in rivers and lakes)		Widespread offensive smell (e.g. Côte d'Ivoire) (UNDAC, 2006; WHO, 2009); leak of chemical from a tailings pond at Baia Mare, Romania killing fish in 3 countries (UNEP/OCHA, 2000)
Food	Routine food monitoring; targeted food surveys		Imported sweets contaminated with lead (US CDC, 2015); fish contaminated with endosulfan (Henry & Kishimba, 2006)
Consumer protection	Reporting systems for unsafe products and articles; testing of products and articles	Rapid Alert System for non-food dangerous products (RAPEX) by the EU (EC, 2015c)	Children's toy, Bindeez beads, contaminated with 1,4-butanediol (National Consumer Agency, 2007)
Hazardous installations	Reporting of chemical incidents by the factory	eMARS European system on chemical incidents (EC, 2015a)	Major chemical accidents
Mass media	Screening of media reports about disease outbreaks and chemical releases	Web-crawler system such as MediSys (EC, 2015b) and GPHIN (WHO, 2015g)	30 000 m^3 of toxic sludge released from a break in a contention dyke from mining areas to a main river basin that shares international waters (Redaf, 2014)

[3] Different surveillance activities may detect an event at the same time, e.g. if reported by media and detected by poisons centres.

3.3 Preparedness and emergency response

Once an event is detected and verified, the appropriate authorities need to respond by evaluating the risks to public health and to the environment, and implementing appropriate actions based on established guidelines and procedures. As an event response progresses, national resources and expertise may be required to provide support.

The existence of a national chemical event emergency response plan, including the roles and responsibilities related to the IHR (2005), is a key element of preparedness for the timely and adequate response to any chemical event (within or outside the scope of the IHR (2005)). The process of putting a chemical event response plan together creates an opportunity to liaise, network and gain an understanding of future partners in chemical event response acting under the various international and national agreements, including the IHR (2005).

There may be some type of national plan or programme that already covers certain aspects of the IHR but not chemicals. There may also be some legal and technical instruments or plans already in place for responding to chemical events and emergencies. In this case, a decision should be made as to where the integrated national chemical response plan will "reside", based on the specific context in each country. The national plan for chemical events under the IHR could then be a combination of a number of different types including:

- a stand-alone integrated-response plan for all types of chemical events that is adopted by all relevant organizations or agencies. Among other requirements, this plan should clearly define the roles and responsibilities of the different actors under the IHR (2005) as well as other relevant legislation.
- a plan combined with a pre-existing public health emergency plan (e.g. for outbreaks of food poisoning or infectious diseases). As such plans may already exist for other hazards covered by the IHR (2005), it would require the integration of the roles and responsibilities for chemical events.
- a plan linked to emergency plans for registered hazardous installations regulated under national law that already partially address chemicals. These plans normally do not address the IHR (2005).

Whichever framework is developed, the national plan should include arrangements for scaling up the response, for command and control, risk assessment and communication, training and exercises, public crisis communication, and health sector communication once an alert has been received from the surveillance system. The national plan should be developed in close cooperation among, and with input from, all the stakeholders who will need to interact during a chemical event. Under the IHR, this plan would also need to involve authorities dealing with the travel of persons and the transport of baggage, cargo, containers, goods, postal parcels, and human remains that are chemically contaminated or carry sources of chemical contamination (WHO, 2009; IOMC, 2015b).

In addition to the national plan, local chemical event plans would need to address more specifically the types of events, the anticipated health effects and the special situation, for example, of vulnerable populations, health-care workers and emergency responders. Guidelines should be available in relevant languages and should contain easy-to-follow and specific instructions on how to handle chemicals and contaminated items in case of an emergency. This often involves input from fire services and other specialists in hazardous materials in the planning. Plans should also include

operational information such as where to set up a site emergency coordination unit and how to find and maintain access to electricity, water and other facilities. In addition, local plans should make reference to more detailed plans by both local public health chemical event response teams and entities such as hospitals, as well as chemical event response plans for specific hazardous sites.

3.4 Capacity-building

The public health response to a chemical event of public health significance is a multi-disciplinary one, and a wide range of skills and expertise is required. Individuals and organizations with specific responsibilities should receive training in the use and implementation of appropriate emergency response plans.

Training is important to ensure that staff from all organizations gain a basic understanding of their own and of others' needs and expertise. It is essential that training is provided regularly so that individuals stay informed about key components of the event response, as well as receiving updated information regarding new technologies and changing potential hazards. Public health elements that should be included in the core training include[4]:

- IHR (2005) and core capacities related to chemical events
- surveillance/notification systems for chemical events
- environmental chemistry, fate and persistence
- common symptoms associated with chemical exposures
- epidemiology and toxicology
- risk and exposure assessment
- emergency actions and procedures to reduce risk to both responders and the public
- proper use and limitations of protective equipment
- shelter and protective measures
- biological and environmental sampling
- key components of a control system for a major chemical hazard
- risk communication techniques
- risk mapping.

Finding the right technical expertise or equipment can be very difficult at the time of a chemical event. A roster of experts should be established and maintained for a number of technical areas, including for risk assessment, exposure modelling, chemical fate and transport assessment, biological and environmental monitoring, (clinical) toxicology, and diagnosis and treatment (if not available at a poisons centre). Furthermore, access to specialized drugs and equipment to be used by experts and/or specialized centres needs to be arranged and to be placed strategically to ensure national coverage. This would include antidotes, personal protective equipment (PPE), decontamination equipment, and equipment for biological and environmental monitoring. Finally, toxicological and environmental laboratories should be identified to accept and analyse human and environmental samples at the time of a chemical emergency and arrangements put in place to ship the samples.

[4] For a web-based training course for the public health management of chemicals, see reference WHO CC (2015).

Poisons centres can be key sources of expertise and information. They have staff with toxicological expertise and they have access to databases on chemicals; many also have product databases which include information on product formulations. Poisons centres can provide information about the routes of exposure and the toxic effects of chemicals, and advise on treatment of exposure. They can assist with the risk assessment of chemical events, provide information to the public on an event and what they should do to protect themselves, and assist with triage by guiding callers as to whether they need to seek medical care. In addition, some poisons centres maintain a stock of antidotes, or have information about where stocks can be found, for the few events where antidotes are needed (WHO, 2015e).

Countries may not have all the necessary capacities within their own borders. This is a common problem in Small Island States, for instance. Bilateral or multilateral agreements with neighbouring countries to supply certain needs may be used to enhance the capacity for diagnosis and response, and to facilitate cross-border transportation of laboratory samples, orphan drugs and medicines, and experts in times of crisis and outbreak investigation of possible chemical origin.

3.5 Chemical event scenarios

The likelihood that a chemical event will occur can be greatly reduced through the implementation of a range of preventive measures (WHO, 2009). However, even with a good prevention system, not all events can be avoided and there is always a residual risk that an event may occur. Chemical event scenario analysis is a technique for exploring how chemical events occur and their possible consequences. The findings are used to guide the building of surveillance and response plans and to develop related capacities.

Monitoring chemical events or near-events, both national and international events, is one way to identify the major impacts or risks that should be taken into account. Another way is to model major impacts. The recurrence of small events linked to a particular chemical or application may serve as a warning flag for the existence of problems, which if properly addressed could help to prevent a major event. Information on chemicals stored and used in a country, and the location of hazardous installations that might be the origin of an event, should be available from relevant authorities, i.e. authorities should have developed inventories of major hazard sites (risk mapping). In addition, the risk assessment is very much driven by the assumptions made on the anticipated human and/or environmental exposure situation. Often it is recommended to base planning on worst-case risk scenarios.

Scenario analysis (especially involving hazardous installations and transportation) only considers the consequences of a release and requires technical input from engineering, emergency response and health professionals. The role of the engineer (e.g. one employed by the company of concern) would be to identify where failures could occur. Emergency responders can make a realistic estimate of the time required to terminate the resulting emissions. Combining this information provides an estimate of quantities and release rates of chemicals, which is the starting point for dispersion modelling. Based on calculated concentrations in all relevant contact media, health professionals can make an exposure assessment and characterize health impact or risk resulting from each of the possible event scenarios.

It is crucial that the scenario analysis is inclusive. Policy-makers and local authorities often may not fully appreciate all impacts or risks associated with a particular chemical or situation. This could result in an underestimate of chemical risks and surveillance, and lead to response plans that do not adequately reflect the situation.

4. International Chemical Safety Agreements

As described above, certain IHR (2005) core capacities that are the responsibility of sectors other than health might already be in place, established as part of the process of economic development that should incorporate measures for the sound management of chemicals. While the responsibility for this management typically lies with ministries of environment or industry, it is recognised that a multisectoral approach is needed. There are clearly areas of common ground between responsibilities for IHR (2005) implementation with respect to chemical events and responsibilities for sound management of chemicals in countries and, therefore, opportunities for cooperation and synergy. It follows that these sectors should be aware of, and work with, each other.

At the national level, countries should put in place regulations and laws to ensure that chemicals are produced, used, transported and disposed of in a manner that minimizes harm to health and the environment. For certain chemicals there are also several international agreements governing various aspects of the importation, use, transboundary movement and disposal of chemicals and chemical products. Each of these agreements includes mechanisms for technical and financial assistance for countries that lack the necessary capacities for implementation of the agreements. Moreover, for each of the international agreements there is a contact at national level. This contact is important to the IHR NFP for the purposes of coordination and information-sharing. Table 4 provides a list of international agreements and their contact. A more detailed description of the agreements listed is available in Annex C.

Table 4: International agreements addressing chemicals

Agreement	Scope	Contact	Reference
Strategic Approach for International Chemicals Management (SAICM)	Sound management of chemicals	National SAICM Focal Points	SAICM, 2015a; SAICM, 2015b
Rotterdam Convention	Hazardous chemicals and pesticides in international trade	Focal Points at Designated National Authorities	UNEP, 2015b
Basel Convention	Transboundary movement of hazardous waste	National Competent Authorities and Focal Points	UNEP, 2015d
Stockholm Convention	Persistent organic pollutants	Official Contact Points and National Focal Points	UNEP, 2015f
Minamata Convention	Mercury	National Focal Points (not yet identified)	UNEP, 2015g
Chemical Weapons Convention	Chemical weapons	National Authorities	OPCW, 2015c
Convention for the Prevention of Pollution from Ships	Pollution of marine environment by ships	National Contact Points	IMO, 2015a; IMO, 2015b

5. Resources

A key role of WHO is the development of tools, including guidance and training material and courses to assist countries with the public health management of chemical events and the implementation of the IHR. This work is often done in close collaboration with partners and other specialized institutions.

Generic tools provide the principles of chemical event prevention, preparedness, detection and alert, response and recovery (WHO, 2009; IOMC 2015). Other tools address specific technical aspects of dealing with chemical events of public health importance such as human health risk assessment (WHO, 2010b) and investigation of disease outbreaks (WHO, 2015a). Training courses on chemical risk assessment and risk management are available from WHO Collaborating Centres (WHO CC, 2015; CRI, 2015). Training materials on Annex 2 of the IHR (2005) are available from the WHO web site, as is information on poisons centres, including contact details of poisons centres worldwide (WHO, 1997; WHO, 2015b; WHO, 2015e). A summary of the tools is given in Table 5.

An additional resource for all countries is the network of WHO Collaborating Centres (WHO, 2015h), which contributed to the development of many of the available tools and also made contributions to capacity-building activities in all the WHO Regions.

Table 5: Tools developed by WHO and partners to assist countries in implementing the IHR (2005) regarding chemical events

Tools	Scope	Type	Stage	Comment	Reference
WHO − Manual for the Public Health Management of Chemical Incidents	All chemical incidents; prevention, preparedness, detection and alert, response, recovery	Publication	Published	Mentions IHR; includes sections relevant to IHR core capacities; basis for training activities	WHO, 2009
WHO − IHR Training	Introduction to IHR	Web-based training	Published	IHR-related issues (not chemical-specific)	WHO, 2015c
WHO − Manual for Investigating Disease Outbreaks of Unknown Origin	Events of (potential) chemical etiology	Publication	In preparation	IHR-relevant	WHO, 2015a
WHO Guidance for the Use of Annex 2 of the IHR (2005)	Decision instrument for the assessment and notification ofevents that may constitute a public health emergency of international concern	Publication	Published	Case studies, including chemical events	WHO, 2010a

Tools	Scope	Type	Stage	Comment	Reference
WHO − Costing Model for IHR Core Capacity Development and Maintenance	All core capacities under IHR (2005)	Electronic tool	In preparation	IHR-specific; standardized methodology to estimate the costs needed for States Parties to develop and maintain IHR core capacities	WHO, 2015d
WHO – 1st and 2nd Tutorial for Notification Assessment under the IHR (2005)	Annex 2 of IHR (2005); all type of events, including chemical event scenarios	Web-based training	Published	IHR-specific with chemical event case studies	WHO, 2015b
WHO CC (CRI, Bangkok) − Electronic Distance Learning Training	Risk assessment and management of chemicals	Web-based training course	Launched in 2014	Not specific to IHR; requires login	CRI, 2015
WHO Collaborating Centre (Cardiff) − International Training Centre for the Public Health Management of Chemical Incidents	All chemical incidents; prevention, preparedness, detection and alert, response, recovery; IHR-relevant	Web-based and face-to-face training	Established in 2012 by WHO CC in collaboration Cardiff Metropolitan University (CMU)	IHR-relevant; training module on IHR (2005) and chemical events in preparation; training based on WHO Manual (see (WHO, 2009)	WHO, 2009; WHO CC, 2015
Guidelines for the Notification of Chemical Events under the IHR (2005)	Annex 2 of IHR	Publication	In preparation	IHR-specific; proposed by GHSAG Chemical Event Working Group	GHSAG CEWG, 2015
WHO − Human Health Risk Assessment Toolkit	Roadmaps for chemical risk assessment; case studies	Publication	Published	Not specific to IHR; used for training, including chemical incident scenarios; eToolkit in preparation	WHO, 2010b
IOMC − Toolbox for Decision-making in Chemicals Management	Major chemical accident prevention, preparedness and response	Web-based collection of tools developed by IOMC Particip-ating Organ-izations	Ongoing	Not specific to IHR; addresses a number of chemical management issues	IOMC, 2015b
WHO − A	Event-based	Publication	Published	IHR-specific	WHO,

Tools	Scope	Type	Stage	Comment	Reference
Practical Guideline for the Implementation of Early Warning and Response	surveillance, including chemical events				2014b
WHO Guidelines for Poisons Control	Describes functions of a poisons centre and the requirements for setting up a centre	Publication	Published	IHR-relevant; pre-dates IHR	WHO, 1997
WHO – World Directory of Poisons Centres	Contact details	Web site	Ongoing	IHR-relevant	WHO, 2015e

6. Summary

The IHR (2005) apply to chemical events of public health significance and require countries to establish a number of core capacities for the surveillance of and response to chemical events, as mentioned in Annex 1 of the Regulations.

For the purpose of the IHR (2005), core capacities for chemical events include (i) designated Focal Points for the IHR in all authorities that have a role in chemical event surveillance and response for coordination and communication; (ii) tested surveillance plans for the detection of chemical events of (potential) international health concern (as part of an "all-hazard" surveillance system); (iii) tested chemical event response plans taking into account all possible event scenarios; and (iv) systems to ensure timely access to expertise (e.g. risk assessment, exposure modelling, diagnosis and treatment), specialized drugs and equipment (e.g. antidotes and decontamination equipment) and toxicological and environmental laboratories for the analysis of human and environmental samples.

The production and use of chemicals (one of the largest economic sectors worldwide) is already widely regulated in many countries, and capacities for the sound management of chemicals might be already in place outside the health sector, e.g. within environment, labour, agriculture, civil protection and other sectors.

Effective coordination is therefore needed between sectors, and the health sector will need to put in place measures to ensure that agencies and organizations already engaged in the sound management of chemicals are aware of and contribute to IHR implementation. The scope for areas of common ground between those responsible for IHR implementation with respect to chemical events and those responsible for the sound management of chemicals in countries and, therefore, the opportunities for cooperation and synergy, should not be overlooked.

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Annexes

Annex A: IHR (2005) Core capacity requirements

Annex 1 of the Regulations asks countries to utilize existing national structures and resources to meet their core capacity requirements for surveillance and response.

- At the local community level and/or primary public health response level, the necessary capacities include those: to detect events involving disease or death above expected levels; to report all available essential information immediately to the appropriate level of health-care response; and to implement preliminary control measures immediately.

- At the intermediate public health response levels, the necessary capacities include those: to confirm the reported events and to support or implement additional control measures; and 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 assess all reports of urgent events within 48 hours; and 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).

  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; vii) to establish, operate and maintain a national public health emergency response plan; and viii) to provide the foregoing on a 24-hour basis.

At designated airports, ports and ground crossing, 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 conveyances;
- 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.

For responding to events that may constitute a public health emergency of international concern, capacities should be in place to:

- provide appropriate public health emergency response by establishing and maintaining a public health emergency contingency plan, including the nomination of a coordinator and contact points for relevant point 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 their isolation, treatment and other support services that may be required;
- provide appropriate space, separate from other travellers, to interview suspect or affected persons;
- provide for the assessment and, if required, quarantine of suspect travellers, preferably in facilities away from the point of entry;
- apply recommended measures to disinsect, de-rat, disinfect, decontaminate or otherwise treat baggage, cargo, containers, conveyances, goods and postal parcels including, when appropriate, at locations specially designated and equipped for this purpose;
- apply entry or exit controls for arriving and departing travellers;
- provide access to specially designated equipment, and to trained personnel with appropriate personal protection, for the transfer of travellers who may carry infection or contamination.

Annex B: IHR monitoring tool – questions concerning chemical events (WHO, 2015f)

Q 1 -	Have experts been identified for public health assessment and response to chemical incidents?[a]
Q 2 -	Are national policies or plans in place for chemical event surveillance, alert and response?[b]
Q 3 -	Do national authorities responsible for chemical events have a designated focal point for coordination and communication with the ministry of health and/or the IHR National Focal Point?[c]
Q4 -	Do coordination mechanisms with relevant sectors exist for surveillance and timely response to chemical events?
Q5 -	Have functional coordination mechanisms with relevant sectors been implemented for surveillance and timely response to chemical events?
Q6 -	Is surveillance in place for chemical events, intoxication or poisonings?
Q7 -	Has a list of priority chemical events/syndromes that may constitute a potential public health event of national and international concern been identified?
Q8 -	Is there an inventory of major hazard sites and facilities that could be a source of chemical public health emergencies (e.g. chemical installation and toxic waste sites)?
Q9 -	Has a national chemical profile been developed?[d]
Q10 -	Are manuals and standard operating procedures (SOPs) for rapid assessment, case management and control of chemical events available and disseminated?
Q11 -	Is there timely and systematic information exchange between appropriate chemical units, surveillance units and other relevant sectors about urgent chemical events and potential chemical risks?[e]
Q12 -	Is there an emergency response plan that defines the roles and responsibilities of relevant agencies in place for chemical emergencies?
Q13 -	Has laboratory capacity or access to laboratory capacity been established to confirm priority chemical events?
Q14 -	Has a chemical event response plan been tested through occurrence of real event(s) or through a simulation exercise, and updated as needed?
Q15 -	Is there an adequately resourced poisons centre(s) in place?[f]
Q16 -	Have country experiences and findings regarding chemical events and risks of national and international concern been shared with the global community?

[a] "Experts" include chemical risk assessors, risk managers and clinical toxicologists.

[b] Elements of alert include SOPs for coverage, criteria of when and how to alert, duty rosters, etc.

[c] Note that this cross-references with coordination (core capacity 2) and this component should also be fully addressed under that core capacity.

[d] Definition and relevant information on National Chemical Profiles are available at http://www2.unitar.org/cwm/nphomepage/index.html

[e] e.g. chemical surveillance, environmental monitoring and chemical incident reporting.

[f] e.g. clinical toxicology, 7/24 hotline, material data sheet, safety data sheet and contact details of chemical manufacturers.

Annex C: International agreements concerning chemicals

Strategic Approach to International Chemicals Management (SAICM)

SAICM was adopted by the International Conference on Chemicals Management (ICCM) on 6 February 2006 in Dubai, United Arab Emirates. It provides the international policy framework to foster the sound management of chemicals. Governments have agreed a target that, by 2020, chemicals should be produced and used in ways that lead to the minimization of significant adverse effects on human health and the environment. The involvement of all relevant sectors and stakeholders, including at the local, national, regional and global levels, is seen as key to achieving this objective. The main stakeholders in SAICM are governments, regional economic integration organizations, intergovernmental organizations, nongovernmental organizations and individuals involved in the management of chemicals throughout their life-cycle from all relevant sectors, including, but not limited to, agriculture, environment, health, industry, development cooperation, labour and science. Individual stakeholders include consumers, employers, farmers, producers, those responsible for waste management, regulators, researchers, suppliers, transporters and workers. Assistance is available through SAICM for countries to improve their chemicals management capacities. A gaps assessment prepared by the SAICM Secretariat has identified that, among other things, many countries need to strengthen their capacities for the prevention and management of poisoning and of chemical incidents (SAICM, 2014). These are also directly relevant to IHR implementation.

There is a specific health sector strategy under SAICM adopted at the International Conference on Chemicals Management in 2012, which aims to improve awareness of the sound management of chemicals within the health sector and to strengthen the capacity of this sector to fulfil its own unique roles and responsibilities in chemicals management (SAICM, 2012). While the WHA in 2006 urged WHO Member States to take full account of the health aspects of chemical safety in SAICM (WHO, 2006), the participation of the health sector in SAICM is weak in most countries. For example, the majority of the projects granted through the SAICM Quick Start Program have not involved the health sector, and only a few of the country focal points are from the health sector. More, therefore, needs to be done by the health sector to take up capacity-building opportunities under SAICM. At the Mercosur meeting in Montevideo in 2013, for instance, health ministers declared their commitment to strengthen the health sector's role in the management of chemicals (Mercosur, 2013).

Governments have nominated national SAICM focal points (SAICM FPs). The role of the focal points is to provide a conduit for communication about issues concerning SAICM and to facilitate an integrated approach to managing chemicals. In most countries the SAICM FP is based in the ministry of environment, although in a small number of countries the FP is in the ministry of health. A list of national SAICM FPs including contact details is available on the SAICM web site (SAICM, 2015b).

Rotterdam Convention

The full name is the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (UNEP, 2015a).

The Convention was adopted on 10 September 1998 and entered into force on 24 February 2004. Its objectives are to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals, in order to protect human health and the

environment from potential harm, and to contribute to the environmentally sound use of those hazardous chemicals by facilitating information exchange about their characteristics.

The Designated National Authority (DNA) for the Rotterdam Convention plays a crucial role in the implementation of the Convention by disseminating information concerning the provisions of the Convention to the relevant government departments as well as to other partners, such as export and import industries and customs officers. Each Party should have at least one DNA. However, in some countries there are separate DNAs for industrial chemicals and pesticides. A database of national DNA FPs is available at UNEP (2015b).

Basel Convention

The full name is the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (UNEP, 2015c).

Adopted in 1989, the aim of the Basel Convention is to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movement and disposal of hazardous wastes and other wastes. The Convention regulates the transboundary movements of such wastes and obliges its Parties to ensure that these wastes are managed and disposed of in a sound manner. Of particular relevance to the IHR is the requirement for Parties to inform other States immediately whenever it comes to the Party's knowledge that an accident occurring during the transboundary movement of hazardous wastes or other wastes is likely to present risks to human health and the environment in those States.

States Parties must designate a Competent Authority (CA) and a Focal Point (FP) for the Basel Convention. The CAs are the governmental authorities responsible for receiving and responding to notifications and other information about a transboundary movement of hazardous or other wastes. The CA decides whether to allow the transit or import of the waste. The FP is responsible for receiving information from the CA and submitting it to the Secretariat and other Parties. This includes national definitions of hazardous waste and information about accidents. A database of CAs and FPs is available on the web site of the Basel Convention (UNEP, 2015d).

Stockholm Convention

The full name is the Stockholm Convention on Persistent Organic Pollutants (POPs) (UNEP, 2015e).

The Stockholm Convention is a global treaty to protect human health and the environment from highly dangerous, long-lasting chemicals by restricting and ultimately eliminating their production, use, trade, release and storage. Currently 23 industrial chemicals and pesticides are listed under the Convention for elimination or restriction of use. There are also five chemicals, or groups of chemicals, that are by-products, for which Parties must take measures to reduce unintentional release. POPs are of concern because, once released into the environment, they: i) remain intact for exceptionally long periods of time (many years or decades); ii) become widely distributed throughout the environment as a result of natural processes involving soil, water and, most notably, air; iii) accumulate in the fatty tissue of living organisms including humans; iv) accumulate in the food chain; and v) are toxic to both humans and wildlife.

States Parties must designate Official Contact Points (OCPs) and National Focal Points (NFPs) for the Stockholm Convention. The OCP is responsible for administrative functions and all formal communications under the Convention through the ministry of foreign affairs or the diplomatic

missions. The NFPs deal with the exchange of information about the reduction or elimination of the production, use and release of POPs and alternatives to POPs, including information relating to their risks as well as to their economic and social costs. The lists of national OCPs and NFPs are available at UNEP (2015f).

Minamata Convention on Mercury

The Minamata Convention is a relatively new treaty that was presented for adoption and signature in October 2013 and currently has 128 signatories and ten ratifications (UNEP, 2015g). It will enter into force after the 50th ratification. The Convention will require Parties to take measures to reduce usage and emissions of mercury across a range of products, processes and industries. Governments have agreed on a number of mercury-containing products that will be banned by 2020, for example mercury-containing thermometers. In addition, governments have agreed to draw up strategies to reduce the amount of mercury used by small-scale gold miners. Furthermore, the treaty aims at controlling mercury emissions and releases from, for example, coal-fired power stations, industrial boilers, smelters, waste incineration and cement clinker facilities. The Minamata Convention includes a specific article on health, and it encourages States Parties to promote appropriate health-care services for prevention, treatment and care of populations affected by mercury exposure and to establish and strengthen capacities for the prevention, diagnosis, treatment and monitoring of health risks related to mercury exposure (WHO, 2014a).

The Convention requires that National Focal Points (NFPs) are identified for the exchange of information.

Chemical Weapons Convention (CWC)

The CWC (OPCW, 2015a) aims to eliminate an entire category of weapons of mass destruction by prohibiting the development, production, acquisition, stockpiling, retention, transfer or use of chemical weapons by States Parties. All States Parties have agreed to disarm chemically by destroying any stockpiles of chemical weapons they may hold and any facilities that produced them, as well as any chemical weapons they abandoned on the territory of other States Parties in the past. States Parties have also agreed to create a verification regime for certain toxic chemicals and their precursors.

The Organisation for the Prohibition of Chemical Weapons (OPCW) has a programme for building capacity for the peaceful uses of chemistry, including the strengthening of laboratories (OPCW, 2015b).

Under the CWC, States Parties designate or establish a National Authority (NA). This body: i) escorts OPCW inspections of relevant industrial or military sites; ii) submits initial and annual declarations; iii) assists and protects those States Parties that are threatened by, or have suffered, chemical attack; and iv) fosters the peaceful uses of chemistry. In addition, the National Authority acts as the focal point in the State Party's interaction with other States Parties and the Technical Secretariat of the OPCW. A list of NAs is available at OPCW (2015c).

International Convention for the Prevention of Pollution from Ships (MARPOL)

The International Convention for the Prevention of Pollution from Ships (MARPOL) (IMO, 2015a) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.

The MARPOL Convention was adopted on 2 November 1973 at the International Maritime Organization (IMO). The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977. The Convention includes regulations aimed at preventing and minimizing pollution from ships, both accidental pollution and that from routine operations.

The IMO keeps a list of national contact points for safety and pollution prevention and response (IMO, 2015b).

Other sources of information

The Organisation for Economic Co-operation and Development (OECD) has a long-running Chemical Accidents Programme, which works in three areas: i) developing common principles and policy guidance on prevention of, preparedness for, and response to chemical accidents; ii) analysing issues of concern and making recommendations concerning best practices; and iii) facilitating the sharing of information and experience between both OECD and non-member countries (OECD, 2015a).

Much of this work is carried out by the Working Group on Chemical Accidents (WGCA), which comprises representatives nominated by member countries and representatives of the European Commission, observers from non-member countries, and international organizations that carry out work in the field of chemical accidents. A list of member countries is available at OECD (2015b).

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