Public Health Toolkit for Shoreline Response to Maritime Chemical Incidents

Activity 2

Task 2.3

ARCOPOLplus

Improving maritime safety and Atlantic Regions' coastal pollution response through technology transfer, training and innovation

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Introduction

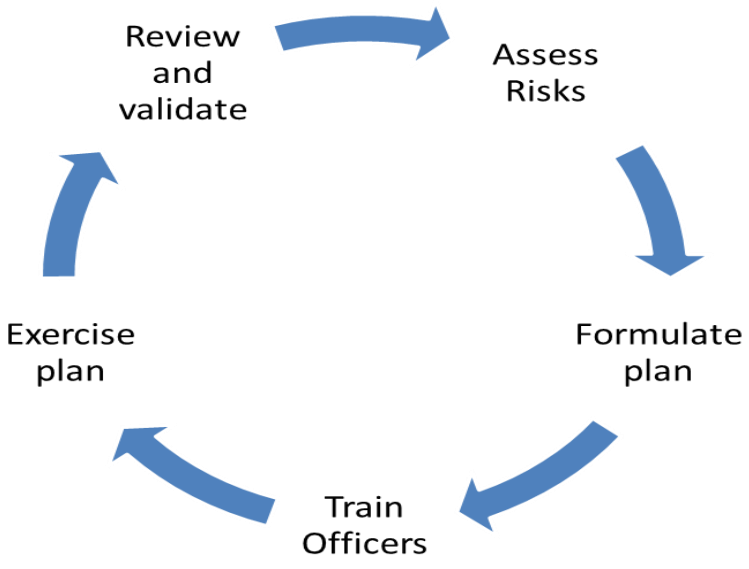
The following manual has been developed by Public Health England (CRCE Wales) to aid shoreline response to maritime chemical incidents. The manual has been developed for the Arcopol Plus Project under Activity 2.

The manual is supplemented by a series of E-learning modules, also developed for Arcopol Plus, which provide short interactive units to train and test the understanding responders. The E-learning package can be accessed via Links on the Arcopol website and links provided in the sign-post page below.

The manual is aimed at emergency responders, planners and public health professionals and aims to provide an overview of key aspects of shoreline incident response, particularly in respect of incidents involving hazardous chemicals (HNS). The manual also provides a collation of usable documents relevant to planning for such events, as well as links to additional reference materials.

The manual is structured into the following sections, providing an overview of key elements in each phase of incident planning and response:

- Chemical Hazard and Risk
- Planning and Preparedness
- Risk Communication
- Response
- Recovery
- Management and Audit



Sign-post document for Manual

Process Phase	Key Points	Arcopol Resources
Chemical Hazard and Risk	Assess Hazards Prioritise Risks	E-Learning Units 1 and 2 Arcopol Prioritisation Tool Datasheets (Appendix 1) Case Studies
Planning and Preparedness	Prepare controls and procedures with reference to legislation and best practise Testing and Training	Checklists (Appendix 2) Exercises (Appendix 5) Case Studies E-Learning Unit 3
Risk Communications	List Key Contacts Develop Key messages and Information	Communication Strategy FAQs (Appendix 3) Case Studies E-Learning Unit 3
Response	Prepare Inventory of equipment and resources Establish arrangements with Accredited Contractors Exercise	Case Studies E-Learning Unit 4 Exercises
Recovery	Engage with Stakeholders Follow-up Health impact Record actions for Compensation Apply Lessons Learnt	Stakeholder Engagement Case Studies E-Learning Unit 5
System Management	Set Targets Audit Review Improve	Audit Report

Chemical Hazard and Risk

Maritime Transport of Hazardous Chemicals

Shipping offers a highly efficient option for global transportation of bulk materials including chemicals. Data estimate some 2,000 hazardous substances (HNS) carried by sea on a regular basis.

Chemicals carried by maritime shipping and **with the potential to cause harm to health and the environment** can essentially be classified into 2 categories:

- Oil i.e. petroleum hydrocarbons
- Hazardous and noxious substances (HNS) i.e. anything hazardous other than oil

Oil

Oils are complex mixtures of hydrocarbon chemicals typically carried in bulk either as raw material for refining (crude oil), or as refined products. They are also used by ships as fuel and lubricants.

HNS

By their definition HNS can be a multitude of chemicals ranging from gases and solvents to vegetable oils and metals. Again they may be carried in bulk or as packaged goods.

Characteristics of oils and HNS can be found in a number of databases including: REMPEC MIDSIS TROCS, ARCOPOL HNS prioritisation DB and ARCOPOL Online Database for properties of oil & HNS substances.

Hazards to Health and the Environment

Two factors essentially govern the hazards posed by a chemical carried at sea, namely;

- Its harmful properties (toxicity, flammability, reactivity, persistence)
- Its behaviour in the environment.

Harmful properties of chemicals carried at sea can be obtained from a multitude of reference sources, such as GESAMP, WHO IPCS, TOXNET , OECD and others.

Likewise the behaviour of both oil and HNS when released into the environment can be defined by knowing certain chemical properties, namely density, vapour pressure and aqueous solubility. This will enable responders to establish if a substance will float, evaporate, sink or dissolve in the marine environment. Knowledge of reactivity of substances will also be helpful. Such data can be obtained from a variety of sources e.g. CAMEO

The information described above can be used to assess and prioritise risks associated with maritime activities as follows:

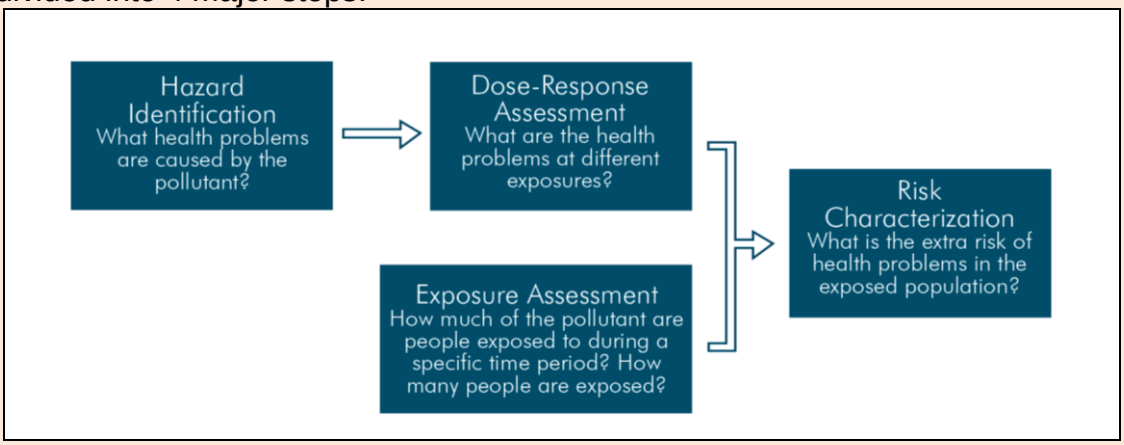
Risk assessment

Risk is defined as the likelihood of harm occurring; it is an expression of probability and outcome. Risk can relate to both acute (immediate) and chronic (longer term) effects.

Risk= (severity of hazard) x (likelihood of exposure)

Assessment of the risks is vital to incident management. It is the process whereby the risk(s) to human health or the environment are characterized through consideration of the nature and probability of adverse effects.

Risk assessment typically involves a **source-pathway-receptor** approach i.e. a source of chemicals, receptors (people and ecological) that may be affected by those chemicals and a means of the chemicals reaching the receptors. All 3 must be present to represent a risk. The risk assessment paradigm is classically divided into 4 major steps:



Risk Prioritisation

Once risks have been assessed, they may be compared to help identify those chemicals posing highest relative risk. This provides a manageable basis for prioritising resources to those situations which are likely to have the greatest impact and likelihood to occur. The following link provides access to a simple risk prioritisation tool developed for Arcopol.

Once risks have been prioritized, measures can be put in place to manage these, such as developing more detailed information for responding to releases of specific chemicals. Appendix 1 provides a series of datasheets developed for response to HNS prioritised from studies on the EU Atlantic region.

Residual risk

Despite available measures, risk management will not completely eradicate risk. The remaining risk is referred to as residual risk, which forms the basis for subsequent **emergency planning and preparedness**.

Planning

Emergency planning is an essential activity and serves to prevent, reduce or mitigate the impact of incidents. This usually takes the form of a written document or plan. It is often typical to plan a tiered system of response to marine incidents dependent upon their scale and level of response. For example

- Tier 1 = Requiring local response
- Tier 2 = Requiring wider regional response
- Tier 3 = Requiring National or International response

National Plans (Tier 3)

A national maritime incident plan is strategic and should recognise internationally binding agreements and legislation, such as those defined by OPRC and the EMSA Mar-Ice Agreement.

Regional Plans (Tier 2)

Regional plans should recognise the major regional players and ensure co-ordination, tying in with both national and local plans.

Local Plans (Tier 1)

Local plans should be drawn up reflecting hazards that may pose a risk to local communities. It is therefore necessary to identify principal hazards in a given locality and understand the risk mitigation strategies in place. All principal parties, including the community should be engaged in this process. The local plan should emphasise:

- The importance of protecting the community and in particular vulnerable populations and environmentally sensitive areas.
- Operational information as to where to set up emergency co-ordination units, access to electricity and other utilities.
- The need for integration into broader plans that deal with natural disasters and acts of terrorism.
- The need for familiarisation by responsible agencies such that response is timely and effective.
- Communications channels for responders, managers and the public.

Preparedness

Preparedness in essence refers to a state of readiness and is a prime responsibility of incident management and response teams. Key considerations of this process are presented below

Command and Control

Having a pre-agreed incident command and control structure facilitates understanding of respective roles and responsibilities and provides the basis for multi-disciplinary incident response. In view of the large numbers of agencies and groups involved in such scenarios, it is vital to ensure that a lead body is identified and that reporting channels are clearly defined.

Detection & Alerting

Detection of an incident is the first crucial step in responding. Timely detection and notification allows mobilisation of resources in a co-ordinated, efficient and effective manner, thereby reducing the impact. Whatever the mechanism of incident detection, incidents may occur at any time and at any place, thus access is required 24/7/365.

Training of staff

In order to ensure an efficient, effective timely response, human resources need to be identified and suitably trained through theoretical materials and participation in exercises.

Exercises

One way of providing practical incident management experience is to construct exercises. Exercises that address specific components of the incident management cycle improve the effectiveness of theoretical training and contribute to preparedness. Examples of exercises can be found in Appendix 4.

Checklists

A series of checklists have been developed to assist with developing the planning and preparedness process. These are available in Appendix 2.

Risk Communications

Having a mechanism in place to facilitate effective communication of public health risks (both proactive and reactive in nature) is essential and must be supported by a robust risk assessment and a sound understanding of the target audience.

Such communication falls into 2 categories –

- Risk communication – Developed at the planning stage and involving preparation of predetermined materials regarding hazards and response. This should be done in liaison with all stakeholders including local communities, businesses and action groups.

- Crisis Communication – Applied after an incident has occurred involving essential advice such as sheltering, evacuation, all-clear messages etc. via various media.

Failure to implement suitable communications channels can have detrimental effects on the ability to respond to an incident, whilst failure to issue appropriate advice can lead to increased risks to the public. This is illustrated in the case study No. 4 on this link. Further information can be found here: Risk Communications Strategy

Stakeholder Engagement

In all phases of chemical incident management, it is vital to have stakeholder "buy-in". Key to this will be initiating methods to engage communities and include their views within proposed planning and response / recovery processes. This must be done at the earliest stages of the work to enable full participation.

Platforms such as social media and internet will form significant mechanisms for these activities in addition to conventional methods such as mail drops, public meetings and formal press statements.

A guide to this process has been developed as part of the Arcopol Plus project. This details approaches to engage communities and stakeholdersand can be obtained here: Community Engagement Document

Predefined information

Preparation of relevant information and messages that may be used pre and during an incident can aid the communication and engagement process. A series of FAQs (Frequently asked questions) in relation to HNS are presented in Appendix 3

Response

Response covers a wide range of activities as discussed below. In all cases response should be undertaken by trained specialists such as fire and rescue teams and accredited chemical spill / salvage contractors.

Initial Response to Pollutants at Sea

Attempts can be made to prevent pollutants reaching the shore in significant quantities, such as using booms and sorbent materials to contain surface slicks, or using chemical dispersants to dissipate spills. Further detail on these techniques can be obtained from Arcopol.

Shoreline Response

If pollutants come ashore the immediate priorities will be to clear affected areas, provide emergency care to those suffering health effects, protect sensitive ecosystems and rescue wildlife. In such circumstances it is often recommended to delineate the incident area into zones; The “Hot Zone”, nearest the incident where only responders have access, The “Warm Zone” for decontamination, and the “Cold Zone” where control and staging centres are located. The scale of such zoning will depend upon the incident but indicative distances can be found from sources such as the Emergency Response Guidebook

Decontamination and Personal Protective Equipment (PPE)

Decontamination serves to remove the hazardous substance and thus limit casualty exposure. It also serves to prevent secondary contamination of responders as well as the wider public. It may involve decontamination of casualties exposed to chemicals and / or removal of chemical contamination from environmental media. When initiating such activities, it is important to consider control of wastes and the protection of operatives i.e. PPE.

PPE will vary depending upon activity. Those working in the “hot zone” may be exposed to noxious atmospheres requiring gas tight suits and self-contained breathing apparatus (SCBA). Those working in the “warm zone” by contrast are potentially exposed to contaminated individuals and as such require liquid tight suits and respirators with filters. Whatever the level of appropriate PPE, it should only be used after completion of suitable training and fitting tests.

On-going Response

As the incident continues, focus will shift from the management on-scene to the wider implications of exposure. This requires as much information as possible regarding the incident and the chemicals released, such that an assessment can be made regarding the potential or actual risks to the environment and health. Environmental modelling and monitoring will help to provide useful information in this regard. Details on modelling and monitoring can be obtained via Checklists in Appendix 2 as well as links such as - Arcopol, CIIMAR, PREMIAM, SCAT.

Recovery

Recovery refers to the return to normality, either naturally or via intervention, and incorporates economic, environmental and health aspects.

Community Recovery

Incidents may result in both acute and chronic health effects both physical and psychological. The rapid availability of medical assistance, facilities, housing and clothing is of prime importance. Instigation of a single point of contact for the public is also a key aspect of this phase whilst a register of the affected population should be compiled as a prelude to further follow-up and epidemiological investigation. Such studies should be undertaken by skilled medical professionals.

Environmental Recovery (Remediation)

Remediation refers to the process of making the environment cleaner and safer following contamination. It may occur naturally via dilution, evaporation and dispersion, or through active interventions. Active remediation is often required, particularly if the chemicals involved are environmentally persistent. Under such circumstances, a full site characterisation will be required, identifying the extent and scope of contamination, and a method appraisal assessing appropriate remedial targets, logistical issues and cost implications. Examples of this process can be found here: Chemical Recovery Handbook.

Restoration and Rehabilitation

Restoration and rehabilitation looks beyond simply removing contamination and may involve landscaping and rebuilding, replacing equipment and infra-structure, replanting and restocking wildlife, and assisting the community to return to a sustainable position in terms of health, social and economic status. It may be both extremely time-consuming and expensive. Compensation may be awarded where sufficient evidence of damage and liability can be proven.

Management and Audit

Management systems (including incident management) typically follow similar logic and principles, namely:

- Recognition / identification of hazards, risks and existing performance levels
- Processes to manage and respond to identified hazards and risks and improve performance
- Monitoring of the effectiveness of the existing process (review / audit)

The objective of any management system is to facilitate continual improvement. The process by which this is achieved is often based upon the model of Deming and others consisting of: **Plan – Do – Check – Act**.

Checking of performance forms an integral phase of the cycle and can be achieved via formal audit or from lessons learnt following an incident or test.

Audit

Audit is the process whereby independent, systematic review of a management system is undertaken in order to assess compliance with explicit and pre-determined criteria. Where there are recognised deficiencies, procedures should be put in place to implement change. Audit therefore contributes to management system improvement.

An important element within the process is the determination of suitable standards or performance indicators against which the system can be assessed. In many cases audits will be undertaken against recognised standards e.g. ISO14001 or EMAS (eco management accreditation scheme). However in many cases a formal standard may not exist and in such cases the system will need to be audited against some form of agreed good practise indicators.

Examples of Audit checklists and templates are presented in this link.

Post-incident Assessment

Lessons learnt following a maritime incident will help to contribute to improvement of the response process. As such after any incident it is important to undertake a detailed de-brief. Such investigations may be taken at national, regional or local level depending upon the scale of involvement, but should always ensure input from local representatives who will have first-hand knowledge of the incident.

Information obtained from the post-incident assessment(s) should subsequently be disseminated as lessons learnt and incorporated into the emergency planning and preparedness phase thereby completing the management cycle.

Appendices

Appendix 1

Datasheets for Selected HNS

(Additional sheets may be obtained from EMSA MAR-CIS during 2014)

Name	Link
Ammonia	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=23
Chlorine	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=24
Ethylene Oxide	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=25
Methylamine	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=26
Vinyl Chloride	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=67
Formaldehyde	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=66
Dimethylamine	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=65
3-Methyl Pyridine	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=64
2-Aminoethoxy Ethanol	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=63
2-Amino-2-methyl-1-propanol	http://www.arcopol.eu/arcopol/fichaDocumento.aspx?id=62
Hypochlorites	http://www.arcopol.eu/fichaDocumento.aspx?id=46
Acids Organic	http://www.arcopol.eu/fichaDocumento.aspx?id=49
Acids Inorganic	http://www.arcopol.eu/fichaDocumento.aspx?id=47
Alkaline Liquids	http://www.arcopol.eu/fichaDocumento.aspx?id=45
Tars	http://www.arcopol.eu/fichaDocumento.aspx?id=50
Oil Wastes	http://www.arcopol.eu/fichaDocumento.aspx?id=48

Appendix 2

Checklists for Planning and Preparedness

Name	Link
Management Plan – Checklist No.1	http://www.arcopol.eu/arcopol/archivos/V2_DOCUMENTACION/52/Checklists_V1.pdf
Incident Plan - Checklist No.2	
Toxicological Datasheet - Checklist No.3	
Operating Procedures - Checklist No.4	
Detection and Alert - Checklist No.5	
Training and Exercise - Checklist No.6	
Response - Checklist No.7	
Countermeasures - Checklist No.8	
PPE - Checklist No.9	
Decontamination - Checklist No.10	
Sampling and Monitoring - Checklist No.11	
Risk Communications - Checklist No.12	
Recovery - Checklist No.13	
Audit - Checklist No.14	

Appendix 3

Frequently Asked Questions for Chemical Behaviour Classes

Name	Link
Gases and Evaporators	See page 23 in http://www.arcopol.eu/fichaDocumento.aspx?id=18
Floaters	See page 25 in http://www.arcopol.eu/fichaDocumento.aspx?id=18
Dissolvers	See page 27 in http://www.arcopol.eu/fichaDocumento.aspx?id=18
Sinkers	See page 29 in http://www.arcopol.eu/fichaDocumento.aspx?id=18
Packages	See page 31 in http://www.arcopol.eu/fichaDocumento.aspx?id=18

Appendix 4

Exercises

Name	Link
Tempest 1	http://www.arcopol.eu/fichaDocumento.aspx?id=53
Tempest 2	
Tempest 3	