

EROCIPS

Emergency Response to coastal Oil, Chemical and Inert Pollution from Shipping



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WP 1: Pollution Threats

Task 1.5: Pollution Scenarios

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1. Executive summary

This report summarises the results that partners participating in the EROCIPS project have obtained in relation to the pollution scenarios along their coasts. Using shipping and port information, the risks of occurrence of various maritime incidents, such as collision, grounding, fire, explosion and structural failure, were assessed (including those associated with both ships and shore-based facilities such as port facilities, refineries, etc.). The type and quantity of pollution (oil, chemical or inert substance) and the type of container likely to be released and its likely point of release were considered. This study aims to be a supporting tool for contingency planning and training that contributes to the improvement of the management of marine incident contingency along the Atlantic coast.

2. Introduction

The European Atlantic area has been involved in numerous accidents that have implied disasters at several levels. The increasing maritime traffic makes it impossible to avoid this kind of incident, but a better knowledge of pollution scenarios at regional and national levels will result in better handling of crises, minimising the harmful consequences for the environmental, social and economic interests.

The immense wealth of coastal areas and interior waters, with respect to sea resources and tourism, may be threatened by activities related to industrialisation and territorial occupation, which necessarily implies an increase in port activities and navigation with the consequent risks of spills, especially of hydrocarbons and other dangerous or noxious substances.

The correct balance between these activities, of undeniable socio-economic interest, are the subject of several studies, among which it is important to consider the existence of Emergency or Contingency Plans that can be activated in the case of an incident that puts in danger the normal development of these different activities.

For the establishment of these Contingency Plans the elaboration of risks analysis is indispensable. This analysis should not only be used in the establishment of these Plans, but should also help in setting up and use of the preventive actions that are used to minimise the occurrence of incidents/accidents and also evaluate their severity. Environmental and socio-economic parameters of the areas in the study should be considered in this analysis.

The EROCIPS project tries to develop protocols and tools that can be used by regional and local authorities that are in charge during a maritime incident that causes a spill. In this sense, the elaboration of risk analysis that can contribute to the establishment of Contingency Plans appears indispensable in the setting up and use of the preventive actions to minimise the occurrence of incidents and also evaluate their severity.

3. Objective and geographical scope

3.1. Objective/aims of the task

The main objective of this task is to analyse the pollution scenarios in the EROCIPS regions so as to help evaluate the risks associated with the intense maritime transportation that takes place along the Atlantic coast of Europe.

The analysis of the pollution scenarios aims to become a useful tool in order to improve the preparedness of regional authorities that have to deal with the contingency, minimising the undesirable effects on human and environmental health.

3.2. Geographical scope of the task

An analysis of the pollution scenarios has been carried out for the different regions that participated in the EROCIPS project, which are represented in yellow in Figure 1.

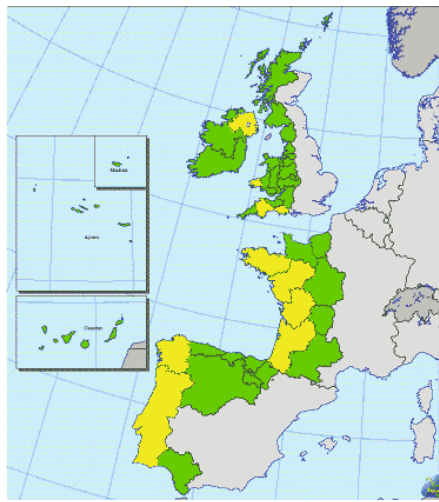


Figure 1. EROCIPS geographical scope.

The partners involved in this pollution scenario analysis were:

From the **United Kingdom**: Devon County Council, Dorset County Council, Pembrokeshire County Council, Environment and Heritage Service (Northern Ireland).

From **France**: Conseil Régional d'Aquitaine, Conseil Régional de Bretagne, Conseil Régional des Pays de la Loire, Conseil Régional de Poitou-Charentes.

From **Portugal**: HIDROMOD, Instituto Superior Técnico and CIIMAR.

From **Spain**: Autonomous Government of Galicia (INTECMAR, Ministry of Fisheries and Maritime Affairs, Ministry of Environment) and CETMAR.

The EROCIPS regional authorities each had a very different status in relation to the risk analysis for their areas, not only because of the different levels of responsibility assigned to each participant, but also because of the varying levels of development of the analysis.

4. EROCIPS context and framework

Nowadays, the management of the contingencies of marine pollution must be focused on three different areas:

- a. the environmental sensitivity issues;
- b. the risk of spills occurring and their possible consequences;
- c. the capabilities of the different authorities and their competence for dealing with oil spills.

These three aspects must be taking into account in order to know which pollution scenario is being considered.

The analysis of the environmental sensitivity of coastal areas implies a detailed study, which has been covered in other work packages of the EROCIPS project. In this sense, Work Package 2 deals with the analysis of coastal sensitivity and the analysis of the different methods of cleaning that can be applied after an incident, depending on the coastal sensitivity. On the other hand, Work Package 7 establishes protocols that can help scientists and stakeholders monitor the status of coastal communities before and after an incident takes place and during the restoration period. These two previous aspects constitute basic information to complete the analysis of pollution scenarios based on the risk of spills occurring.

Work Package 1 of the EROCIPS project tries to develop maritime incident scenarios and their associated pollution risks by:

- analysing the complex mix of international and short sea shipping and associated port operations within the Atlantic Area, identifying ship types, cargo types and port facilities and combining these with risk factors (collisions, groundings, etc.) to assess the risk of incidents;
- using a standard geographical information system (GIS) to map an inventory of natural, human and built environment assets and coastal oceanographic and meteorological processes (wind, tides, etc.) to provide baseline information; and
- reviewing past experience of incidents and the lessons learnt so as to provide baseline information on risks and threats, on which effective contingency planning can be based.

The different regions participating in the project have used the analysis developed under Work Package 1 as basic information to evaluate the pollution scenarios in their area.

5. Methodology

Taking into account the fact that other work packages of the EROCIPS project are focused on issues related to the sensitivity of coastlines, we decided to carry out the analysis of pollution scenarios basing on the risk assessment for the different areas involved in the project. The partners of the project were asked to describe how they carried out the risk assessment in their regions and what are their main conclusions.

The following is a description of the different methodologies that have been used by the different regions.

5.1. Methodology developed in the UK regions

5.1.1. National risk assessment framework for incidents: Civil Contingencies Act

With the introduction of the Civil Contingencies Act 2004 a duty was placed on all Category 1 responders to produce a *Community Risk Register*. This outlines what the local resilience forum (LRF) sees as the risks associated within their area. This is a “living” document, which will see the risks and risk ratings change as new risks are recognised and old threats also change. The LRF is the forum for multi-agency cooperation based on each police force area.

A number of risk assessments will be passed down by central government and government agencies, such as the Maritime Coastguard Agency (MCA), and in some cases generic threat statements and information on hazard likelihood – in the form of the LRAAG, Local Risk Assessment Guidance – are provided via the Regional Governments. The Regional Assemblies may issue its own risk assessments to responders in the region. The Community Risk Register should be shared with LRFs with whom a boundary is shared.

The fact that a risk is included in the register does not mean that any particular incident will happen. Nevertheless, the possibility, however remote, has been recognised and the relevant agencies have arrangements in place to mitigate the effects of such incidents and must have plans to respond to these major incidents. The Community Risk Register does not cover all eventualities. There is no need to assess every single risk, particularly those with a very low likelihood of occurrence. Neither is there a need to individually assess all risks on a neighbourhood by neighbourhood basis.

The Risk Register allows the LRFs to focus multi-agency emergency planning work on a rational basis of priority and need. This is the case of Dyfed Powys LRF, which refers to the following counties: Pembrokeshire, Ceredigion, Carmarthenshire, Powys. Many risks are assessed on their impact across the entire Dyfed Powys area. The threshold for the Community Risk Register is those incidents that will potentially have an impact on one or more Category 1 Responders across Dyfed Powys. Therefore, risks that are routine business for Category 1 Responders are not included in the Community Risk Register, but only those events which constitute major incidents.

The current Risk Register gradings for the Dyfed Powys LRF are demonstrated in Table 1 with marine/coastal pollution from an oil spill being seen as a medium risk. Each LRF in the UK (<http://www.ukresilience.info/preparedness/ukgovernment/lrfs.aspx>) must prepare a community risk register and this one is specific to the Dyfed Powys area.

Category National	Reference	Hazard/Threat	Outcome Description	Likelihood	Impact	Risk Rating	Actions Taken
Transport Accidents	HL37	HL37 – Release of significant quantities of hazardous chemicals/ materials as a result of major shipping accident	Up to 50 fatalities and up to 250 casualties. Significant environmental/ ecological damage. The extent of the impact would depend on substance involved, quantity, nature and location of accident	2	5	High	
Industrial Accident and Environmental Pollution	H15	H15 – Maritime Pollution Spillage of up to 100,000 tonnes of crude oil into the sea polluting up to 200 km of coastline	Potentially significant damage to amenity value, i.e. tourism, agriculture/ commerce and aquatic ecosystem	1	5	Medium	
Industrial Accident and Environmental Pollution	HL4	HL4 – Major pollution of controlled waters/water courses	Pollution incident impacting upon controlled waters and water courses, e.g. could be caused by chemical spillage or release of untreated sewage) leading to persistent and/or extensive effect on water quality, major damage to aquatic ecosystems, closure of potable abstraction points, major impact on amenity (i.e. tourism) value, serious impact on human health	4	5	Very High	

Table 1. The current Risk Register gradings for the Dyfed Powys LRF.

5.1.2. Shipping traffic and pollution risk assessment

Northern Ireland

The study of pollution scenarios for this area was carried out by Anatec UK Ltd on behalf of the Environment and Heritage Service (EHS), Northern Ireland. They used the Shipping and Ports study to estimate the risk of a shipping accident leading to a spill of pollutant that subsequently reaches the Northern Ireland coastline. Once the frequency of incidents was determined, Anatec's COLLRISK spill models were used to estimate the frequency of a spill and, where outflow was predicted, the type and quantity of pollutant entering the sea (fuel oil, cargo oil and bulk chemicals).

There were five scenarios considered and several parameters used within the risk models that were applied in the assessment:

- ship collision: route positions, number of vessels on route, vessel type, size and speed distributions, visibility, encounter angle;
- fire and explosion: number of vessels on route, vessel type and size distributions;
- foundering: number of vessels on route, vessel type, size and age distributions, traffic densities and probability of severe weather in different geographical locations;
- powered grounding: number of vessels on route, vessel type and size distributions, proximity of route to coastline, sea state, geometrical probabilities, navigational error probabilities;
- drifting grounding: route positions, number of vessels on route, vessel type and size distributions, wind strength and direction, sea state, mechanical failure probabilities, self-repair probabilities, drift speeds.

Finally, a spill drift model was used to predict the quantity and location of pollutant reaching the Northern Ireland coastline. This model takes into account various factors including spill location, type of quantity, metocean conditions, effect of weathering and evaporation, etc. From the outputs of the risk assessment modelling, the areas of the Northern Ireland coastline most exposed to risk were identified to aid in emergency/pollution response planning.

Devon County Council

The methodology followed by this region has been developed by Anatec UK Ltd and is similar to that followed by Northern Ireland.

Pembrokeshire County Council

The methodology followed by this region has been developed by Anatec UK Ltd and is similar to that followed by Northern Ireland. This methodology and risk assessment has enabled the LRF to justify the risk rating for major pollution of controlled waters from chemical or oil spill, stated as Very High.

Dorset County Council

The risk assessment for this area provides a generic assessment for the entire Dorset coastline considering the impact that a major release could have on both the natural environment and the economy and community that inhabit the coastal zone. It is based upon the largest possible pollution release for each type of pollution. For the impact on the natural environment the following are considered: the damage to habitats, the loss of wildlife and the contamination of the environment. For the impact on socio-economic aspects, the following are considered: public safety, loss of recreational assets, damage to property, loss of tourism and pollution to fisheries. From these aspects four categories of impact were established for the risk assessment:

- health;
- social;
- economic;
- environmental.

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According to the impact study, an impact scoring was established (insignificant, minor, moderate, significant and catastrophic) to set the impact risk rating (low, medium, high).

Three different pollutant types were considered for the risk assessment:

- oils: very light oils, light oils, medium oils and heavy oils;
- chemicals: explosives, gases, flammable liquids, flammable solids, oxidising substances and organic pesticides, toxic and infectious substances, radioactive materials, corrosive substances, miscellaneous dangerous substances and articles;
- inert: food wastes, glass, metal, wood products, fishing related waste, polystyrenes, lost cargo.

Ten causes of pollution release were considered for the risk assessment:

- collision between two vessels (offshore);
- collision between two vessels (in port);
- collision between vessel and fixed installation;
- collision between vessel and land (grounding);
- break-up of vessel as a result of bad weather/high seas;
- ship to ship transfer;
- illegal cleaning of ballast tanks;
- release from onshore/offshore installation;
- onboard explosion/fire (offshore);
- onboard explosion/fire (in port).

Analysing the shipping statistics available for this area and considering the likelihood over a five-year period, a likelihood scoring to determine the level was established (negligible, rare, unlikely, possible and probable).

For each type of pollution a risk grading (low, medium, high) was established for the entire Dorset coastline.

5.2. Methodology developed in France

The French regions participating in the EROCIPS project have neither any responsibility nor any say in the accidental marine pollution risk assessment, because this is the hands of the Maritime Prefects according to the French Polmar directive. The Polmar sea plan assumes that the region has a high density of traffic, with, in addition, areas of crossing traffic which constitute evident critical passages. In this sense the risk is assessed on past experience, not on probabilities. Taking into account the spills of various importance that have occurred in the area, with no evidence for direct linking between one specific site and a particular type of accident, size of spill or nature of oil spilled, the authorities in charge must be prepared for any accident comparable to past incidents, anywhere in the area.

5.3. Methodology developed in Portugal

The risk assessment for this area is based on the analysis of:

- the existing risks;
- the impact of spills on the different areas of the coast line.

To carry out the analysis of the existing risk and because of the lack of statistics for this area to base the analysis on, the method elaborates a risk matrix according to technical experience and international statistics. The method defines a risk index that is the sum of the likelihood/frequency index and the severity index.

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The *likelihood/frequency index* is based on that used by the US Coast Guard and covers five categories of accidents offshore, one of illegal discharges offshore, seven categories of accidents in port involving ships and four categories of accidents in port involving land installations:

- ship-to-ship collision;
- explosion and/or fire;
- foundering/structural failure;
- powered grounding;
- drifting grounding;
- illegal discharges;
- ship-to-ship collision in port;
- explosion and/or fire in port;
- grounding in port;
- collision between vessel and fixed installation;
- loading and loading failures;
- stocking up failures;
- ship tanks failure;
- land storage tanks failure;
- accidents from port road traffic;
- accidents from port train traffic;
- outlet discharges.

The severity index is based on that used by the International Maritime Organisation (IMO) and classifies the level of severity as insignificant, reduced, minor, moderate, significant, severe, extreme and catastrophic.

5.4. Methodology developed in Spain (Galicia)

The study of pollution scenarios for this area was divided into two steps. The first step was carried out by SeaPlan Lda on behalf of Galician partners of the EROCIPS project and it followed the same methodology as that used for the Portuguese risk analysis.

In a second step, Intecmar in close collaboration with MeteoGalicia have improved the risk assessment by, firstly, introducing into the study the oceano-meteorological situations that are usually present in the region during the year and, secondly, combining that analysis with the information stored in the georeferenced databases.

For this second part of the risk assessment MeteoGalicia developed a synoptic circulation atlas for the Galician coast. The coast was studied in order to detect those points where a spill is more likely to occur. To carry out this study, information about the main ports and the locations of the main industries and the main maritime traffic lines were considered to determine what were called the “the risk points”. Taking into account these points, the most likely spill paths for spills were determined on a monthly, seasonal or annual basis.

To simulate the different oil spill paths originating at the supposed “risk points”, the following parameters were considered:

- type of fuel-oil: heavy or light;
- the direction of the tide at the start of the spill: ebb tides or flow tides;
- the kind of tide: neap or spring tides;
- winds: 10 different wind patterns, with main clusters of the Galician synoptic conditions, and two representative cases for each cluster;
- time: 48 hour simulation for each case.

Software named the MarGis Tool was developed in order to use all the information obtained in the atlas in conjunction with the geographical information recovered for the coastal

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inventory that was developed under the EROCIPS project. The software MarGis represents a useful tool that allows the incorporation of the synoptic circulation atlas into a GIS. The combination of these sets of information has allowed georeferenced queries to be made which improve the management of information. As a result of these queries, the simulated percentage of oil beached by a council was found depending on how many hours had taken place since the incident.

6. Results

6.1. UK

See Annexes [1](#), [2](#), [3](#), [4](#), [5](#), [6](#), [7](#), [8](#), [9](#) and [10](#).

6.2. France

See Annex [11](#).

6.3. Portugal

See Annexes [12](#) and [13](#).

6.4. Spain (Galicia)

See Annexes [13](#), [14](#) and [15](#).

7. Discussion

Looking at the EROCIPS region coastline and considering the high density of maritime traffic, it is easy to imagine the high probability that an incident occurs in the area causing a spill. As, unfortunately, has been demonstrated over the years, the effect of these incidents have caused catastrophic consequences for the environmental and economic resources. However, throughout this study we have realised that there is a lack of evaluation of pollution scenarios for this region, especially if we consider those on a regional scale. Moreover, this evaluation is mainly based on the probability that an incident takes place, with the consequences considered of secondary importance, and global measures that could minimise the risks are rarely developed.

During the duration of the EROCIPS project most of the regions involved have developed risk assessments for their area. The methodologies used to assess the risk of spill occurrence derived from maritime incidents such as collision, grounding, fire, explosion and structural failure are very different depending on the region. These methodologies include methods based on probabilities, impact assessment, different models, several indexes, the combination of dynamic and static information, etc. Although it is difficult to find common elements among the different methodologies, in all the regions historical data are used to assess the frequency of accidents, and are considered as the basic information for the development of risk analysis. A previous study developed under the EROCIPS project revealed that medium and small incidents are poorly documented in the EROCIPS area. In this sense, we consider that the incomplete historical databases that we are working with could have a detrimental effect on the risk assessment. Moreover, if we consider the importance of small spills in their contribution to the chronicling of contamination of coastal waters, the recompilation of this information becomes a fact of considerable importance.

Looking at things from another angle, it is supposed that hydrocarbons are the most probable pollutant for the EROCIPS region, and most of the methodologies are focused on this kind of pollutant. However, it is necessary not to underestimate the risk of other pollutants, which can have even more dramatic consequences, as is the case for some chemicals.

The large variety of methodologies used to develop the risk assessment is also a handicap when comparing results across the regions and consequently there is a large difficulty in generating common measures to minimise the risk of contamination for the coastlines.

Nevertheless, whatever the methodology used by each region, we can say that the risk assessment process in terms of considering pollution risks along the coastline has already proven essential for the EROCIPS partners so as to enable appropriate allocation of resources, efforts and funds to specific areas. The process has also enabled responders to justify their actions and work in this particular field of contingency planning.

In this sense, in Northern Ireland, for example, the location of the EHS stockpile was based on the risk assessment work developed under this project. The warehouse containing most of their antipollution equipment and stockpile has been proven to be located in a strategic location, with the surrounding coastline determined as high risk. In the same way, in Pembrokeshire, the risk assessment has helped to justify the location of the Wifi network and the need to further develop the communication network within the Milford Haven waterway, a zone of heavy shipping traffic and high risk in terms of pollution. The assessment will also assist the Local Authority in planning the validation program of their booming plans along the coastline. As there is a cost associated with the validation process, which has to be borne by Local governments, the program will be carried out on a risk priority basis. Moreover, all of the risk assessments undertaken in the UK under the EROCIPS project have been forwarded to the MCA to add value to their plans and response arrangements.

8. Recommendations

Considering that the risk assessment constitutes useful information that can support authorities in charge during a crisis, it is very important that it is periodically updated and not just seen as static information. In this sense, the risk assessment must include *protocols for its own updating*. The outcomes of the risk assessment are especially important in pre-incident planning for contingency arrangements and response.

It is necessary to *standardise* methodologies in order to compare the risks in the different regions (i.e. IMO guidelines, etc.)

Historical databases should be carefully revised and maintained in order to supply the most detailed information for the risk assessment.

The results obtained by the risk assessment must be included in the *contingency plans* at local, regional and national levels.

9. Conclusions

The EROCIPS project has given several regions the opportunity to carry out their risk assessments.

Oils are the most probable pollutant in the EROCIPS region. However, *chemical* risks can have more dramatic consequences.

The intense maritime traffic along the EROCIPS coastline implies the existence of areas with *high risks* of pollution from a maritime incident in all the countries involved in the project, which makes it necessary to take *mitigation measures* in order to reduce the risk.

The risk assessment carried out in this task together with the coastal sensitivity mapping supplies a useful tool in order to analyse the *pollution scenarios* in the EROCIPS region.

Annexes

[Annex 1](#) Northern Ireland Report

[Annex 2](#) Northern Ireland Appendix A

[Annex 3](#) Northern Ireland Appendix B

[Annex 4](#) Pembrokeshire

[Annex 5](#) Pembrokeshire Annex A

[Annex 6](#) Pembrokeshire Annex B

[Annex 7](#) Devon Part One

[Annex 8](#) Devon Part Two

[Annex 9](#) Devon Part Three

[Annex 10](#) Dorset

[Annex 11](#) France

[Annex 12](#) Portugal

[Annex 13](#) Portugal Galicia Methodology

[Annex 14](#) Galicia Part Two

[Annex 15](#) Galicia Part Three