



Environmental management of port operations - the ports sector's response to the European dimension

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Abstract

Environmental management of port and harbour operations is taking on a consistently higher profile as the port sector responds to the challenges of new and evolving legislation aimed specifically at environmental protection. The formation of the European Ports Organisation, the first EU member states' independent port sector representative organisation, has been the catalyst for a series of port based initiatives offering a positive and increasingly proactive response to the environmental imperative. An environmental Code of Practice and several research projects have contributed both to policy development and effective implementation methodology. Port management responses now include a variety of organisational, procedural, operational and technical options. A survey of the status and implementation of environmental management responses in 281 ports from 15 European maritime member states confirmed the diversity of port characteristics, the major issues of concern, the resources and provisions currently applied and the challenges still to be addressed. However laudable the policy statements, targets and objectives, effective management depends on sound science and relevant criteria if compliance is to be confirmed and performances monitored. Regions of the Mediterranean exemplify the opportunities, potential and cautions for a port sector response to environmental protection.



Introduction

The activities and operations of ports and harbours are subject to critically important new and evolving legislation and regulation aimed specifically at protecting the environment. Traditionally, port operators have been concerned more with the effect of the environment on them, than with the effects of their operations on the environment. Winds, waves, tides and currents have been taken into account and studied for their effect on the safety of navigation. The commercial activities of the port have been influenced by the environmental considerations of the dynamics involved in berth performance and manoeuvring, and the impact of siltation on navigable depth. Sufficient control of the hydrographic components was required for navigation, loading and unloading. Today, however, the impact of port operations on both the local and global environment are coming under growing scrutiny. Also, as Dalley and Deeming (1994) point out, ports have pursued complementary business opportunities by diversifying into property development and the management of industrial estates and free-trade zones. This has exposed environmental issues typical of other large industrial and manufacturing operations. The environmental imperative, commercial targets and political directives all place different and often conflicting demands on those with responsibility for environmental management. The concept of sustainable development, "the goal of maximising the net benefits from existing resources (human, natural and produced capital), subject to maintaining the services and quality of these resources over time" (World Bank Team), is now established as a significant component of the environmental policy statement of many Port Authorities and indeed, it may reasonably be suggested that the port industry and society in general accepts the scientific, legal and moral argument for environmental protection and that the challenge now is to identify appropriate management options for the effective implementation of port environmental policy statements. The commercial context within which ports have evolved their environmental response is significant for the constraints, challenges and opportunities it has imposed on management options.



Background

The vital importance of the ports sector within the transport chain is demonstrated by the statistics: the maritime sector is responsible for approximately 90% of the European Union's trade with third countries, as well as some 35% of intra-Community trade. The volume of cargo handled by European Union ports currently amounts to 2.3 billion tonnes. Much of this is in the form of raw materials - oil, petroleum, chemicals, ores, grain, animal feedstuffs - which are needed to fuel the Union's economy. In addition, ports facilitate the movement of millions of passengers each year and a wide range of goods including vehicles, fresh foods, steel, timber, building materials, machinery and manufactured goods. As a result, ports attract industry, especially further processing and refining capacity, and act as significant generators of employment. It is not unusual for a port directly employing 100 people to support as many as 1,000 jobs in the local economy. Yet ports provide a range of other services besides cargo handling and the transfer of passengers. A substantial number are fishing ports, harbours providing leisure and recreational facilities or ferry terminals providing links to the more remote parts of the Union.

The demand for transport services has increased each year since 1970 by roughly 2.3% for goods and 3.1% for passengers which is broadly in line with economic growth patterns. At the same time the environmental credentials of the maritime sector are self evident. The energy consumption of a medium size container ship represents approximately 10% of that used by road freight and only 20% of that used by rail. As a result of such fuel efficiency, it has been estimated that it costs the same to transport a car by sea from Japan to Belgium as it does to transport it overland from Belgium to Switzerland. Investment in maritime infrastructure is lower and more cost effective than infrastructure investments in land modes; with a European Union coastline of 20,000 km, most industrial centres are situated less than 400 km from their nearest port.

Setting up of European Sea Ports Organisation (ESPO)

Although the environment in a number of guises has always been of the utmost importance to ports, it is only in recent years that the sector has been able to formalise its policies and embark on a programme of action. This has largely resulted from structural changes within the sector and particularly the formation of the first EU member states' independent



port sector representative organisation, the European Sea Ports Organisation (ESPO). Until the setting up of ESPO in March 1993, port affairs had been handled by port representatives working jointly with the Commission without the benefit of an independent organisation funded and organised by its members. ESPO has allowed ports to establish their own policies based on day to day operational experiences.

One of the first actions taken by ESPO was to set up an Environment Committee whose initial task was to write an environmental Code of Practice (ESPO, 1994). This was published in December 1994 and combined recommendations on a management approach with targets and objectives for priority areas such as monitoring, dredging, port planning and development and emergency response plans. The Code had to take into account the remarkable diversity of the port sector. For example, it has been estimated that ESPO represents the interest of over 700 ports, each dealing with environmental problems related to their location, size, type of operations and national and local policies. It was crucial therefore that the Code should take into account this diversity.

Changes in the ports sector

The Code should be placed in the framework of the significant changes that have been taking place within EU member state ports. Over the last few years in particular, ports have begun to act more as commercially independent units strongly competing with other ports and working most effectively when their management is allowed to act autonomously. This independent approach has generated a much greater awareness of the impact of port activity on the coast and locality, and the need to take responsibility to measure and mitigate this impact. The stronger role of the market has been further confirmed by the recent publication of the European Commission's Green Paper on Ports and Maritime infrastructure (COM 97). This maps out a way ahead which foresees the gradual elimination of national funding and consequently the direct influence of government. Ports therefore must look more and more to their own resources to tackle environmental questions resulting in significant growth in the willingness to co-operate and exchange ideas and information.

Growth of environmental legislation

ESPO's environmental programme also needs to be set against the increasing volume of environmental objectives. Existing legislation such

as the Environmental Assessment Regulations (EEC 1985) which have recently been updated and amended, act as a restraint on port development and ensure that port expansion is compatible with EC and national environmental standards. The introduction of the Habitats Directive (EEC 1992), which identifies both marine and land sites requiring a high level of protection, has meant that ports require greater expertise in the detail of site management. Management plans need to be worked out between the ports and the environmental authorities in each member state, but it can easily be seen that the standards required are over and above anything applicable previously. Pending legislation such as the Water Quality Directive will also bring in more testing targets and estuarial ports will be required to participate in river basin management plans; again this will raise awareness and increase the amount of information available about the environmental integrity of each port and allow comparisons to be made between them. A further direct influence is the Commission's transport policies which are based on reducing pollution, relieving congestion and achieving a better integration of the various modes. The TENs programme began funding feasibility studies in ports for the first time in 1997 and more funding is expected. Such funds can be used to promote short sea shipping and to reduce the amount carried by road. Ports therefore have a strong role to play in supporting the Commission's transport and environmental policies, and in providing intermodal links.

ESPO's environmental programme

ECEPA (Environmental Challenges for European Port Authorities) was established at the same time as ESPO to provide a vehicle for setting up joint environmental research projects between ports from different member states (de Bruijn, H. et al, 1997). It has its own secretariat and from a small beginning with only a few ports ready to participate, the latest project (ECO-Information, see below) now involves 50 ports, each of which is contributing to the research. ECEPA has close contacts with the Commission and receives funding from the various framework programmes; in 1997 it completed work on soil recycling. One of the important motivations for ECEPA is removing the element of competition between ports over environmental matters, something demonstrated by the success of projects already initiated.

ESPO's environmental Code of Practice provides:

- A check list of crucial environmental issues and concerns.
- Recommendations on best practice, objectives and targets.



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- A basis on which to establish and encourage common policies and procedures, and to promote exchanges of information and best environmental practice.

The Code is endorsed by each delegate member of ESPO and recommends each port to:

- Initiate steps to consider the potential for the improvement of environmental standards beyond those required under legislation.
- Nominate representatives from senior management positions to take responsibility for co-ordinating policy and action within the port's sphere of competence.
- Promote environmental awareness to all those working within the port and all those associated or connected with it.
- Promote regular surveys and appraisals of policies which take account of research related to the environment, the dynamics of trade and economic, legislative and social trends.

Originally published in a joint English/French version, the Code has subsequently been translated into every Member State language and circulated extensively both within the E.U. and elsewhere.

Survey of the ports sector

Having established basic principles and main areas of action through its Code in 1994, ESPO commissioned an independent questionnaire survey in 1996, specifically aimed at assessing the extent to which it was being implemented by the Organisation's member ports. A total of 281 ports from 15 European maritime member states responded to the request for information and returned completed questionnaires for analysis. Detail from each individual port was entered into a database and manipulated on a spreadsheet to generate tables and statistics. Quality checks and validation of results were carried out by reference back to primary input data and follow up enquiries to selected ports. It soon became apparent that the size of the port (measured in annual tonnage) was a significant characteristic in terms of initiatives and responses to the environmental challenge. This probably reflects the resources and structures available in individual ports to facilitate implementation of environmental policy objectives.

The majority of the 281 respondent ESPO ports, approximately 72%, handle less than 5m tonnes of cargo annually, 17% deal with 5m - 20m tonnes and 11.0% have an annual tonnage figure of over 20m tonnes. The purpose of the survey was not only to establish the impact of the Code but also to define the extent of environmental awareness in ports,

to find out what arrangements there were to implement environmental policies - and to make an assessment of the environmental issues which cause the greatest challenge in terms of management (see Table 1).

Table 1
Top ten major environmental issues within port areas
(from a survey of 281 ESPO port members)

Rank	Issue	No of ports	% of ports
1	Dust	161	57.3
2	Dredgings disposal	140	49.8
3	Port development (land)	129	45.9
4	Dredging	127	45.2
5	Garbage	121	43.1
6	Port development (water)	119	42.3
7	Noise	115	40.9
8	Water quality	111	39.5
9	Traffic volume	104	37.0
10	Hazardous cargo	101	35.9

(Source: Wooldridge, C.F. & McMullen, C., 1996)

Note: Overall, dust was acknowledged as being a significant issue by 161 ports, representing 57.3% of total respondents.

The questionnaire consisted of 21 major headings inviting 54 answers. Some of the responses to management issues are listed in Table 2 overleaf.

Independent research amongst many ports confirmed the existence of good practice, innovative schemes and significant experience in dealing with major environmental issues associated with port operations and development projects. Although challenges and difficulties remain there is a substantial capacity and capability within the ports industry to develop and implement solutions. The 1996 survey results highlight the importance of resources (finance and personnel), effective management options and training, and will also serve as useful baseline data against which to assess subsequent performance.



Table 2
Responses to ESPO questionnaire survey

	All ports	Size of port: Annual Total Tonnage for all commodities (millions)		
	(281)	>20M (31)	20M-50M (46)	<5M (204)
	Does the port have its own environmental plan?			
% Yes	44.5 (125)	61.3 (19)	54.3 (25)	39.7 (81)
	Does the port plan promote environmental awareness by all port users?			
% Yes	43.8 (123)	64.5 (20)	52.2 (24)	38.7 (79)
	Does the plan aim to improve standards beyond minimum requirements?			
% Yes	32.4 (91)	48.4 (15)	37.0 (17)	29.0 (59)
	Does the port have designated personnel for co-ordinating environmental policy?			
% Yes	55.9 (157)	77.4 (24)	69.6 (32)	49.5 (101)
	Is environmental monitoring routinely carried out within the port area?			
% Yes	52.4 (150)	77.4 (24)	69.6 (32)	46.4 (95)
	Have any training initiatives dedicated to environmental management been implemented during the period 1993-1996?			
% Yes	48.4 (136)	71 (22)	54.4 (25)	44.1 (90)
	Is the port involved with other organisations in coastal or estuary management plans?			
% Yes	46.4 (130)	58.1 (18)	47.8 (22)	43.6 (89)

(Source: Wooldridge, C.F. and McMullen, C., 1996)

Current and future work

The results of the questionnaire survey contributed to the growing volume of information about the port environment and provided important preliminary data for the **Eco-Information** project (European Commission DG-7, 1997). This project is more ambitious than any of its predecessors in that it takes an holistic perspective on port environmental management rather than the issue by issue approach which has been characteristic of previous research. The Eco-Information project represents a systematic approach by ESPO members to respond to international and European environmental legislation in a unified manner through shared experience and self monitoring for the mutual advantage of environmental protection and sustainable development of port activities. Its main components are a data base configured as an information retrieval system and a self diagnosis methodology for assessing compliance and supporting methodology for assessing decision

making. The objectives of the project have been detailed by H. Journée (1997) and include the goals of:

- assessing the current environmental situation in ports through the collection and analysis of information related to activities, issues, impacts, priorities and cost effective solutions applied in European ports;
- exchanging practical experiences between partner ports;
- supporting managers in policy development and response options;
- demonstrating good practice and a pro active stance to legislators and third parties.

The concept and components of the integrated framework are shown in Diagram 1.

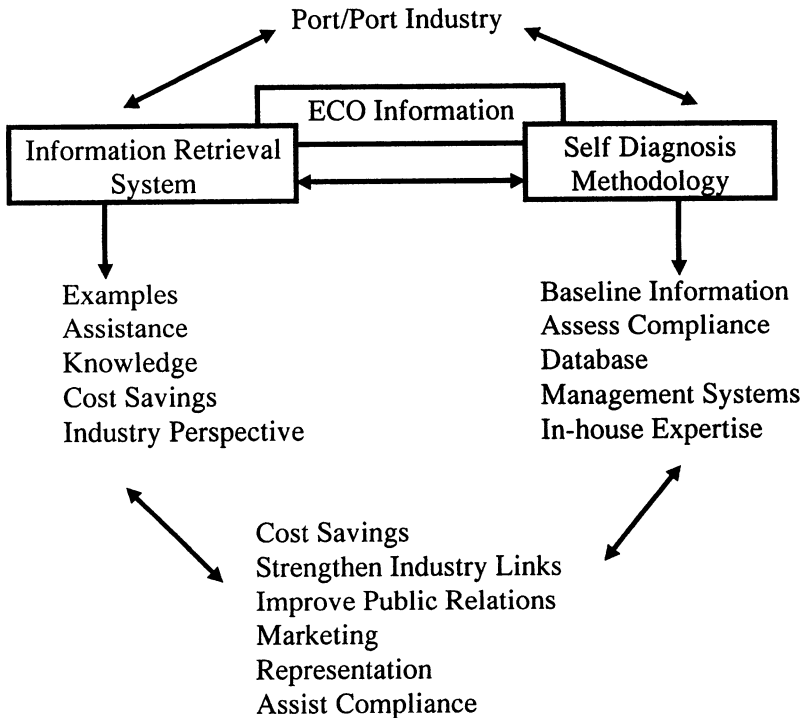


Diagram 1
Concept of the ECO-Information Framework

Preliminary analysis of data returns from over 20 partner ports shows:

- a wide range of experience;
- evident disparity in resources and management systems;



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- high levels of expertise in specific areas and issues;
- many examples of best practice;
- common areas of interest;
- effective case study examples and costings.

The project reflects the day to day operational and longer term developmental challenges faced by ports and the ways in which they are being tackled. It is possibly unique as a co-operative venture within an industrial sector in that it relies on the active participation of the partner ports on a non competitive basis and their willingness to provide detailed information for a common cause to mutual advantage.

The ESPO Code of Practice has therefore initiated a range of linked programmes and actions. A key message from the Code is “only a clean and safe port will be able to survive”. Throughout its work, ESPO has always stressed the need to combine environmental controls and standards with good commercial practice; the two aspects are not mutually exclusive, they are intrinsically linked. The Organisation has also stressed that good intentions alone are not sufficient; implementation of environmental policies can only be achieved by management decision based on sound science and quantifiable environmental performance indicators.

The need for scientific methodology and techniques

As has been stated above, ports are complex and variable environments, their characteristics and peculiarities depending on size, location, hydrographical determinants, industry and urban relationship and commercial function. Port and harbour operations often pose pressures and may adversely affect particular section of water, land and air environments. Estimating environmental impacts, however, is extremely complicated since it involves dealing with the dynamic and complex situation of the interface between land sea and air. The physicochemical and biological processes active in coastal environments have been, and still are, the subject of rigorous research, aimed at gaining an appreciation of the interrelations that exist between the different but closely linked and interdependent environmental domains. It has been obvious for some time that the assessment of environmental quality of areas affected by anthropogenic activity is extremely complicated and often prone to misjudgment and erroneous conclusions, unless a long term study is implemented, incorporating and measuring a series of parameters that have been proven to be important indicators of basic natural biogeochemical processes. In this respect the implementation of



a comprehensive, systematic and scientific monitoring programme has been proven to be the most reliable and efficient way to collect environmentally sound data and provide the port authority with:

- baseline data against which changes with time can be assessed;
- data highlighting priority areas, and forewarning of environmental problems;
- details of local conditions and important information necessary for developing a cost-effective environmental monitoring system which is capable of supporting management decisions and assessing effectiveness of measures taken.

Many of the environmental parameters selected for monitoring strategies are usually chosen according to local and reference data indicating major sources of pollution with particular attention to elements that have been shown to be toxic to humans and organisms such as polycyclic aromatic organic moieties, petroleum hydrocarbons, heavy metals (Pb, Cr, Zn, Ni, Cd, Hg, Sn), organometallic compounds (especially of tin), in the water column and sediment. Microbiological profiles have always been important in assessing urban waste pollution from land as well as maritime sources. Atmospheric pollutants such as NO_x, SO₂, CO, hydrocarbons and smoke are an integral part of a monitoring strategy since it has been shown that exhaust emissions influence the atmospheric quality of urban settlements along the coastline. These data are correlated with basic hydrographical parameters (waves, tides, currents) as well as basic physicochemical parameters including salinity, temperature, turbidity, dissolved oxygen and nutrients, allowing for natural variation and biogeochemical cycling.

Since no previous studies exist on the subject it is imperative to establish the necessary methodology pertinent to Greek seas and enclosed bays, in order to monitor the existing levels of pollution and assess further environmental impacts arising from new marine constructions put into operation, especially in an era where pressure for new marinas and extensions of existing shipyards in the Mediterranean are increasing rapidly.

Relevant standards - assessing compliance

At present there are no standards aimed directly to harbours and ports and no directives setting out legal obligations to improve water quality. This is not an unreasonable situation, since the basic science relevant to collecting environmental data and assessing the quality of the port environment is, as explained above, complex, time consuming and site



specific. In many cases no previous studies exist and it is imperative to establish the necessary methodology pertinent to local seas and enclosed bays, in order to monitor the existing levels of pollution and assess further environmental impacts.

On the other hand, studies, over recent years, have shown that the organic moieties of many heavy metals are far more toxic than the metallic form of the element, and as yet no provision has been made for such pollutants in environmental directives and laws. This is especially so for tin (Sn) where the metal Sn^0 is considered non toxic whereas organotins are extremely exotoxic and were promoted to the "black" list in 1980 by the E.E.C. and similarly were included as a group in Annex 1 of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (UNEP, 1982) and in the "priority list" of environmental contaminants prepared under the Toxic Substances Control Act (ToSCA) by the Environmental Protection Agency (EPA) of the USA (US EPA, 1982).

Defining the background level and assessing the bioavailability and toxicity of pollutants in different media are only a few examples of the uncertainty governing much of the present knowledge in this field. Recent reports (Ko, M.M.C., Bradley, G.C., Neller, A.H. & Broom, M.J., 1995), on sites where anthropogenic inputs have ceased to exist, but still present high pollution sites, due to variations in flushing, penetration sediment aerobic/anaerobic conditions, fresh water inputs, dredging and yacht manoeuvring, indicate the complexity of the processes involved.

Water quality parameters are regulated in most countries mainly by national legislation. EU Shellfish waters directive 79/923 states that the concentrations in waters must not reach a level harmful to the larvae of marine organisms, and it seems to be up to the national governments to set specific limit values to pollutants. Greece for example has not as yet set such values although the EU directive has been integrated into national law (FEK 438/3.7.86). Complicating the issue, levels set by national governments may differ considerably from country to country as is the case the Chromium (Cr III) levels. Limit values set out by the Greek laws (FEK B/582/2.7.79, 1132/21.12.79 and 1136/27.12.79) are higher (2,000 micrograms per liter, $\mu\text{g/l}$) than limit values set by the German (200 $\mu\text{g/l}$) and British (1000 $\mu\text{g/l}$) authorities. Thus the most important questions still remains as to what standard should the water quality in ports and harbours be set, since for chemical determinants there are no widely accepted sets of standards. The standards set for the protection of aquatic life as well as those relevant to bathing waters (EU 76/160), could be considered as long term targets for the port industry.



Legally adequate and scientifically sound criteria can serve the goals of environmental protection by providing the means or standards by which quality and achievements can be tested. The legislation itself is increasingly international and European, shipping is ubiquitous, yet ports remain unique in their location, hydrography, activity base, culture and corporate strategy. It is no surprise therefore that within ESPO membership there are a wide range of responses to the environmental imperative in terms of action, implementation, targets and plans. Parts of the Mediterranean in particular demonstrate the challenges, potential and opportunities for ports to develop effective management options.

The Greek situation

Major Greek ports are at present facing increased challenges to respond to the predicted increases in world trade and are currently undergoing major re-organisation in an attempt to increase competitiveness and fulfil economic and social functions in their regions. Recent studies have shown that the existing multi government agency control (Ministry of Mercantile Marine, Ministry of Finance, Ministry of Interior, Ministry of Defense, Ministry of Development, Ministry of Transport, Local Authorities, and Trade Unions) in conjunction with a rigid and old fashioned business plan, do not allow Greek ports to easily and dynamically adapt to modern needs in the technical, economic, social and political sectors, arising from increased competitiveness in the field of high quality services providers. Due to the often conflicting and contradictory interests of the government institutions involved in the control of port operations and development, in most ports no Departments of Strategic Planning and Management exist, and if some do exist, their function is drastically restricted due to the inherent limitations in the decision making processes and procedures. Within existing business plans no Department is allocated the responsibility of addressing the environmental implications of port operations and compliance requirements. Most situations are usually dealt with by the Technical, Engineering and Construction Departments or the European Union Office on a circumstantial basis.

In the 1990s almost all new developments and planning proposals for Greek ports and marinas have been accompanied by an Environmental Impact Assessment Study (EEC, 1985), which includes an assessment of the existing state of the environment, as well as an estimate of future environmental pressures arising from such operations. Most experts agree, however, that time and financial constraints do not always allow



systematic and thorough investigations, leading to scientific data that are often insufficient in representing the true state of the environment. At present efforts are being concentrated on studying existing environmental data from various sources collated over recent years, in order to highlight priority areas and major sources of pollution. It is planned to establish long term monitoring programmes with the active participation of the Port Authorities which will provide a thorough and integrated set of environmental data based on sound methodology concerning the sampling of parameters in the particular settings and conditions of the port.

Mediterranean cases

Italian and Spanish ports have gone through major reorganisation leading to changes in the organisational and management structures and privatization of a number of port services and activities. This situation is a challenge to publicly owned ports (such as the Greek ones) since their new status allows for flexible, competitive and novel management and marketing methods. Although Mediterranean ports differ in their organisational structure, technical expertise, cargo management and their importance on both national and European level, they share a common environment that is already characterised as a Special Region where more stringent environmental constraints are applied (MARPOL 73/78). Recent studies (Ridolfi, G., 1995) indicate that these ports have set equally high standards compared to other European ports in the commercial and environmental fields (Trozzi, C., Vaccaro, R., & Nicolo, L., 1995).

Tools for monitoring and auditing

Port operators and managers are increasingly having to make decisions concerning environmental issues. Compliance to a host of national and international regulations, accountability for the quality and condition of the port environment and the provision of scientific baseline data for environmental assessments, have been added to the normal day to day operation of a port. It has become obvious that within the logistically, hydrographically and commercially intricate environment of a port, it is essential for the monitoring programme to be based on clearly defined and scientifically sound criteria. From technical and economic studies performed for a Greek port the following conclusions can be drawn.



For a port that has not been active in environmental monitoring the establishment of a specialised team joined to an environmental laboratory seems unrealistic due to increased costs and delays in setting up. The establishment of a sound monitoring strategy has been shown to be high on the priorities list, and can be instigated almost immediately with the long term collaboration of an environmental office, within the new organisational and business plan of the Port Authority, and specialised laboratories and consultants that have proven expertise in the field. This form of co-operation may prove successful for the first period, until a time when the port authority may decide to get more actively involved. The specialised laboratory will be in a position to suggest the most cost-effective and scientifically sound methods and tools for monitoring and auditing the port environment.

Conclusion

In spite of the range and diversity of the characteristics of its member ports, the European Sea Ports Organisation has instigated a series of initiatives in research, training and implementation of management systems which have made a substantive contribution to environmental protection. This has been achieved through raising awareness and the implementation of practicable management options. The sector has a proven and expanding competence and capacity to develop appropriate responses and is supporting research aimed at assessing compliance and monitoring performance.



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