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UNITED NATIONS ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

REMEDIAL ACTIONS FOR POLLUTION MITIGATION AND REHABILITATION IN CASE OF NON-COMPLIANCE WITH ESTABLISHED CRITERIA
(with particular reference to the Mediterranean)

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- Curbing Pollution
- Safeguarding Natural and Cultural Resources
- Managing Coastal Areas
- Integrating the Environment and Development

This series contains selected reports resulting from the various activities performed within the framework of the components of the Mediterranean Action Plan: Pollution Monitoring and Research Programme (MED POL), Blue Plan (BP), Priority Actions Programme (PAP), Specially Protected Areas (SPA), Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC), Environment Remote Sensing Centre (ERS), and Cleaner Production Centre (CP).

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LIST OF ACRONYMS

BAT	Best Available Technology
BEP	Best Environmental Practice
BOD	Biochemical Oxygen Demand
BP/RAC	The Blue Plan Regional Activity Centre
CA	Coastal Area
CCA	Carrying Capacity Assessment
CEC	Commissions of the European Community
CM	Coastal Management
COD	Chemical Oxygen Demand
EIB	European Investment Bank
EPA	Environment Protection Agency (US)
EQC	Environment Quality Criteria
EUROCOAST	European Coastal Management Association
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
HM(s)	Heavy Metal(s)
HQC	Health Quality Criteria
IAEA	International Atomic Energy Agency (UN)
ICAM	Integrated Coastal and Marine Areas Management

ICARM	Integrated Coastal and River Basin Management
ICCOPS	International Centre for Coastal and Ocean Studies, Genoa (NGO)
ICZM	Integrated Coastal Zone Management
IOC	Intergovernmental Oceanographic Commission of UNESCO
IRBM	Integrated River Basin Management
LBSP	Protocol on Protection of the Mediterranean Sea against Land-Based Sources of Pollution
LNG	Liquefied Natural Gas
LWM	Liquid Waste Management
MAP	Mediterranean Action Plan, UNEP
MCSD	Mediterranean Commission for Sustainable Development
MEDCOAST	Mediterranean Coastal Management Association, Ankara (NGO)
MEDPOL	Joint Coordinated Mediterranean Pollution Monitoring and Research Programme, MAP
METAP	Mediterranean Environmental Technical Assistance Programme
MWI	Mediterranean Water Institute, Marseilles (NGO)
NGO(s)	Non-Governmental Organization(s)
PAH(s)	Polyaromatic hydrocarbons
PCB(s)	Polychlorinated biphenyls
PFU	Plaque forming units
P/H	Petroleum hydrocarbons
PNAs	Polynuclear aromatics
POP(s)	Persistent organic pollutants
ppb	Parts per billion
QC	Quality criteria
RA(s)	Radioactive substance(s)
REMI	(*Réseau de surveillance microbiologique*) – Microbiologic monitoring network
REPHY	(*Réseau de surveillance du phytoplancton*) – Phytoplankton monitoring network
RNO	(*Réseau National d'Observation de la Qualité du Milieu Marin*) – National monitoring network of the quality of marine environment
SAP MED	Strategic Action Programme to Address Pollution of the Mediterrenena Sea from Land-based Activities
SEA	Strategic Environmental Assessment
SSA	Systemic Sustainability Analysis
SNG	Synthetic natural gas
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNCED	United Nations Conference on Environment and Development, 1992, Rio de Janeiro
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WB	The World Bank
WHO	World Health Organization (UN)
WHO/Euro	WHO Regional Office for Europe, Copenhagen
WMO	World Meteorological Organization (UN)

PREFACE

Throughout the centuries and long before the start of the industrial revolution, men have been using the sea as the most convenient place for the disposal of wastes resulting from human activities. The sea's self-purification ability has been largely abused. Dumping of domestic, industrial, and radioactive wastes, as well as the run-off from agricultural products have not only created considerable hazards to human health but have also endangered the marine environment.

The deterioration of the Mediterranean marine environment drew the attention of the governments of the Mediterranean region and resulted in a series of scientific meetings and intergovernmental discussions. At a conference convened by UNEP in Barcelona, representatives of Mediterranean countries adopted the legal support needed for the implementation of the Mediterranean Action Plan (MAP) Programme. More specifically, the Barcelona Conference adopted and signed a landmark document that became known as **The Barcelona Convention**. This is an international agreement reached between Mediterranean countries for the protection of the Mediterranean Sea against pollution.

A subject of major concern has been the preparation of appropriate legal instruments to deal with land-based sources of pollution. So, the legal framework of the MAP Programme has been enlarged and modified several times since the adoption of the Barcelona Convention.
According to estimations made, land-based sources of pollution constitute more than 80% of the total pollution load of the Mediterranean Sea. To respond to this specific need, one of the most important legal instruments was developed and approved: the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources. This Protocol was adopted and signed in Athens in May 1980 and entered into force in June 1983. The amended Protocol was adopted and signed in Syracuse in 1996.

The MED POL (Mediterranean Marine Pollution Monitoring and Research Programme) was created to answer the specific needs to better assess, qualify and quantify the marine environmental problems of the Mediterranean Sea and to implement the above-mentioned Protocol. In the 1995 Barcelona Resolution, the Contracting Parties affirmed their determination to use MAP as a tool for sustainable development. To this end the Barcelona Convention was revised and MAP was reformulated with the title of MAP Phase II, while the Mediterranean Committee on Sustainable Development (MCSD) was established as a consultative body to the partners in sustainable development in the Mediterranean. MAP's component programme for pollution monitoring and research in the Mediterranean Sea (MED POL) then entered into its third phase for the period 1996 - 2005.

The new MED POL III, called "Programme for the assessment and control of pollution in the Mediterranean region", presents a stronger emphasis on the managerial aspects of pollution control and a more direct link with the implementation of the relevant Protocols (Dumping and LBS). Under the assessment component, the Programme includes activities related to the establishment of trends in the levels of pollutants (trend monitoring) and effects of contaminants (biological effects monitoring) as well as the inventory of pollution sources and loads. Under the control component, the Programme includes the monitoring on a continuous basis of the effectiveness of action plans, programmes and measures for pollution control implemented by the governments (compliance monitoring).

Identification and assessment of non-compliance with Environmental and Health Quality Criteria (EQC and HQC) results with formulation and implementation of the needed remedial actions. Following a more or less standard procedure, the results of trend and compliance monitoring identify the coastal hot spot areas non-complying with EQC and HQC. Upon analysis and interpretation of monitoring results, remedial strategies and needed actions should be formulated and implemented. It is understood that the actions to be proposed should be applicable, affordable and cost effective.

Unfortunately, experience indicates that many actions aimed at reduction of pollution, restoration and/or rehabilitation of degraded coastal and marine areas being implemented late or resulting with partial improvements or even with failure. The consequence were not only substantial losses of funds, time, energy, environmental values and resources, but also loss of credibility; putting thus at risk the credibility of similar initiatives in the future. Analyzing the causes of poor results of a number of remedial initiatives in the Mediterranean region and elsewhere, the absence of an integrated approach has been put at the very top of the list.
In addition to the need for an integrated approach, the application of proper procedures, selection of most appropriate strategies and application of standard project management methods and practices might also be listed among prerequisites for success.

This document aims to present a framework approach and a check list of procedures recommended for the formulation and implementation of remedial programmes. Its long-term objective is to contribute to a sustainable development of coastal and marine areas providing a framework approach and guidance for remedial actions in cases of non-compliance with environmental and health quality criteria and standards.

The immediate objectives of the document are: to contribute upgrading of the present level of relevant institutional and human capacities of coastal, sub national and national authorities, institutions and professionals, responsible for and/or involved in: (i) control of the state of environment, pollution and health conditions, (ii) development planning and management of coastal and marine areas, and (iii) planning and implementation of remedial actions; and introduction/strengthening of the integrated approach to remedial actions.

Due to its character and the target audience, the document does not present details of: monitoring and compliance control, quality criteria and environmental standards, or emergency issues. Consequently, the document should be understood and used as a framework document presenting basic principles and recommending methodologies and tools for a comprehensive approach to remedial actions.

I. INTRODUCTION

I.1. Pollution: pollutants, causes and causative activities

Since the ancient times the sea has been used as a receptacle for different kind of waste. Due to its large volume, the sea was able to accommodate moderate amounts of waste generated in pre-industrial era without significant impacts. By the development of industry and improving the quality of life, the amount of generated and in the sea discharged waste has increased considerably. The increased amount of waste started creating marine pollution problems, and in the early 1950s scientists recognized that the quality of the seas could be affected by human activity. In the last decade, international and national policies were dedicated to land and air pollution and remedial strategies. The seas were considered sacrosanct and were not to be soiled (Goldberg, 1994).

The present state of pollution of Mediterranean coastal and marine areas is the consequence of the amount and nature of pollutants, the way and intensity of their introduction into the marine environment, as well as of local characteristics of the environment.

The Mediterranean Sea lies between three continents (Europe, Asia and Africa) and covers a surface of about 2.5 million km sq. The average depth is about 1.5 km, which brings its volume to 3.7 million km cu. The whole Mediterranean may be divided into two basins: western and eastern, and adjacent seas like the Alboran Sea, Ligurian Sea, Ionian Sea, Adriatic Sea and Aegean Sea. Each of these parts has its own specific characteristics regarding climate, hydrology, sources of pollution, topography, bathymetry, water mass circulation, chemical and biological properties, etc.

The Mediterranean is a climatically transitional area, with a temperate, damp climate in the north and extreme arid climate in the south. The Mediterranean climate may be defined as one in which winter rainfall is at least three times the summer rainfall. In many places over the Mediterranean region the summer rainfall is virtually zero, particularly along the southern coast. Surface winds are generally from the north and west, but in some regions, e.g. Adriatic, the southern winds are also among the dominant ones.

General water mass circulation is driven by density gradients. Surface currents in the basin are of eastern direction carrying the Atlantic low salinity water, with numerous spin-off eddies along the way. In contrary to the surface currents, the Levantine intermediate and Mediterranean deep water flows to the west and spills over the sill of Gibraltar into the deep Atlantic. Besides the general circulation pattern, each of the adjacent seas has its specific water masses circulation regime within the sea and related to the exchange with the basin.

From the chemical point of view the Mediterranean basin is highly specific and different from the Atlantic. It has high salinity as the consequence of high evaporation rate, and low concentration, even in the deeper water, of some biologically important chemical constituents, especially nutrients. The low concentrations are the result of outtake of relatively nutrients-rich deep water and its replenishment with nutrient-poor Atlantic surface waters. In some areas the nutrients concentration is increased due to river input and agricultural run-off or pollution.

From the biological point of view, the Mediterranean is rich in variety but relatively poor in the quantity of organisms produced. The biological productivity of the Mediterranean Sea is known to be among the lowest in the world. Despite this, fisheries activities are essential for local population of most parts of the region.

Pollutants

Numerous substances enter the marine environment, but a limited number of them are potentially harmful to the marine life and man, impair the use of the sea, and become subject of concern in terms of pollution. As indicated in the Annex I of the LBS Protocol (UNEP, 1997), the

following characteristics of substances in the marine environment should be taken into account for the designation of substances as potential pollutants:

- persistence;
- toxicity or other noxious properties (e.g. carcinogenicity, mutagenicity, teratogenicity),
- bioaccumulation;
- radioactivity;
- the ratio between observed concentrations and not observed effect concentrations;
- the risk of eutrophication of anthropogenic origin;
- health effects and risks;
- transboundary significance;
- the risk of undesirable changes in the marine ecosystems and irreversibility or durability of effects;
- interference with sustainable exploitation of living resources or with other legitimate uses of the sea;
- effects on taste and/or smell of marine products for human consumption; and
- effects on smell, color, transparency or other characteristics of sea water.

The LBS Protocol contains, among others, a list of 19 categories of substances, including thermal discharges, which should be given priority in the preparation of action plans, programmes and measures for the elimination of pollution from land-based sources and activities. Some of the categories, or even particular compounds and elements, are listed in other Protocols to the Barcelona Convention.

The Mediterranean countries adopted the at the 1997 Tunis Meeting of the Contracting Parties the Strategic Action Programme to Address Pollution from Land-Based Activities in the Mediterranean Region (SAP MED) (UNEP, 1999). The Programme provides the framework, targets and time table for the implementation of mechanisms and measures for the protection of the Mediterranean marine environment, including its biological resources and diversity, from the effects of harmful land-based activities.

Within the programme of the Global Environmental Facility (GEF), overall coordinated by UNEP, the Project "Determination of priority actions for the further elaboration and implementation of SAP MED" has been formulated (UNEP, 2000). The overall goal of the project is to improve the quality of the marine environment in the Mediterranean Region by better shared-management of land-based pollution through improved international cooperation in the management of land-based pollution of transboundary and regional significance. Specific objectives of the project and proposed activities are given in Box 2 and Box 3, respectively.

The most important pollutants for the Mediterranean Sea, as well as main sources and concentrations of pollution, when available, are presented below.

Box 1

Categories of substances selected as priorities for the action within the Strategic Programme to Address Pollution from Land-Based Activities

1. Urban environment
   - 1.1. Municipal sewage
   - 1.2. Urban Solid waste
   - 1.3. Air Pollution
2. Industrial development
   - 2.1. Substances that are Toxic, Persistent and liable to Bioaccumulate (TPB)
     - a) Persistent Organic Pollutants (POPs)
     - b) Heavy metals (Hg, Cd, Pb) and Organometalic compounds
   - 2.2. Other heavy metals
   - 2.3. Organohalogen compounds
     - a) Halogenated Aliphatic Hydrocarbons
     - b) Halogenated Aromatic Hydrocarbons
     - c) Chlorinated Phenolic Compounds
     - d) Organohalogenated Pesticides
   - 2.4. Radioactive Substances
   - 2.5. Nutrients and Suspended Solids
     - a) Municipal sewage
     - b) Industrial waste water
     - c) Agriculture
     - d) Atmospheric Emissions
   - 2.6. Hazardous Wastes
     - a) Obsolete Chemicals
     - b) Used lubricating oil
     - c) Batteries
3. Physical alterations and destruction of habitats

Box 2

Specific objectives of the GEF Project to support SAP MED (UNEP, 2000)

- to complete an analysis of the transboundary importance of the identified 103 hot spots and finalize the priority list for intervention and investments,
- to formulate and adopt principles, approaches measures, timetables and priorities for action, that address each major land-based source of pollution and assist countries in the implementation of such actions,
- to conduct pre-investment analysis of expected baseline and additional actions needed to address the selected hot spots, and secure recipient country agreement to baseline investments,
- to prepare and adopt at the regional level, detailed, operational guidelines for the formulation of National Action Plans (NAPs) for the protection of the marine environment from land-based activities,
- to assist countries to prepare, adopt at the highest level, and implement, country specific NAPs based on the regionally prepared and adopted guidelines,
- to identify roles for, and ensure effective participation of non-governmental organizations in the implementation of components of the SAP MED, and where appropriate incorporate these into the National Action Plans, and
- to address other transboundary issues as follows:
  - finalize and adopt a comprehensive and holistic Transboundary Diagnostic Analysis, and
  - develop and adopt a strategic action plan for biodiversity in the Mediterranean in conformity with the provisions of the Protocol on Specially Protected Areas and Biodiversity.

Box 3
Activities envisaged by the GEF Project to support SAP MED (UNEP, 2000)

There is a number of major activities proposed in this project, grouped into the following components:

- Establishment and coordination of the project includes activities for the hiring of the project manager and support staff and to function within the MAP structures; establishment of the Interagency Steering and Coordination Committees; convening of three meetings of the Interagency Steering Committee; two consultations with donors; and regular reporting to GEF and to the Contracting Parties of the Barcelona Convention and the LBS Protocol.
- Regional Cooperative Actions include activities for the preparation and adoption of nine sets of regional guidelines and eight regional plans, which will establish the administrative, legal and technical basis for the implementation of the SAP MED at the level of participating countries and will be based on data and information collected and assembled through the MED POL programme.
- Hot Spots includes activities for the preparation of an analysis of the main causes and impacts in the areas of the 103 hot spots identified during the SAP MED preparation and their transboundary and regional importance. Criteria and methods for determining the regional and transboundary significance of these hot spots will be developed, priorities determined and a selection made of the most important from a regional perspective. Following regional and national agreement on the selection, pre-investment studies will be executed for those occurring in GEF eligible countries, leading to investment by countries and donors in the elimination or reduction of transboundary pollution from these hot spots.
- Sensitive Areas includes activities for the preparation of a detailed analysis of the major threats and a environmental audit of the 51 sensitive areas identified during the SAP MED preparation in order to determine their regional and global significance and likely risks from future development activities. Criteria and methods for determining the regional and transboundary significance of these sensitive areas will be developed in order to identify priority areas in GEF eligible countries for investment in environmental protection and the preparation of comprehensive integrated management plans.
- Strategic Action Plan for Biodiversity includes an analysis of the relationships between pollution, primary production and biodiversity; problems of non-indigenous species; the causes of human induced changes to populations and communities of organisms, in particular threatened species of global significance; the regional and global significance of sensitive areas and critical habitats; and preparation of a listing of areas of concern encompassing pollution hot spots, critical habitats for threatened and endangered species and sensitive areas threatened by future land-based activities including pollution.
- Sustainability of SAP MED includes activities for the identification of economic instruments that will assist in developing a sustainable financial platform for the continued implementation of the SAP MED in the long term and incorporation of such economic instruments at the national level in the National Action Plans. These activities will develop administrative, legal and fiscal mechanisms for the sustainable financing of the implementation of SAP MED at country level.
- Capacity Building includes activities for the preparation and implementation of seven regional training programmes for training national administrative and technical experts in the implementation of the SAP MED.
- Public Participation includes activities for the development and implementation of a regional programme of public participation in the implementation of the SAP MED that will include provision of information to the general public on the state of the environment and the measures taken to improve it; and identification of the potential role of NGOs in the implementation of the SAP MED.
- National Action Plans (NAPs) includes activities for the assistance to the interministerial committees of the twelve recipient countries in the development and implementation of individual NAPs.

Heavy metals

The most relevant heavy metals for the Mediterranean Sea are Mercury, Cadmium, hexavalent Chromium, Copper, Lead and Zinc. The *Ad hoc* Expert Meetings held on April and June 1996, convened in order to propose a list of priority substances that are toxic, persistent and liable to bioaccumulate (UNEP, 1996), recommended to include the above heavy metals in the list. In accordance with the Article 6 of the Resolution on the Environment and Sustainable Development in the Mediterranean Basin, adopted by the Conference of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution and its Protocols (Barcelona, 10 June 1995) (UNEP, 1997), the discharge and emission of these substances should be reduced by the year 2005 to levels that are not harmful to man or nature, with a view to their gradual elimination.

Heavy metals enter the marine environment as the result of a variety of human activities, and natural weathering of soils and rocks. The most important sources are metal plating industry, tanneries, foundries and smelters, as point sources, and diffuse sources such as combustion by-products, traffic, etc.

Mercury (Hg) is the metal that received a great attention in the studies of its concentration in the marine environment of the Mediterranean. The main reason for it is the high percentage (65%) of the total world's mercury reserves being located in the Mediterranean basin (UNEP, 1996 a). Mercury enters into the marine environment by weathering of minerals, deposition from the atmosphere, and from many human activities. Mercury is used for a great variety of purposes, including industrial and medical applications, as well as scientific research. A high amount of mercury use is related to the production of dry cell batteries, paints, wiring devices and switches, and in chloralkali electrolysis. According to some estimates, the amount of mercury returned to the environment through emissions to the atmosphere, discharged to aquatic systems or disposal in landfills is equal to the yearly production (Laws, 1993). Direct use of mercury is not the only cause of anthropogenic releases of mercury into the environment. Additional discharges result from the burning of fossil fuels and processing of minerals and other metallic ores. Much of the mercury introduced into the coastal sea is probably retained there because of very high insolubility of its compounds, such as the sulfides and oxides. This is proved by relatively high concentrations of mercury in coastal areas with high mercury discharges, e.g. the Triest Bay (Jeftic *et al.*, 1990). Appropriate micro-organisms may convert inorganic mercury to methyl mercury that is much more toxic to some living organisms. Biological activity is high, and mercury, particularly methyl mercury, becomes associated with the biosphere (Laws, 1993).

Cadmium (Cd) is a metal chemically similar to zinc. It is used for the production of Ni-Cd batteries, pigments, plastic stabilizers, alloys, pesticides, and for electroplating. Cadmium enters the marine environment as a result of man's activities, through the atmosphere and by the discharge of industrial and urban wastewater, through rivers, and as result of geological weathering and erosion of the earth's crust. The major emission source categories are: non-ferrous metallurgy (65%), waste incineration (15%), power plants (13%), and ferrous metallurgy (5%). From the total estimated atmospheric deposition of cadmium to the Mediterranean Sea (500 t/y), 64% comes from the Mediterranean countries, which is about 19% of their emissions into the atmosphere (GESAMP, 1989). Cadmium is a highly toxic metal and is not required at all for the maintenance of life. EPA has defined the Criterion of Continuous and Criterion of Maximum Concentrations of Cadmium in sea water for the protection of marine organisms as 9.3 ppb and 43 ppb, respectively (Laws, 1993).

Chromium (Cr) is an element abundant in the earth's crust. Its most common oxidation state in nature is trivalent, which is considered essential as a trace element in living organisms. The hexavalent state of chromium, which is stable in the marine environment, is highly toxic, and its introduction into the environment is of great concern. Main sources of chromium are metal plating and tannery industries, ore refining, and fossil fuel combustion. It enters into the sea by the direct discharge of industrial waste waters, and indirectly by river discharges, or by atmospheric fallout. There are no precise information regarding the total amount of chromium

discharging into the Mediterranean Sea. Earlier estimations (UNEP, 1984) indicated 250, 950 and 1,200 t/y of chromium from domestic, industrial and river discharges, respectively.

Copper (Cu) is widely distributed on Earth as metal, in sulfides, arsenides, chlorides, carbonates, etc. It is used in many alloys, such as brass, for the production of wires, anti fouling paints, and wood preservation salts. Copper enters into the marine environment from mining operations and by weathering of rocks and soils, as well as from electroplating industry and run-off from areas where copper salts were used for different purposes. Copper is an essential metal, it is the third most abundant metallic element in the body, following iron and zinc, but at higher levels becomes toxic to plants and algae.

The total load of copper into the Mediterranean Sea (including atmospheric input and inputs through the straits of Gibraltar and Dardanelles) is 29,000 tons per year (UNEP, 1996b).

Lead (Pb) is widely distributed in the rocks and soils of the earth's crust. The major use of lead is the production of lead batteries, while other uses of significance from the standpoint of environmental pollution and human health are the use of lead in ammunition, paint pigments and gasoline additives. The main sources of lead emission to the environment are lead alkyls (the most important is tetraethyl lead), ore smelting and coal burning. Lead is a highly toxic metal and may be harmful to wildlife. EPA Water Quality Criteria for Lead for the protection of the marine organisms expressed as Criterion of Continuous and Criterion of Maximum Concentrations are 5.6 and 140 ppb, respectively (Laws, 1993).

The amounts of lead discharged into the Mediterranean Sea by domestic and industrial wastewater (river inputs not included) have been estimated at 200 and 1,400 t/y respectively (UNEP et al., 1985).

Zinc (Zn) has relatively low abundance in the nature, but it is present widely in a number of minerals. It has very wide field use, e.g. metal plating and galvanizing, paints and dyes, dry batteries, etc. The main sources of zinc emissions to the environment are: ore smelting, galvanizing industry, oil refining, fertilizer production and paper manufacture. Zinc is an essential trace metal, but at higher levels it may become toxic to plants. It appears to be one of the most important metals biologically. So far, more than 25 zinc-containing proteins have been identified, most of them enzymes.

The total load of zinc into the Mediterranean Sea (including atmospheric input and inputs through the straits of Gibraltar and Dardanelles) is 92,400 tons per year (UNEP, 1996b).

Persistent Organic Pollutants (POPs)

Persistent organic pollutants (POPs) are defined as organic substances highly resistant to degradation by biological, photolytic or chemical means. In addition, these substances are toxic and liable to bioaccumulate. The above mentioned ad hoc meetings related to Article 6 of the Barcelona Convention (UNEP, 1996), proposed the following POPs substances as a matter of priority concern: Aldrin, Chlordane, DDT, Dieldrin, Dioxins and Furans, Endrin, Heptachlor, Hexachlorbenzene, Mirex, Polychlorinated Biphenyls (PCBs) and Toxaphene.

The majority of these substances are being used as pesticides. PCBs are a group of 209 chlorine derivatives of biphenyl that have a very wide use. The largest application of PCBs is in electrical equipment, and as plasticizers, hydraulic fluids and lubricants, for the manufacture of carbonless copy paper and as heat-transfer fluids. These substances are very persistent in the environment, toxic and liable to accumulate in marine organisms and sediments. Dioxins represent a group of substances (75 different isomers) that are by-products of pesticide manufacture. The most notable dioxine pollutant and hazardous waste compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), often referred to simply as "dioxin". It has been identified in some municipal incineration emissions, and has been a widespread environmental pollutant from improper waste disposal. TCDD is a stable, persistent pollutant and hazardous waste

constituent of considerable concern. Polychlorinated dibenzo-p-furans (PCDFs) are a group of compounds (135 different compounds) not produced commercially. They are byproducts resulting from the production of PCBs, but are related to a variety of incineration reactions. Furans, as well as dioxins, have been detected in emissions from the incineration of municipal waste, hospital waste, hazardous waste, car emissions, and the combustion of coal, peat and wood (TNO, 1994).

These substances can reach the marine environment through agricultural runoff, rivers, atmospheric deposition, or discharge of industrial and urban waste waters.

Petroleum hydrocarbons and used lubricating oils

Petroleum hydrocarbons represent a very wide group of natural hydrocarbons that can be grouped into three classes: alkanes, cycloalkanes (naphthenes) and aromates, contained in crude oil and refined petroleum products. They enter the sea from different kinds of sources: natural seeps, offshore production, maritime transport, coastal refineries, the atmosphere, urban wastewater, industrial wastewater, urban and river runoff. In the marine environment petroleum hydrocarbons may be dissolved/dispersed in the sea water, accumulated in the sediments and biota, and floating as tar balls.

Used lubricating oils are lubricated oils that have gone through their intended use cycle and must be disposed of or treated and re-used. They represent a fraction of crude oil consisting of various groups of hydrocarbons such as linear and branched paraffins, cyclic alkanes and aromatic hydrocarbons and additives. The majority group of hydrocarbons contained in lubricating oils is polynuclear aromatics (PNAs) (McCabe, 1989). Additives which are contained in amount up to 20% of the oil weight (UNEP/UNIDO/WHO, 1989) are primarily dispersants and detergents. Beside these compounds, lubricating oils contain some organometallic compounds, such as zinc diaryl or dialkyl dithiophosphates, and inorganics, such as molybdenum disulfide or zinc dithiophosphate (UNEP/UNIDO/WHO, 1989). Additives are added for improving the quality of the oils, and types of additive vary according to the specification for a particular use. Used oils may contain additional compounds, such as chlorinated solvents introduced either during use, or illegally blended with the used oil during storage. (McCabe, 1989). The presence of these compounds, which are suspected carcinogens and mutagens, is the reason of concern about the introduction of used oils into the environment. During the use, various metals (such as aluminium, zinc, chromium and lead) may be introduced into the oil as the result of erosion of an engine or metal wear, or due to contamination from leaded gasoline.

Sources and activities producing used lubricating oil are industries, such as primary metals production, metal processing and machinery production, vehicles, airplanes and heavy machinery. The used oils may enter into the marine environment directly by discharges of urban wastewater, or indirectly, via rivers, and by urban runoff. It is estimated that urban runoff contributes to the contamination of the Mediterranean coastal area with 48,500 t/y of used lubricating oil (UNEP/UNIDO/WHO, 1989), while the urban wastewater and industrial (non-refinery) wastewater contribute with additional 218,500 t/y and 1,630 t/y, respectively.

Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) represent a group of organic compounds which consist of condensed ring aromatic molecules. The most often cited example of a PAH compound is benzopyrene. Some PAH compounds, including benzopyrene, are of toxicological concern because they are precursors to cancer-causing metabolites. Polycyclic aromatic compounds may be formed from higher alkanes present in fuels and plant materials. This happens by incomplete combustion of other hydrocarbons, a process that consumes hydrogen in preference of carbon. The carbon residue is left in the condensed aromatic ring system of the PAH compounds. Because there are so many partial combustion that favor production of PAHs, these compounds are encountered abundantly in the atmosphere, soil and elsewhere in the environment, originating from sources that include engine exhaust, wood stove smoke, etc. PAHs enter the marine environment predominantly by deposition from the atmosphere.

Same PAHs are carcinogenic, and those that are carcinogenic are generally also mutagenic (UNEP/WHO, 1995).

Radioactivity

Radioactivity is a spontaneous process consisting of the transformation of one isotope into another. The isotopes having capability to be transformed into another are called radioisotopes. There are two types of radioisotope: naturally occurred and artificially prepared. The transformation of isotopes is accompanied by the emission of alpha, beta or gamma rays. The emission of rays is harmful to all living organisms. Besides the lethal and sub lethal effects, the radiation also has genetic impacts. Acute radiation doses that have been shown to be lethal to aquatic organism lie in the 2-55 Gy range for invertebrates and adult fish, and as low as 0.16 Gy for fish embryos (Laws, 1993). Adverse effects on fish reproduction have been reported at chronic dose rates in the 6-120 mGy d/l range. Sub lethal effects associated with genetic defects have been reported at acute doses as low as 0.5 Gy.

The main sources of radioactive pollution are nuclear power plants, fuel reprocessing plants, research reactors and, to a lesser extent, hospitals and scientific laboratories.

Nuclear power plants are operational in only four countries in the Mediterranean region (France, Italy, Spain and Slovenia) (UNEP/IAEA 1992), while research reactors are located in nine Mediterranean countries.

The radioactive isotopes from nuclear reactors, all of them located on the mainland, enter the Mediterranean Sea via rivers receiving nuclear wastewater, and by precipitation from the atmosphere.

Pathogenic organisms

A wide variety of pathogenic organisms may be found in the excrement from humans and animals. Most human pathogens can be classified as either viruses, protozoan, intestinal worms, or bacteria. Sources of human pathogens are infected individuals carrying pathogenic organisms either as permanent or temporary carriers. Pathogens are contained in urban wastewater, sludge, and may be found in runoff water from animal husbandry and some agricultural areas.

Pathogens are not routinely monitored in natural waters. Instead of the pathogens monitoring, a monitoring of indicator non-pathogenic organisms is applied. Fecal Coliform and Faecal Streptococci are selected as indicator organisms.

Each individual emits between 5·109 to 1012 coliform bacteria per day and between 0.5·106 and 3·106 enteric virus per day. Concentration of coliforms in urban wastewater ranges between 107 and 5·108 per 100 ml, while concentration of fecal coliforms usually amounts to between 10 and 60% of the total coliforms. Enteric virus concentration varies between 400 and 2,000 plaque forming units (PFU) per 100 ml in urban wastewater.

Survival time of the indicator organisms in the marine environment is very short. T90 (time to die off 90% of organisms entered into the sea) at the sea surface is between 1 and 5 hours, therefore the increased concentration of indicator organisms may be observed in the vicinity of wastewater discharge points. Indicator organisms, as well as pathogens, may be concentrated in marine organism, especially shellfish. Contaminated organisms may cause harm to human health.

In order to protect the human health, WHO has developed the Guidelines for Health-Related Monitoring of Coastal Recreational and Shellfish Areas (WHO, 1994).

Organic matter and nutrients

A majority of organic matter reaching the marine environment is degraded by microorganisms. The biodegradation process occurs by way of a number of stepwise, microbially catalyzed reactions consuming dissolved oxygen. The final results of organic matter degradation are inorganic compounds: nutrients, carbon dioxide and water. The oxygen consumption during the biodegradation process, called Biochemical Oxygen Demand (BOD) may lead to oxygen depletion, particularly at the sea bottom where organic matter is deposited after entering the marine environment. Generally, negative impacts of organic matter on the marine environment are connected to areas in the vicinity of discharge of urban and industrial wastewater heavily loaded with organic matter.

Nutrients (nitrogen, phosphorus) are essential for marine biota, but their extremely high concentrations in the sea water may have considerable effects on the marine ecosystem.

The main sources of organic matter and nutrients are urban and industrial waste, particularly the food and beverage industries, breweries and distilleries, paper industries, tanneries, refinery and petrochemical industries, canning industries, as well as meat processing. A survey conducted in 1976/77 (UNEP, 1984) indicated that a total 800,000 t/y of nitrogen was reaching the Mediterranean Sea from anthropogenic sources, out of which 200,000 t/y from coastal discharges and the rest through rivers. In addition to the above mentioned sources, the agricultural runoff and fertilizer production plants can be significant sources of nutrients, both nitrogen and phosphorus.

I.2. Pollution monitoring for compliance control

Monitoring, in broader sense, may be considered as any kind of observations and/or measurements, carried out according to previously adopted plans and programmes.

For the purpose of this document under the term "monitoring" are understood observations and measurements of sources of pollution as well as of the marine environment.

The overall objective of a monitoring programme is to provide information necessary for the formulation of remedial measures for marine pollution control, as well as for an environmentally sound management of coastal areas, in order to protect the marine ecosystems, human health and secure sustainable development.

The basic prerequisite for the implementation of any kind of monitoring programme is the existence of the respective political will on a broad scale. It includes general public, authorities at all levels, scientific community and NGOs. Each of the mentioned parties can play its own role, each one complementary to another, in creating the conditions necessary for a successful implementation of the monitoring programme.

The basic prerequisites for a successful monitoring programme may be grouped as follows:

- political will;
- legal basis;
- funding;
- institutional arrangements; and
- human and technical capacities.

As the result of activities undertaken by the parties involved, the political decision on the introduction of the monitoring programme should be made. The political decision is a prerequisite for further activities related to monitoring design and implementation, and should define issues like:

- area to be monitored;

- type of monitoring to be implemented;
- legal and technical instruments needed for the establishment of the monitoring programme;
- global amount and sources of financing; and
- institution to be responsible for the programme design and implementation.

In addition to providing the legal basis to the monitoring programme, legal instruments have to secure enforcement of remedial measures and liability in case of non-compliance. Bylaws, norms and standards should define the needed organizational and technical issues, including EQC and HQC. Monitoring activities, particularly those related to monitoring of the marine environment, are very expensive and their development and implementation require constant and reliable funding. In many cases the preparation of a monitoring programme would require higher funds for capacity building and purchase of necessary instruments than later on for the regular implementation of the programme.

Political decisions should define the need for new institution/organization to implement the monitoring programme and/or define the role of the existing ones with or without their organizational adjustment. Finally, it should define the programme of development of professional and technical capacities.

Monitoring of sources of pollution and the marine environment, in general, may be divided into two categories:

- monitoring for pollution trends and status ("trend monitoring"); and
- monitoring for compliance purpose ("compliance monitoring").

The purpose of trends and status monitoring is to provide information on trends (spatial and temporal) and status of monitored parameters or phenomena, while compliance monitoring indicates the observed phenomena or parameters with reference to prescribed EQC and HQC. Monitoring of eutrophication phenomena or concentration of selected pollutants in designated marine organisms (e.g. Mussel Watch Programme) are examples of trend and status monitoring. On the other hand, monitoring of sanitary quality of marine beaches or monitoring of shell-fish mariculture sites are examples of compliance monitoring.

The establishment and implementation of a monitoring programme consists of following steps:

- definition of specific monitoring objectives;
- definition and implementation of research activities, if necessary;
- design of the monitoring programme;
- data quality assurance;
- implementation;
- data processing, quality control and data storage; and
- reporting and dissemination of data.

When establishing a monitoring programme, the first step is to define its short term and long term objectives. There are many examples of existing monitoring programmes, particularly on international level, with very broad and ill-defined objectives. As the consequence, the results of these programmes were frequently difficult to evaluate.

Prior to the design of a monitoring programme, in many cases research activities are needed in order to secure a better understanding of relevant phenomena, to allow for the design of a rational programme.

Variation of many parameters of the monitoring programme may be caused by both anthropogenic impacts and natural variations. By proper programme design these variations might be minimized. The programme design should define the area to be monitored, monitoring stations, matrix and parameters (water, sediment, biota) to be monitored, monitoring frequency and timetable. The

parameters selected should be appropriate to the objectives defined. The sampling frequency should be adjusted in accordance to real needs and the specificity of the relevant phenomena.

Box 4
Objectives of MED POL – PHASE III (1996-2005) (UNEP, 1999)

The ultimate and overall objective is:

- The elimination of pollution of the Mediterranean Sea from all activities that cause such pollution, in particular land-based activities, through the full implementation of the LBS Protocol

The specific objectives are:

- The assessment of all (point and diffuse) sources of pollution, the load of pollution reaching the Mediterranean Sea, and the magnitude of the problems caused by the effect of contaminants on living and non-living resources, including human health, , as well as on amenities and uses of the marine and coastal regions;
- Assistance to countries, including capacity-building, in the development and implementation of national action plans for the elimination of marine pollution, in particular from based activities;
- The assessment of status and trends in the quality of the marine and coastal environment as an early warning system for potential environmental problems caused by pollution;
- The formulation and implementation of action plans, programmes and measures for the prevention and control of pollution, for the mitigation of impacts caused by pollution and for the restoration of systems already damaged by pollution; and
- The monitoring of the implementation of the action plans, programmes and measures for the control of pollution and the assessment of their effectiveness.

In addition, the monitoring programme should include protocols of good quality practice, such as sampling technique, preservation method, analytical method, and data quality control. Good sampling techniques are important in order to avoid contamination of samples. In order to maintain the integrity of samples, appropriate preservation, transport and storage procedure should be defined and respected. The prerequisite for good quality data are well maintained laboratory facilities and use of appropriate quality lab ware and reagents, as well as availability of skilled analytical staff with proper training programmes for new or inexperienced analysts. Furthermore, applying analytical procedures with the required accuracy and precision, regular in-house checks on the accuracy and precision of methods using appropriate reference materials, participation in intercalibration exercises, and, finally, proper documentation of data and use of control charts to check on the quality of data, are the elements of good quality practice. The protocols should be primarily designed to ensure that data collected by different laboratories are comparable and that there is agreement between participants at the outset of the monitoring programme on potentially contentious issues. Would the protocols be ignored, the entire programme might result with failure.

All data collected should be processed, data quality to be checked and data with satisfactory quality may be stored in an appropriate data base. Finally, regular reporting to relevant authorities and public, as well as the dissemination of results, should be secured.

Box 5

Types of monitoring within the framework of the MED POL – Phase III (UNEP, 1999)

A. Compliance monitoring:
- Compliance monitoring of health-related conditions (e.g. sanitary quality of bathing areas and waters used for aquaculture),
- Compliance monitoring of effluents, and
- Compliance monitoring in "Hot Spot" areas.

B. Trend monitoring:
- Coastal zone trend monitoring,
- Trend monitoring in "hot spot" areas,
- Trend monitoring of loads, and
- Trend monitoring of biological effects.

Two basic types of monitoring are identified within the framework of the MED POL – Phase III Programme, namely compliance monitoring and trend monitoring (UNEP, 1998). Surveys are also being carried out in order to complement the monitoring data and facilitate decision-making for management purposes. Compliance monitoring is defined as the collection of data through surveillance programmes to verify that the regulatory conditions for a given activity are being met. If case of non-compliance is identified, appropriate enforcement can be put into effect and escalated until compliance is achieved.

I.3. Institutional arrangements relevant for remedial actions

The countries along the Mediterranean basin are characterized by great differences in country surface, population number, level of development and of urbanization of the coast, national wealth, ways of resource use, political system, governance arrangements. In addition, other not less important factors have to be added, such as historic, national, cultural, religious specificities, traditional management patterns... All these differences result with a variety of actual institutional arrangements relevant for remedial actions.

In spite of the above, the basic institutional framework, its multi level and sectoral character is more or less the same from country to country. Different solutions are applied within individual sectors and different is the degree of integration of the decision making and development process. Structure variables range from strong administrative control to pronounced rights of private interest groups; administrative variables range from sectoral planning to broad function responsibilities. In some cases some of the relevant institutional functions are not sufficiently developed and/or weak.

Management levels typical for the Mediterranean basin, all relevant within the context of this document, are presented in Table 1 (adapted from: Pavasovic, 1995).

Out of the 6 mentioned levels, it is mostly the “national”, “sub-national I” and “local I” that are of relevance for remedial activities; regarding the application of the participatory principle, the “Local II” level might be at least as much relevant as the other ones.

The sectoral governance arrangement follows, more or less, the standard sectoral classification, which is, as a rule, more diversified in developed countries.

Table 1: Institutional arrangements in the Mediterranean – Management levels and Institutional forms

Level	Institutional forms
1. International	Conventions, protocols, UN agencies, international organizations
2. National	Presidency of State, National Government, Ministries, National (State) Agencies, National (State) Corporations, National Offices, Inspectorates at national (ministerial) level
3. Sub-national I	Regional governments and ministries, or departments and offices. Also, Autonomous Regions, Regions, Counties, Provinces, Departments, Mohafaza, Willaya, Governorates, Inspectorates
4. Sub-national II	Provinces, association of communes, agencies at sub national level, Inspectorates
5. Local I	Municipalities, Communes, City Councils, local (municipal or other) agencies, Inspectorates
6. Local II	Arrondissement, quartieri, small local units, small settlements and rural administrative and/or self-management units

Ministries and/or National Agencies relevant and/or sharing competencies for compliance monitoring, detection of non-compliance, and formulation, approval and implementation of remedial actions are those responsible for:

- economic and social development;
- environment protection;
- resource use and development (energy, water resources, agriculture, fisheries, forestry);
- health and sanitation;
- land and sea use planning;
- sectors, whose activities are likely to be causes of non-compliance or to be affected by them (industry, transport, mining, tourism...);
- communal/urban infrastructure and services;
- defense;
- finance; and
- science and technology.

In many Mediterranean countries sectoral authorities relevant for remedial actions are systematized within larger administrative units, for example: fisheries and aquaculture within the ministry of agriculture; land-use planning and/or environmental protection within the ministry of civil engineering/or public works and/or construction; tourism sometimes within different ministries; maritime transport within the ministry of transports, communications and maritime affairs, etc.
Functions important for remedial programmes are sometimes located in “non-standard” administrative bodies and agencies, such as, for example:

- "Agences du bassin" (France), funded through tariffs on water used and discharged waste water; Water Service Corporation (Malta), Water Resource Management Agencies (Croatia, Turkey...) all very important and active in monitoring and remedial actions related to water resources and river basins;
- Ministry of Hydraulics and Equipment including the National Agency for Water Resources and Public Works department (Algeria), Ministry for Water Resources and Irrigation (Syria);
- National Planning Council, including the National Agency for Land use Planning (Algeria), State Planning Organization (Turkey), Ministry for Reconstruction and Development (Croatia), National Council for Regional Development, National Council for Industrial Development (Tunisia), The Planning Authority (Malta), etc.

In many cases ministries and agencies have sub-national or local branches with delegated authority or sharing competencies for remedial actions in coastal and marine areas.

For example, in Italy the authorities and institutions with competencies on management of coastal areas count: 11 Ministries, 18 Central Departments and Agencies, 2 state managed Holdings, 7 types of local branches of various Ministries and Agencies with a large number of authorized offices, and 2 types of local authorities. Regarding local branches, for example the Ministry of Public Health through the High Health Institute has a large national network of local health authorities, the Ministry of Merchant Marine through the Harbor Authority has 12 harbor head offices and 44 local executive branches, all relevant in case of non-compliance from oil spills and other harbor/marine emergencies.

The "local I", and sometimes the "local II" level units might have considerable competencies, such as urban planning, issuing building permits, inspection, monitoring, and health and environment inspection and control.

Impacts on human health are likely to occur in almost every case of non-compliance. Due to their extreme importance for the well-being of the population and potential adverse effects of increased health risk and morbidity on political, social and economic (on tourism, for example) aspects in coastal areas, the health related impacts and remedial measures have to be carefully considered and formulated; this has to be done in close cooperation with public authorities and institutions responsible for public health, usually Ministries of Public Health and/or Sanitation and the relevant health inspectorates and Public Health Institutes at various levels.

The fact should not be neglected that not in all cases the decision-making and the coastal and marine management process occur according to the official institutional arrangement. The cases are not rare that decision making is dominated by more influential ministries or ministers, or dominant political forces or lobbies.

Inspectorates, i.e. offices of sectoral inspectors or their equivalents exist in almost all Mediterranean countries, established at practically all levels. The usual structure of inspectorates includes: health and sanitation, environment protection and resource use, mining, water resource, agriculture, veterinary, forestry, fisheries, civil engineering, tourism, ports and navigation, and others. In case of non-compliance, their institutional arrangements, levels and role are of particular importance, being directly responsible and authorized for compliance control, and "indoor" inspections and interventions, i. e. inside limits of industrial and other facilities.

Usually inspectorates are organized on a sectoral base, within respective Ministries at national level, each inspectorate being top-down organized, with a strong hierarchy, with a number of sub national and local offices/inspectors under supervision of the national level inspectorate. Different inspectorates among themselves usually are not integrated on horizontal levels, and there are no organizational provisions for it. The consequences in such cases are described in the following chapter. Therefore, the institutional arrangements, practice and competencies of

inspectorates play an important role in detecting non-compliance, assessing impacts and implementing remedial actions, in particular actions to be immediately implemented.

At international level, the institutional arrangements relevant for the Mediterranean region include: the ratified global, regional and multilateral conventions and treaties, the UN Agencies, the European Union, international funding organizations and agencies (GEF, WB/METAP...) etc. Within the context of this document, the Mediterranean Action Plan (MAP) and the World Health Organization (WHO) and its Regional Offices for Europe and for North Africa and East Asia are of particular importance.

NGOs. Today, a large number of national, and especially local NGOs act in coastal areas, orienting their activities at environment protection and coastal management. A good Mediterranean example is the NGOs' Tunis Declaration on Sustainable Development, presented at the Ministerial meeting held in Tunis in 1994, adopted by the representatives of national NGOs from 14 Mediterranean countries. However, many of those, especially local NGOs, need further assistance in raising the level of knowledge on problems of coastal eco-systems and resources, as well as on the mechanisms and methodologies for remedial actions. At regional Mediterranean level, a number of Mediterranean NGOs specialized in remedial problems with good scientific base and human capacities. Those are ICCOPS (International Centre for Coastal and Oceans Policy Studies) Genoa, EUROCOAST, MEDCOAST, Mediterranean Water Institute (MWI – MEDWAN) and others. A number of international NGOs participate also in MAP activities, in particular within the Mediterranean Commission for Sustainable Development (MCSD).

The scientific community. In case of monitoring, detecting non-compliance and remedial actions, the scientific community plays an indispensable role, and therefore should be included in the relevant institutional arrangements. The usual institutional forms of scientific communities in the region are: the National Academia(s), Universities with relevant Faculties, High/superior schools, scientific Institutes and Institutions with recognized scientific status. Scientific institutes and institutions sometimes are of a para governmental character, in some cases such a position may facilitate their involvement in the monitoring and remedial processes.

The participation of the bodies or reputed representatives or members of the scientific community is indispensable also during the implementation phase of remedial actions, avoiding thus the risk of transforming remedial actions in purely sectoral civil engineering projects. Finally, the role of the scientific community in the remedial process is essential within public participation programmes, securing a qualified feedback to the formulation and implementation of the programme.

The general public, in particular population located in areas originating non-compliance and in affected areas is also an important element of the process, and therefore a specific component of institutional arrangements.

Concerning coastal and marine areas, the role of authorities, NGOs, scientific community and authorized institutions and individuals in the process of identification of non-compliance and implementation of remedial activities is dependent on their role in coastal/river basin management: on their hierarchic and sectorial positions, and type of function they perform (administrative, regulatory, research, communication, public relations). It is, therefore, necessary to identify groups relevant for the preparation and implementation of remedial actions. Since as stakeholders are understood all institutions, social groups and authorized and skilled individuals involved in or responsible for the human health and state and use of coastal resources, Table 2 can serve as a basis for such an identification. Within “Specialized activities” presented in the Table, monitoring, identification and assesment of non-compliance, as well as formulation and implementation of remedial activities are understood.

The analysis of national and area related institutional arrangements and practices must be made during the assessment phase of the remedial process.

Table 2: Main institutions, social groups and individuals involved in coastal management, their role and significance (Pavasovic, 1995)

	Type		Group	Role and significance*		
				Decision-making	Management	Specialized activities
I	Governance, management (individuals, groups, bodies, institutions, authorities)	1.	All levels and forms of governmental and administrative bodies	◆	◆	◆
		2.	Legislative bodies	◆	–	◆
		3.	Juridical bodies	◆	–	◆
		4.	Specialized governmental bodies	◆	◆	◆
II	Private interest groups and institutions	1.	Industry	◆	◆	◆
		2.	Tourism	◆	◆	◆
		3.	Maritime transport	◆	◆	◆
		4.	Energy groups	◆	◆	◆
		5.	Fisheries	◆	◆	◆
		6.	Building industries	◆	◆	◆
		7.	Other specific groups: - hunters' associations - fisherman associations, etc.	◆	◆	◆
III	Scientific community and universities	1.	Universities	◆	–	◆
		2.	Scientific and research inst.	◆	–	◆
		3.	Academies of science	◆	–	◆
IV	NGOs, environm. or CA oriented	1.	Of a general type	◆	–	
		2.	Specialized in CM and Env. protection	◆	–	◆
V	General public	1.	At national or sub-national level	◆	–	–
		2.	Coastal population	◆	–	–
VI	International organizations and agencies	1.	UN agencies, MAP, WHO	◆ ◆	◆ ◆	◆
		2.	Other inter-governmental or international organizations	◆ ◆	◆ ◆	◆

* *Significance*: ◆ = great, ◆ = moderate, ◆ = small, – = nil

I.4. The predominating practice

The practice for the identification of non-compliance and implementation of remedial actions in the region is country, area and non-compliance specific. Nevertheless, certain practices and situations are the same or similar in many cases and in almost all the countries. In order to provide a general picture only, emphasizing the present most common problems and difficulties, short comments will be given related to the practice of:

(i) non-compliance monitoring;
(ii) other sources of detection of non-compliance; and
(iii) remedial actions.

Monitoring: quality, reliability, data quality assurance

A detailed survey of existing practice in the countries of the Mediterranean region has not been done so far. The present description of predominating practice is elaborated on a limited number of information that was available to the authors, and is given for the illustration only.

The participation in the Joint Coordinated Mediterranean Pollution Monitoring and Research Programme (MED POL), established in 1974 jointly by the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), the United Nations Educational, Scientific and Cultural Organization (UNESCO) the Intergovernmental Oceanographic Commission (IOC), the World

Meteorological Organization (WMO), and the International Atomic Energy Agency (IAEA), was the first experience of a regional monitoring programme for many Mediterranean countries.

An example of the implementation of monitoring programme is France. Three monitoring programmes with defined specific objectives, funding, institutional arrangements, legislative and related technical acts, are being implemented since many years ago:

- RNO – monitoring of selected contaminants in marine organisms and sediments;
  - REPHY – monitoring of potentially toxic phytoplankton organisms; and
  - REMI – monitoring of sanitary quality of coastal marine water.

The monitoring programme should secure basic information for the formulation of measures for marine pollution prevention and control, as well as for environmentally sound management of coastal zones, in order to protect the marine ecosystems and human health. Unfortunately, due to different reasons as already mentioned, many of past monitoring programme failed and their results could hardly be used.

Some monitoring programmes were designed and implemented without precise definition of goals and objectives. In such cases a set of different parameters was measured at a grid of monitoring stations in regular time intervals, regardless the importance of each specific parameter and temporal variation of the phenomenon monitored. Later on, after some time passed and significant values were spent, it came out during the interpretation of obtained results that many of the measured parameters were inappropriate, while for others the timing was inadequate.

Other programmes underestimated the importance of quality assurance, as consequence the obtained results were not correct and not comparable among different laboratories involved in the programme.

The main shortcoming of many past and ongoing programmes is the lack of the integrated approach. Monitoring programmes are organized on sectoral, rather than on an integrated basis. For example, monitoring of sanitary quality of public beaches is organized by authorities responsible for public health, while monitoring of land based sources of pollution is organized by authorities responsible for environment, or by those responsible for water resource management or by scientific/research Institutes. Data obtained from such monitoring programmes frequently are used on a sectoral base only. Consequently, the correlation of data obtained by different programmes was poor and the duplication of programmes frequent. Such an approach might help sometimes to resolve sectoral problems but doesn't contribute significantly to the environmentally sound management of coastal zones and is much more expensive than the integrated one.

Other sources of non-compliance detection

Besides regular monitoring as a standard, properly designed and scientifically based tool for compliance control, non-compliance might be identified and reported by a number of non standard sources and channels, using various types of indicators.

In most cases this is related to practical observations by: visual, aerial or teledetection of oil/chemical spills over soils, coastline and/or sea- and freshwater surface; detection of dead fish, animals, birds, vegetation; change of color of water masses; odor and bad smell around affected areas; bad taste and/or odor of seafood; health impacts on a larger number of individuals, etc.

The usual sources of detection and reporting in these cases are individuals, NGOs, media, local authorities, inspectors. The related practice consists of informing/reporting to local authorities or inspectors, initiating thus the procedure for official detection of non-compliance and start of remedial actions.

Detection in case of ecosystem degradation

Ecosystem degradation, a very serious type of non-compliance is in many cases due to causes hardly or too lately detectable by standard monitoring programmes, such as: slow changes leading to degradation; impacts leading to drastic instantaneous changes after long periods of "incubation"; aquaculture potentially causing genetic pollution; introduction of alien species; lowering of the ground water level or pollution of ground waters, etc. Too often in such cases the causes are not detected timely and the non-compliance, once occurred, requires complex and expensive long-term remedial actions.

On the other hand, unfortunately, already degraded ecosystems are commonly known or easily identifiable, their non-compliance being "discovered" years ago.

Monitoring/detection of ecosystems endangered by degradation should be implemented according to a comprehensive inter-disciplinary programme. For already degraded ecosystems, instead of standard monitoring, complex studies (and if needed) research programmes should be organized looking for remedial strategies.

Practices after detection of non-compliance

The usual procedure after detection of non-compliance is as follows:

- reporting to authorities;
- inspecting the area affected and actual or presupposed sources (factories, storage; means of transport, treatment facilities, suspect food, water...), rapid assessment;
- immediate remedial action by inspectors, targeted at causes of non-compliance as/if appropriate and feasible;
- emergency action in affected areas;
- technical and scientific analysis of causes and impacts in cases when direct inspection is not capable to identify causes or assess impacts; and
- initiation of remedial process.

The critical points after the detection of non-compliance are:

- timely reporting;
- correct interpretation using available means;
- timely response; and
- appropriateness of immediate actions implemented.

Local, prevailingly accidental non-compliance, is usually handled immediately after detection by responsible inspector(s)/inspectorates at the local level, or by their equivalents, depending on the existing institutional arrangements in the country. According to their legal authority and competence, inspectors implement field surveys, inspect the causative and affected areas, identify causes and impacts and define/order immediate remedial actions to be implemented, if appropriate and feasible. Reporting of the case is presented usually to the responsible ministry and to local authorities in the affected areas. Reporting and information to other sectoral inspectorates covering the same level/area and a full information of the general public is often not envisaged as part of procedure. Regular reports are sectoral and comprehensive reports on the state of environment and resources, covering coastal and marine areas at national or sub national level rare. In most cases, a good practice is established of mutual information among inspectors covering the same level or area, as well as of joint interventions, but a systematic and permanent cooperation and/or coordination is often not prescribed. The individual professional capability of inspectors as well as their hierarchical level and authority provided by law plays a decisive role in timely and efficient immediate remedial interventions.

In some countries inspectors are not authorized to prescribe remedial interventions and order immediate measures to be undertaken, leaving thus space to polluters or causative actors to postpone implementation of remedial measures or to escape them. In such cases, strict enforcement and heavy penalties as deterrents to potential polluters are needed.

In case of non-compliance requiring larger or large actions, in particular those identified by trend monitoring or caused by multiple and/or cumulative effects, or involving large areas often under several local or sub national jurisdictions, the situation is much more complicated. Due to their sectoral professional capacity and institutional status, individual inspectors are not capable and/or authorized for multisectoral and/or multilevel interventions. Furthermore, the very detection and assessment in such cases require the involvement of multidisciplinary teams of professional and scientists. That is the case when local authorities responsible for affected areas should act and in most cases are acting as triggering factors, initiating the remedial process. Such an approach, of a bottom up character, is facing many practical problems due to absence of regulations and lack of experience, in particular related to integration at local and at higher levels. Higher authorities are thus being involved usually on a single sectoral basis, unfortunately. Finally, the government level, including all or some of responsible ministries is involved, and initial decisions are formulated and adopted. The entire procedure in many cases is slow, the degree of integration weak and the involvement of the general public, scientific community and NGOs not structured and/or not timely.

The above described relatively poor practice, should not be interpreted as the dominating Mediterranean practice, and does not fully reflect the situation in any specific country, but is more or less relevant for many cases in the region. In fact many examples could be mentioned of a better and more effective and efficient practice in some countries, not all of them being the developed ones.

Concluding, it might be stated that in cases of weak integration, lack of comprehensiveness and of full and timely involvement of all responsible and involved actors, the consequence is an increased risk of failure of remedial actions.

II. CONCEPTUAL APPROACH TO REMEDIAL ACTIONS

II.1. Understanding non-compliance and remedial actions

Non-compliance within the scope of this document should be understood as a situation not in accordance with Environmental and/or Health Quality Criteria and Standards (EQC and HQC). Non-compliance is in most cases factual and formal, applying adopted EQC and HQC. These criteria at national level might be adapted to country specific and presently affordable conditions, therefore in some cases non-compliance might be actual according to international standards and criteria, and according to wishful conditions to be achieved in a foreseeable future, but not formal according to officially established local or national quality criteria.

In many cases national recipient standards, usually defined according to present and future usage, vary from one country to another. It is therefore recommendable to apply regional standards as a better solution. In the case of the Mediterranean basin such regional standards were elaborated by MAP and adopted by all Mediterranean countries.

In some cases non-compliance is detected while the effluent standards are complying but the recipient standards do not. The causes are usually the cumulative and/or long term impacts, such as, for example, the up welling of pollutants from sea bottom, contaminated by previously deposited organic waste.

Some causative processes with cumulative/long term effects might act for 20 or more years before resulting in a detectable non-compliance. That is why a proactive approach is needed when analyzing the results of monitoring activities.

Finally, some cases of non-compliance are of a seasonal or short term character, for example, due to impacts from tourism of highly seasonal type, or non-compliance caused by runoff after storms and/or by rains after the dry season, etc.

Remedial actions might be defined as structured initiatives oriented at control, reduction, and elimination of causes and consequences of non-compliance with environmental and health quality criteria and standards. Accordingly, the main aim of remedial actions is to:

a) identify causes of non-compliance;
b) identify resources/ecosystems to be protected/restored; and
c) select and implement remedial measures.

the final aim being the resulting long term social, environmental and economic benefits.

Remedial actions in coastal areas should not be restricted to pollution control or reduction only, but should be based on a comprehensive, sequential and holistic approach, within the framework of sustainable development and ICAM, taking into account the complex of present and future environment/development interrelations.

Preventive protection of environment and of human health as related to it, is in principle less expensive than remedial actions in case of non-compliance, not calculating the significance of non-accountable loss of human health and lives, of degraded ecosystems and endangered/extinct species.

In most cases, regrettably and unfortunately, remedial actions are post festum activities, needed due to: failure of timely prevention, absence of proactive and integrated approach, poor management, inadequate institutional and legal framework, lack of enforcement and limited financial/economic potential. Therefore, the basic remedial action per se in any country, would be a careful analysis at national level of most frequent causes of all major non-compliance cases incurred, taking into account their scientific, socioeconomic, and institutional aspects.

The criteria for identification and prioritizing problems related to environmental and health aspects of non-compliance might be cited as formulated by WHO/EURO – CEC:

"• Nature and extent of environmental health hazard (nature and severity of the health effects and number of people at risk);
- evidence of a worsening trend in the severity of an environmental health problem;
- technical feasibility and affordability of envisaged solutions;
- likely health benefits in relation to inputs required." (WHO/EURO – CEC, 1996).

Simpler cases of remedial actions are those when one of likely pollutants or causes is identified as the only one, and the nature of both causes and impacts leads to relatively simple and low cost interventions, implementable rather quickly. Other cases, involving large areas, heavy pollution and complex development/environment interrelations will require large medium term programmes, with investment costs of millions of US$. For example, the full protection and recovery of the Po river basin would need an investment estimated at 2 billion US$, and the waste water collection, treatment and disposal project, as one component of the Kastela Bay (Croatia) remedial programme has been estimated at a sum of about 80-100 mill. US$.

In case of large remedial programmes, their nature and the funds needed for implementation usually require the phasing of the programme, with a number of projects, each phase securing some tangible results within shorter time periods. Large remedial programmes must be included in national development programmes.

In most cases remedial actions are complex middle term oriented programmes, to be handled by interdisciplinary teams, never to be understood as purely civil engineering projects designed for environmental protection purposes. When developing such programmes in coastal areas and/or river basins, the ICAM methodology and tools (UNEP 1995a), or IRBM (PAP-RAC/MAP/UNEP, 1997) or ICARM (UNEP/MAP/PAP-RAC, 1999), should to be applied.

Finally, it has to be noted that in almost all cases of non-compliance, knowledge and technologies to be used within remedial actions are available at national or international level, to be applied according to causes of non-compliance, type and significance of impacts and national and site specific conditions.

Box 6

Estimated costs of remedial activities for SAP MED targets, to be achieved till 2010

Targets, group	Remedial activities	Mill. US$
Hot spots	Impacts evaluation, preinvestment studies, Action Plans for remedial actions, Industrial WWTPs, disposal and treatment of 1 mill t of hazardous waste	6,453
Sensitive areas	Preparation of Action plans, implementation of remedial actions for 54 sensitive areas	195
Cities, according to the LBSP protocol	Remedial actions related to urban solid waste, reduction of pollution by vehicles, reduction of air pollution	2,800
Capacity building		1
Preparation of national programmes		11
BAT & BEP & clean production		471
Monitoring and enforcement		37
Information and public participation		3
TOTAL, estimated		**9,971**

Adapted from (UNEP, 2000)

II.2. Non-compliance: sources, causes and areas of concern

The strategies and measures to be applied in cases of non-compliance will depend on sources, causes, and areas affected.

The most frequent sources potentially causing non-compliance are the following ones:

a) point sources: untreated waste water discharge and waste water treatment facilities; coastal mining – sand – gravel extraction; aquaculture facilities, power plants; industrial plants; construction works – dams, coastal structures and harbor works, urban expansion; tourism and recreation; military – naval installations; dredging – filling of wetlands; large coastal research centers, introduction of alien species (ballast waters...) etc.;
b) non-point (diffuse) sources: various types of runoff – urban, agricultural, forestry; mining waste...; landfills; hazardous waste deposits; erosion processes; changes of water flow dynamics...;
c) atmospheric deposits: volatile pollutants and particles transported by air; industrial facilities, power plants, heating systems in large cities...; and
d) ususstainable/uncontrolled development as a specific cause of non-compliance: population congestion in coastal areas; overbuilding along the coastline; overexploitation, depletion of resources, loss of habitats, endangered biodiversity...

Classification of causes of non-compliance

The standard classification of pollutants, according to the MAP Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources was presented in chapter I. This classification follows the usual scientific methodology and is relevant for every monitoring programme. Since non-compliance phenomena include also cases of ecosystem degradation and other cases, such as biodiversity protection, socioeconomic, including cultural issues, etc., in case of remedial actions there is a need to apply a more transparent, comprehensive and at the same time simpler approach. Therefore, for the purpose of this document, the presentation of causes of non-compliance is following the classification adopted by the Global Programme of Action for the Protection of the Marine Environment from Land Based Activities, adopted in 1995 by an Intergovernmental Conference, convened in Washington, DC, USA, by UNEP (UNEP, 1995), as follows:

A. sewage;
B. persistent organic pollutants;
C. radioactive substances;
D. heavy metals;
E. oils – Hydrocarbons;
F. nutrients;
G. sediment mobilization and siltation;
H. litter; and
I. physical alteration and habitat degradation.

In addition, other specific discharges/pollutants/activities might act as causes of non-compliance, such as military waste, military and naval exercises, not to speak of conflicts and war operations. Due to the very specific character of these cases, they will not be considered within the context of this document.

A description of each potential cause listed above, as well as of potential impacts and relevant remedies to be considered, is presented in chapter III.

Main areas of concern

The following are the main areas of concern to be considered:

- settlements at risk of negative impacts on human health;
- critical habitats, wetlands, coastal lagoons, seagrass beds, inter-tidal zones;
- habitats of endangered species;
- critical ecosystem components: spawning and nursery areas, feeding grounds, adult species habitats;
- shoreline;
- coastal watersheds;
- estuaries;
- coastal/marine protected areas;
- small islands;
- virgin areas; and
- areas of high socio-economic value, including cultural values.

II.3. Types of remedial actions

Speaking of remedial actions, it should be respected that each case of non-compliance has to be approached as a particular one, the same for each remedial action. The reasons for it are: the variety of potentially causative activities; complexity of coastal and marine ecosystems; the relevant health aspects, social and economic implications; differences in nature, scale and area(s) affected and significance of non-compliance; number of actors involved; specific local and national socio-economic, institutional and legal conditions.

The remedial actions might be classified according to the following criteria:

a) cause/source of non-compliance;
b) area generating non-compliance, and the affected area;
c) level of responsibility and of needed intervention; and
d) significance of actual and potential impacts.

Concerning causes and sources of non-compliance, remedial actions might be differentiated as those caused by:

a1) single, sectoral point sources;
a2) multiple point sources;
a3) diffuse sources and atmospheric deposits;
a4) combined point and diffuse sources; and
a5) mismanagement, overexploitation, depletion of resources, degradation of ecosystems.

A description of remedial measures to be considered according to causes of non-compliance is presented in chapter III.

When considering areas generating non-compliance and the affected areas, the following might be distinguished at national level:

b1) individual, relatively small coastal/marine areas;
b2) large coastal areas, encompassing small river basins, if any;
b3) large river basins;
b4) large coastal/marine areas and large river basins involved; and
b5) entire national coastal and marine areas.

In case of non-compliance affecting areas belonging to two or more coastal states or in case of impacts affecting the entire region, the areas generating and affected areas might be of any of b1) – b5) type. In these cases, the procedure to be applied will depend on the relevant international conditions.

The above classification of areas is a simplified one, allowing further differentiation by combining scales of generating and affected areas, or of river basins and coastal areas.

The conceptual framework for integration in cases of types b1) and b2) would be the ICAM process, for cases of types b3) it would IRBM, and for b4) and b5) combined ICARM, see chapter II.5.

Considering the responsibility levels, the following ones are usually relevant:

c1) local I;
c2) sub national I. and II;
c3) national; and
c4) international: bilateral, multilateral, regional.

The responsibility level for a certain case of non-compliance influences the decision making process, the relevant institutional arrangements. In most cases the responsibility level is correlated with the scale of the remedial programme.

Finally, according to significance of impacts, an arbitrary differentiation might be applied to cases of non-compliance, being of:

d1) low significance;
d2) medium significance; and
d3) great significance.

The “low significance” attribution should be understood as a conditional one. Every case of non-compliance is of a great significance for the population and ecosystems affected. However some differentiation of significance, has to be used as one of criteria when defining priorities, taking into account parallel cases of non-compliance and financial and technical resources available. By applying the cost/benefit analyses this arbitrary differentiation of significance may be omitted when prioritizing actions.

Additional criteria might be added to the above listed groups, such as, for example:

- urgency of intervention needed, differentiating accidents and emergencies from other types of non-compliance;
- degree of reversibility of impacts caused by non-compliance, influencing adoption of specific remedial actions such as conservation, restoration, change of use of resources, change of land- or sea use; and
- time span needed for remedial action and re-establishment of compliance status, determining the scale, phasing, and design of actions.

The above elements listed from a) to d), might be used for almost all cases of non-compliance, each of them will influence the selection of the strategy(ies) and actions to be envisaged

II.4. Principles and policies to be applied

Conceiving and implementing remedial actions, the principles of sustainable development (UNCED, 1992) and those of ICAM should be applied, and in particular:

- the polluter pays principle;
- proper resource accounting when assessing costs/benefits of measures envisaged,
- transboundary responsibility;
- conservation of restored ecosystems, whenever appropriate and affordable; and
- specific approaches when measures are related to: urban areas and settlements (applying urban sustainability analysis); highly congested or developed coastal areas; islands; virgin and/or extremely sensitive areas or ecosystems.

Furthermore, deliberations and obligations adopted within international conventions and other documents, should be fully respected and implemented as appropriate.

In addition to general policies of sustainable development and the methodology and tools of integrated coastal and or river basin management to be applied, a set of alternative or combined specific strategies might be applied, such as:

- reclassification of users;
- revision of effluent standards;
- revision of quality objectives;
- strengthening/developing enforcement measures and procedures;
- activity management: discouraging expansion and/or siting of activities potentially causing non-compliance, dislocation of non coastal/marine specific activities, changing present or future use – temporarily or permanently;
- rehabilitation of polluted areas;
- establishment of protected areas after rehabilitation; and
- assessment of impacts and costs of no action.

In addition to the general framework, principles and approaches presented above, some specific approaches should be also taken into account and applied as appropriate and affordable, and in particular:

- "not to transfer directly or indirectly damage or hazards from one area to another or transfer pollution into another type of pollution, unless such an action results in preventing /reducing/pollution and control of pollution of the environment as a whole" (The Montreal Guidelines);
- discharge of waste into the marine environment – to be adopted only if proven as the best alternative, prior to such a decision all other alternatives should be evaluated;
- rehabilitating/restoring affected areas, securing sustainable exploitation of resources for traditional or new activities;
- best available techniques (BAT) and best environmental practice (BEP) to be considered and applied, as feasible;
- environmentally sound and effective technologies to be applied;
- applying the best interdisciplinary and intersectoral integrated management practices – in this case ICAM, IRBM or ICARM;
- substituting products, changing consumption patterns, reducing/eliminating wasteful use of resources;
- reducing pollution by applying efficient waste treatment processes, recovery, recycling, reuse of waste;
- preventing/reducing degradation: applying biological, physical and chemical EQC and HQC;
- applying integrated planning and land-use planning, in particular related to siting of facilities and use of resources;
- securing effective and efficient communication and the consensus building procedure; and
- providing for monitoring of implementation and for post-implementation monitoring and evaluation.

In cases of non-compliance based on emission standards, the following should be taken into consideration: the technologies proposed should be achievable and socially acceptable, distribution of control costs to be defined, and the enforceability of measures secured.

In case of technology based standards, strategies will range from best practicable technology, best available technology, as low as reasonable achievable technology, up to zero discharge. In some cases zero discharge strategies might be misleading, if achieved by transfer and not by pollution abatement.

II.5. The need for an integrated approach

A great majority of causes of non-compliance and their impacts are of a multidisciplinary and multisectoral nature, the relevant actions implying an integrated and multilevel decision making process. The sectoral approach to remedial actions might be effective and successful only in simple cases of non-compliance, caused by one causative agent and with limited local impacts. The "integrated approach" to remedial actions understands integration of all elements of the decision making process (policy integration) and integration of management procedures (process integration).

Policy integration aims at:

- securing comprehensiveness of inputs for decision making with regard to: time, space, actors and issues;
- processing of inputs into decisions, to result with the selection of the most appropriate alternative for action, adopted on an aggregated evaluation of policies; and
- securing consistency of outputs/decisions by harmonizing all policy components, securing integration among policy levels (vertical integration) and implementation of only one policy by all actors (horizontal integration).

Processes and procedures for integrated planning and management in coastal and marine areas were introduced in early 70s and are now successfully implemented in almost all regions of the world. Among them, the Integrated Coastal and Marine Areas Management (ICAM) or Integrated Coastal Zone Management (ICZM) is the most widely applied. UNEP/MAP/PAP has been implementing ICAM in the Mediterranean region since 1986.

ICAM/ICZM was developed as a process to substitute the classical sectoral approach to and practice of coastal management. Among a number of definitions for ICAM, the one used by UNEP/MAP/PAP will be cited:

"ICAM (ICZM) is a continuous, proactive and adaptive process of integrated resource management for sustainable development in coastal areas" (UNEP, 1995a).

The ICAM methodology is characterized by a system prospective and by an integrated multisectoral approach, being long term oriented and open ended. ICAM is an anticipatory and remedial process, particularly suitable to respond to long term concerns and issues, such as increasing rate of pollution and degradation, consequences of cumulative impacts, impacts from global change, al of them the major issues when dealing with large remedial actions. The main goal of ICAM is, per definition, the achievement of sustainable development in coastal and marine areas, by developing – among others – alternative strategies for sustainable use and management of coastal resources, including protection and restoration of environment, within the broader context of national development policies and plans.

The basic elements of the ICAM process are presented in Figure 1 and Table 3 (UNEP, 1995a).

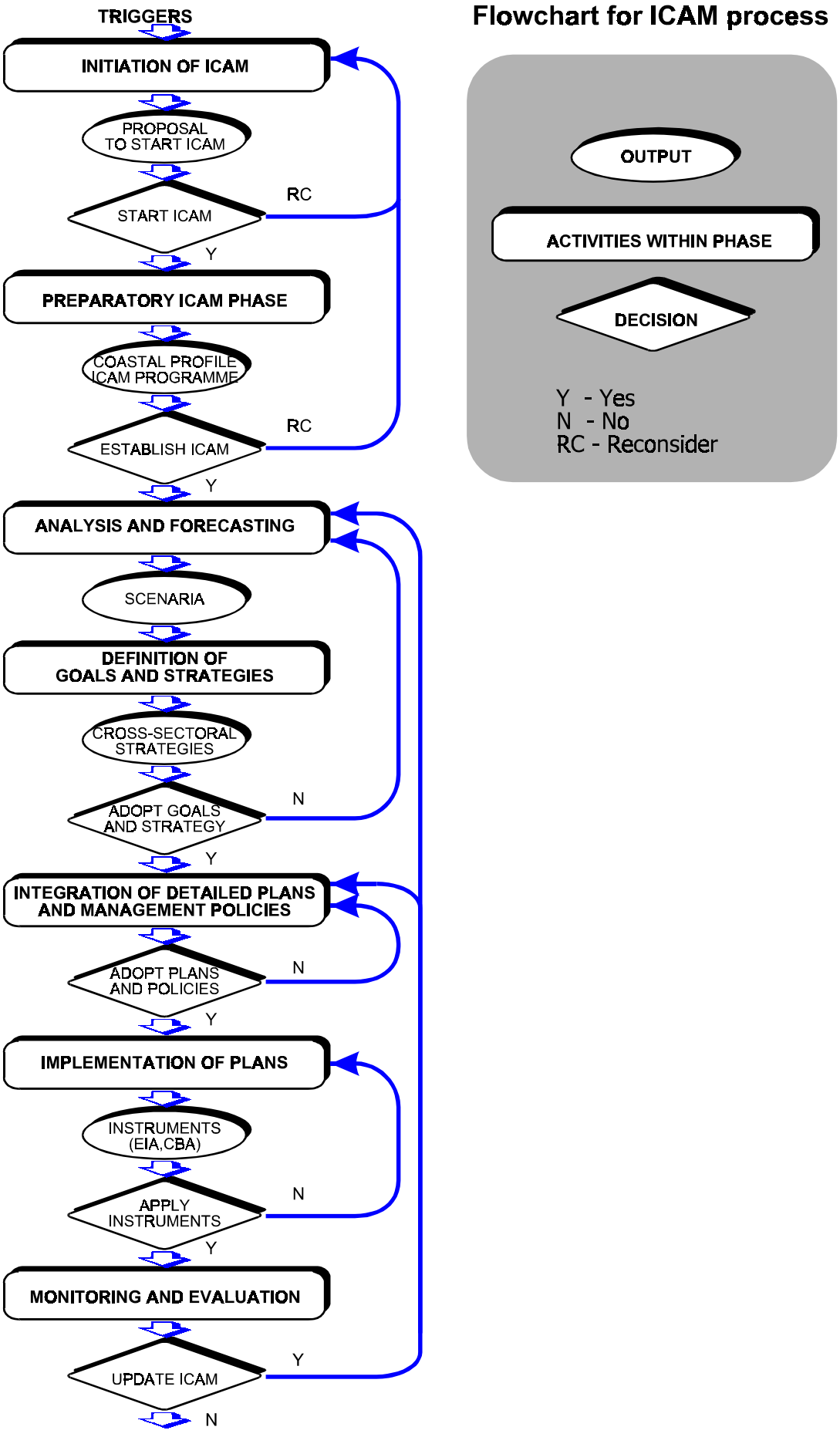


Figure 1: Flowchart for ICAM process (after UNEP, 1995a)

Table 3: Stages, phases, activities and outputs of the ICAM process

Sectoral inputs	Stages	Phases	Activities	Outputs	Political decisions
Triggers: past decisions, new decisions, external influences	**INITIATION**	*INITIATION OF ICAM*	Analysis of prerequisites for ICAM. Tentative boundaries of the area. Preparation of the proposal for initiation of ICAM.	Proposal for the preparatory phase of ICAM	To start ICAM
Sectoral Problem identification	**PLANNING**	*PREPARATORY ACTIVITIES*	Definition of coastal area. Identification of sectoral and cross sectoral problems. Proposal for general goals and objectives. Preparation of development environment, outlooks and tentative strategy. Identification of information gaps. Definition of legal, financial and institutional requirements for ICAM. Proposal for integrated Coastal Master Plan preparation procedure.	Coastal Profile ICAM programme	To establish ICAM as a continuous and long term process
Sectoral analysis and forecasting		*ANALYSIS AND FORECASTING*	Issue-oriented new surveys (generation of missing primary data). Analysis of natural and socio economic systems. Forecasting of future demand. Generation of cross sectoral scenaria and selection of preferred scenario.	Alternative scenaria	
Definition of sectoral goals and strategies		*DEFINITION OF GOALS AND STRATEGIES*	Proposal for sectoral and cross sectoral goals and objectives. Preparation of alternative strategies including legal requirements, financial implications and institutional arrangements. Evaluation and selection of strategy.	Management strategy	Approval of goals objectives and strategies
Sectoral plans		*INTEGRATION OF DETAILED PLANS*	Allocation of land and sea uses. Proposal for implementation procedures (legal, institutional, financial) and relevant instruments (EIA, CBA, etc). Definition of implementation stages. Draft Integrated Coastal Master Plan presented to relevant body for approval.	Integrated Coastal Master Plan	Adoption of Integrated Coastal Master Plan and relevant policies
Sectoral plans and policies	**IMPLEMENTATION**	*IMPLEMENTATION OF PLANS*	Phasing of ICAM proposals and policies. Application of economic, regulatory, and environmental evaluation instruments in development control. Adaptation of institutions to ICAM.	EIA CBA	Approval of implementation instruments used in the development control process
Sectoral monitoring		*MONITORING AND EVALUATION*	Redefinition of cross sectoral problems. Identification of inadequacy of instruments.	Evaluation study	Update of ICAM process

In case of actions related to large river basins, similar to ICAM but respecting different environmental conditions and processes, the Integrated River Basin Management (IRBM) is applied. In areas involving both large river basins and coastal and marine areas, the process of Integrated Coastal and River Basin Management (ICARM) in now being introduced. For illustration, and in order to present differences from ICAM, the flowchart of the IRBM process is presented in Figure 2 (PAP/MAP/UNEP, 1997), and of ICARM in Figure 3 (UNEP/MAP/PAP-RAC, 1999).

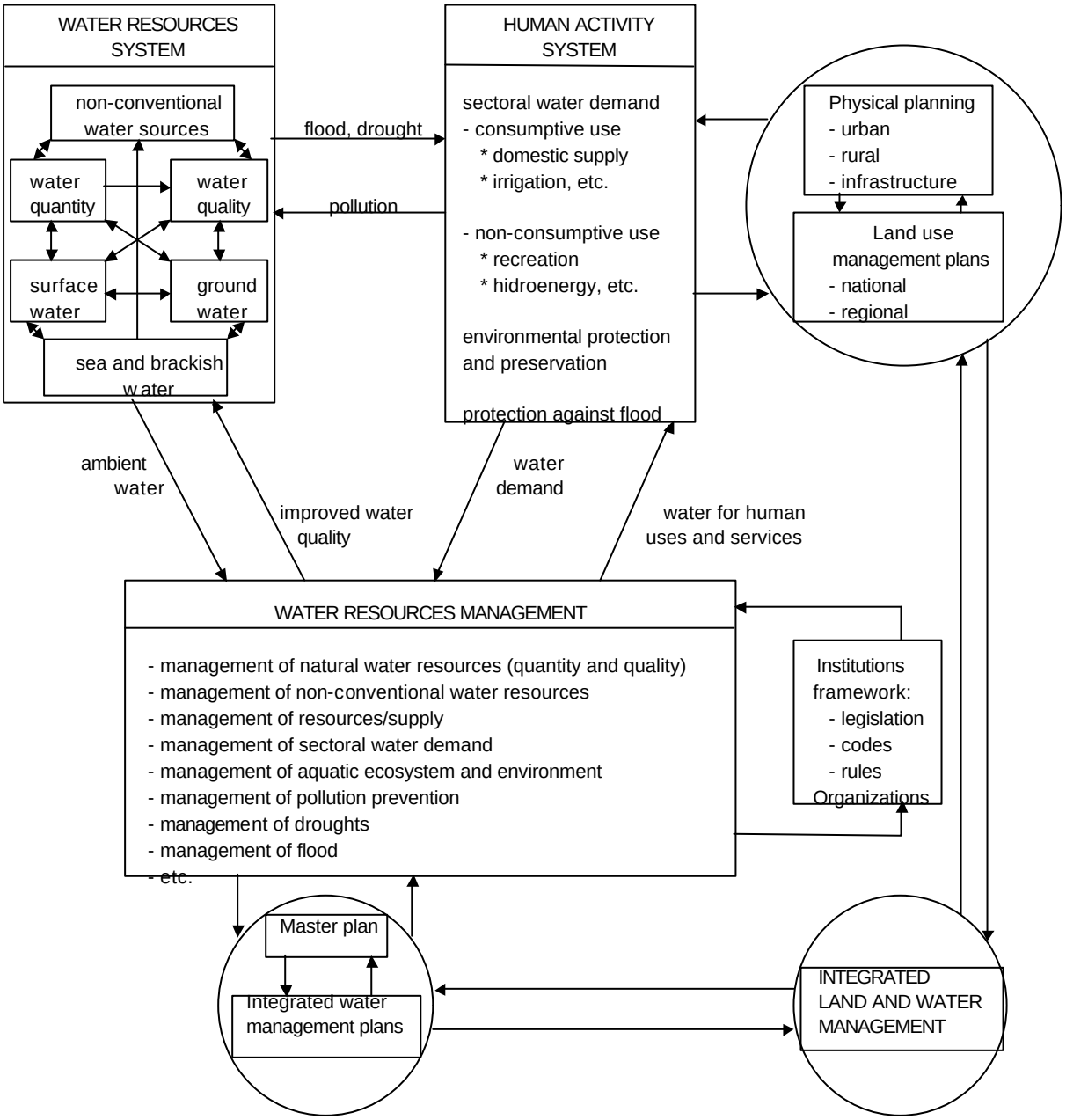
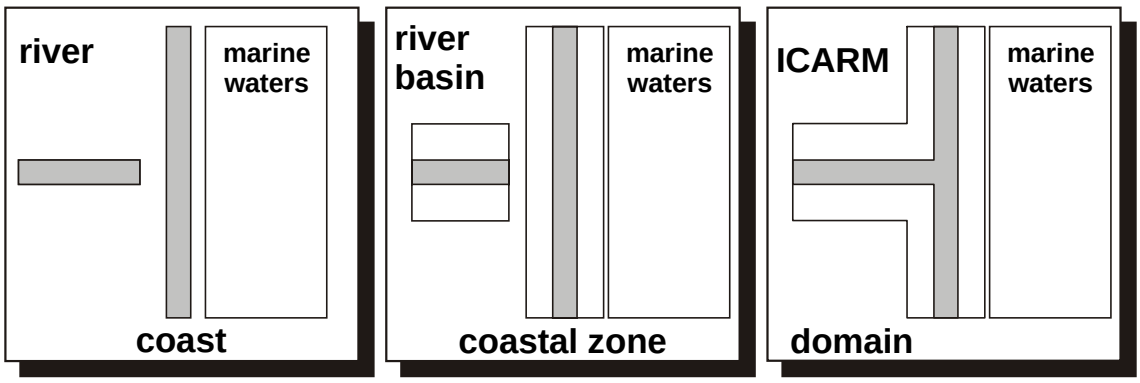


Figure 2: IRBM Flowchart



a) domains of river and coastal management

b) river basin and coastal zone management

c) ICARM

Figure 3: Spatial components of ICARM

Nowadays the major part of coastal states' governments and all major international organizations and institutions have recognized the needs for and benefits of applying integrated management as a major tool for achieving a sustainable development in coastal and marine areas and as a framework process when implementing large coastal specific initiatives and programmes, the remedial ones included.

When defining remedial actions within the framework of ICAM, alternative strategies have to be identified, and the optimal strategy to be selected applying selection criteria (qualitative) and standards (quantitative). The primary criteria for the selection of an optimal remedial strategy are: sustainability of coastal zone development, integrity of its ecosystems, and improvement of the quality of life of coastal population, including health and sanitary conditions. Other criteria have to be defined by decision makers, affected population and stakeholders involved, depending on causes, impacts and significance of non-compliance.

For a more detailed insight on integrated coastal management, references (Clark J., 1992), (UNEP, 1995a), and (Cicin-Sain B. and Knecht R.W., 1998) are recommended.

II.6. Tools and techniques for remedial actions

A number of tools and techniques, pertaining to integrated management might be successfully used within remedial actions, the application of some of them being indispensable for the assessment of non-compliance and programme formulation. The most relevant ones, also most frequently applied, are:

- data management:
  - data base; and
  - geographic Information Systems (GIS).
- evaluation and assessment techniques:
  - environmental Assessment:
    - environmental Impact Assessment (EIA);
    - strategic Environmental Assessment (SEA);
    - carrying Capacity Assessment (CCA);
    - cCA for tourism activities;
    - assessment of soil and coastal erosion;
    - assessment of impacts from climate change; and
    - rapid Assessment Techniques.
  - economic evaluation techniques: cost/benefit analysis, resource valuation;
  - systemic prospective studies (environment/development scenaria);
  - systemic Sustainability Analysis (SSA); and

- instruments for implementation:
- regulatory instruments:
  - land use planning;
  - sea use planning; and
  - codes, norms, standards.
- economic instruments for coastal and marine areas management;
- negotiation/agreements; and
- conflict resolution techniques.

Among the listed tools and techniques, those needed in almost all cases of medium size and large remedial actions are: data base, EIA, rapid assesment, land use planning, and regulatory instruments.

EIA might be considered as the most widely used tool. EIA is a process analyzing impacts of an individual project or activity on the environment. The EIA procedure consists of a number of phases: identification of causative elements, likely to produce impacts on environment; prediction of possible impacts; interpretation of impacts on environment and population; and communication.

EIA should be a mandatory technique to be applied within the remedial process. The principles and procedure of EIA have to be applied within the context of remedial programmes in two different stages:

- during the assesment phase, when identifying causes of non-compliance and impacts on environment and population, including prediction and interpretation of future impacts, and
- within the planning phase, analyzing the impacts of individual remedial activities, ending with EIA Statements to be prepared and presented for each individual remedial project.

A simplified Flowchart of the EIA process, developed by UNEP, is presented in Figure 4 (UNEP, 1990).

The use of other tools will depend of the scope and scale of the remedial programme; for large programmes, as quite mandatory, the following ones should be considered: GIS, assessment of impacts of global change, cost benefit analysis, SEA, systemic prospective analysis, land and sea use planning, economic instruments for implementation, and public participation techniques.

A description of all the above listed tools and techniques would require far more space and information than acceptable for the scope of this document. Therefore, for a more detailed insight, for some of the above tools the following bibliographic references are recommended:

- for EIA: (UNEP, 1990);
- for SEA (PAP/RAC, 2000);
- for CCA for tourism activities (PAP/RAC, 1997a, 1992);
- for SSA (Bell, S. *et al.*, 1996, BP/RAC 2001);
- for erosion control management (PAP/RAC – FAO, 1997, PAP/RAC 2000b);
- for impacts of global change (UNEP/IPCC, 1990);
- for land use planning (FAO, 1993);
- for the application of economic instruments (MAP/MEDPOL/UNEP, 1993, Juhasz, F., 1994);
- for CBA (MAP/MEDPOL/UNEP, 1993, Firn Crichton and GSES, 2000); and
- for public participation techniques (PAP/RAC 2000c and Scoullos, M. 1998).

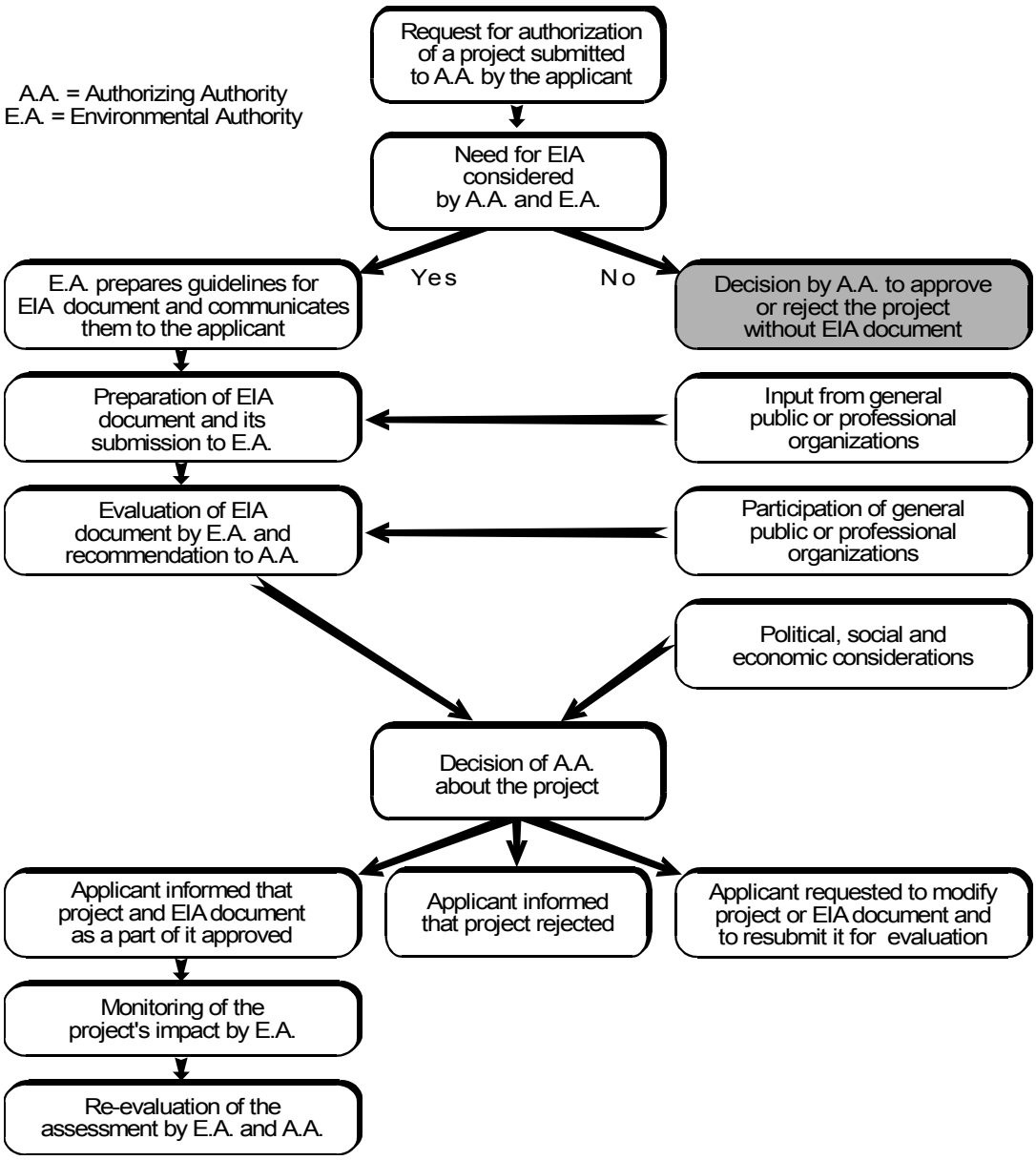


Figure 4: Simplified flowchart for the EIA procedure

II.7. Prerequisites for implementation

Implementation of remedial actions, in particular of the larger ones, requires meeting certain prerequisites, usually the following ones:

a) Political will and social commitment. Political decisions and their formal adoption are required, the context and significance of decisions sometimes might not be limited to the remedial action(s).

This might be due: (i) to the complexity and interrelations of systems, impacts and remedies, and (ii) to the interconnection with and influence of remedial programmes on national development plans and prospective. Decisions should be based, as much as possible, on a consensus reached among political factors, the scientific community and other relevant actors, including the affected population and the private sector.

b) The legal basis. The existing legal basis, particularly in case of large remedial actions, might require adaptation, improvement or new legal acts (norms, standards, plans, laws and bylaws). In most cases the adaptation needed might be secured through the planning process,

at appropriate level and with proper timing. The adoption of new laws, due to the usually lengthy procedure, should be considered in exceptional circumstances only.

c) The institutional arrangements should provide for a prompt, efficient and cost effective formulation, adoption and implementation of remedial actions. The designed arrangements should be capable to achieve the needed degree of integration: the horizontal one, related to the decision making process, and vertical integration related to the implementation process. In practice, existing arrangements should be respected and used as much as possible and adapted to the requirements of the envisaged programme. In all case the arrangements will be country, area and programme specific.

d) Data, information and knowledge. One of basic questions to be analyzed during the initial phase after detection of non-compliance, is whether the available information and knowledge present a sound basis for the formulation of remedial measures and programmes. The needed knowledge should be secured related to: (i) all relevant processes, (ii) ecosystems, (iii) identified impacts, (iv) alternative remedial measures, and (v) implications of envisaged remedial measures on environment, resource use and development. If needed, additional monitoring, research, and/or studies have to be formulated and implemented within the preparatory phase of the remedial process. Here the experience of the MAP Coastal Area Management Programme (MAP CAMP) and its individual projects might be mentioned as example of integrated programmes, contributing to completion of needed knowledge for remedial actions and formulation of appropriate strategies and remedial actions (Pavasovic, 2000).

e) Public participation. The participatory approach is one of basic principles to be applied within the context of sustainable development and of integrated coastal management. Such an approach is indispensable in case of remedial actions. Applying the participatory principle understands a full information to and early involvement in the process of: (i) the general public and affected population, (ii) scientific community, (iii) NGOs, (iv) media, and (v) stakeholders, including the private sector. Therefore, an appropriate public participation programme should be part of the remedial programme/project. Among the expected benefits from such programmes, an active involvement and support of the population and stakeholders, feedback generating ideas and comments, consensus building, readiness to pay for improved conditions and services, might be mentioned.

Box 7

Public Participation, a key element for the formulation and implementation of remedial programmes

- The participatory principle: one of the principles of sustainable development
- Convention on Access to Information, Public Participation in Decision making and Access to Justice in Environmental Matters (the Aarhus Convention):

  Article 7: "*Each party shall make appropriate practical and or other provisions for the public to participate during the preparation of plans and programmes relating to the environment, within a transparent framework, having provided the necessary information to the public*" (UN/ECE, 1999).
- Key elements of a Plan of action for public participation:
  I. Design and planning: a) scooping, b) identification of the decision making process, c) decision on level of participation, d) identification of key points, e) strategy formulation, f) identification of stakeholders, g) planning of activities and tools.
  II. Implementation: a) informing the public, b) providing description of the programme, c) stating potential impacts, d) providing information on the way comments and suggestions to be submitted, e) monitoring, analyzing the reaction, suggestions and comments by the public.
  III. Feedback: a) answering questions and suggestions, b) taking decisions on suggestions, c) analyzing the use of suggestions given by the public.
  IV. Post-evaluation, analysis of: a) tools applied and their appropriateness, b) effectiveness of adopted approaches, c) depth of participation and representativity of participants, d) missing elements and lessons learned.

(Adapted from PAP/RAC, 2000b and Scoullos, 1998)

f) Funding of the programme, from identification of non-compliance onwards implies securing: (i) expenditures of the administrative structure, (ii) expenditure for pollution control, and (iii) expenditures for the implementation of the remedial process. The availability of funds and the related cash-flow are among dominating criteria when deciding on the contents and phasing of the remedial programme. The usual sources of funding are: regular budgets, user charges and taxes, other local and national sources (funds, fund raising, voluntary contributions), and international funds (grants, loans, credits). For large programmes, securing a mix of funding sources is recommended.

g) International cooperation and support. The Mediterranean experience lists a number of short- and medium-term remedial programmes and/or projects successfully implemented within the context of international cooperation and support, with involvement of MAP/UNEP, METAP, FAO, UNESCO, UNDP, UNIDO, WHO, GEF, etc., and on bi-lateral and multi-lateral basis. Such a cooperation provides for: financing, supply of equipment, training and capacity building, and provision of knowledge and know-how. As potential funding sources, of particular interest for the Mediterranean region GEF, METAP/WB and a number of EU programmes should be mentioned. In case of large remedial programmes, and in particular in developing countries, international cooperation and support is highly recommendable and often indispensable. In all cases, the cooperation should be established at the very beginning of the remedial process.

III. REMEDIAL STRATEGIES

III.1. The general framework

The approach to remedial strategies will vary from case to case, depending on specific conditions and needs; nevertheless, it will follow a conceptual and programmatic framework based on generally accepted principles, policies and conventions. The approach will also have to take into account the level of economic development of the country and the need to harmonize, up to a certain extent, the long term environmental requirements with the present national and local economic interests.
Prior to presenting the most commonly applied strategies relevant for specific types of non-compliance, some might be recommended:

- prevention, control and aiming at sustainable development are the most effective and cheapest remedial activities;
- consequences of inaction will usually outstrip the resources needed for the implementation of the remedial programme;
- the concept of integrated management, when applied as appropriate, is the needed framework for prevention and control, as well as for any remedial action;
- in case of large remedial programmes an adequate legal framework and other conditions needed for integrated management should be understood as a prerequisites;
- among best preventive and general remedial strategies the following might be cited: (i) understanding the problems specific for coastal and marine areas, and (ii) applying specific conservation and protection strategies: establishing protected areas, and/or zones of no development, for example 100-300 m wide in coastal strips, 50-100 m along rivers (Council of Europe, 1997), (iii) reducing energy and water consumption by conservation measures, (iv) use of renewable sources of energy, (v) reuse of resources and waste recycling;
- solving individual sectoral causes of non-compliance, without a wider approach might not guarantee long term solutions;
- a great deal of remedial procedures and technologies were applied successfully in the region and are well known and applicable; in similar conditions that experience should be studied, assistance and support asked for; and
- risks and uncertainties have to be taken into account.

In addition, specific elements and facts will have to be considered, according to the results of the assessment of non-compliance.

III.2. Strategies according to causes of non-compliance

Remedial strategies to be taken in consideration in case of non-compliance will depend on causes and their impacts on human health and environment. Following the classification of causes presented in chapter II.2, the major impacts and the available strategies to be considered are presented below.

Sewage

a) Urban liquid waste

Untreated or partially treated urban liquid waste contains: pathogens, suspended solids, nutrients, increased BOD, plastics and debris, heavy metals and other toxic substances; and hydrocarbons, when the urban waste is collected together with the industrial one.

Non-compliance caused by impacts of untreated or partially treated urban liquid waste is usually related to:

- pollution of surface and ground waters;
- pollution of bathing waters and beaches;

- impacts on vegetables and fruit in case of poor treatment and/or unproper reuse of treated waste water;
- contamination of seafood, shells in particular; and
- degradation of environments.

Besides being discharged from standard waste treatment facilities; domestic waste in small settlements and rural areas might be discharged untreated from septic tanks due to overflow or leakage. Most dangerous are cases of infiltration of untreated waste water into water distribution systems caused by accidental drop of pressure in the latter.

The induced impacts might persist for long periods after the elimination of causes: for example, aquifers or freshwater springs, once polluted need sophisticated remedial measures and long term remedial periods.

Freshwater, if contaminated by waste water, might be a cause of infections/illnesses, such as:

- waterborne bacterial, protozoal and viral diseases;
- cholera and typhus;
- hepatitis;
- impacts from nitrates, if above HQC; and
- impacts from pesticides (evidence still not clear).

In some cases treated urban waste water might affect the odor and taste of freshwater, although not affecting health conditions, but generating a negative image of the affected area.

The substances discharged might induce impacts:

- on human health:
    - by pathogens after exposure in bathing waters, causing gastrointestinal problems;
    - causing ear, eye, skin infection and/or respiratory diseases;
    - by use of contaminated shellfish or contaminated surface and/or ground freshwater;
    - by impacts of heavy metals and other toxic substances; and
- on ecosystems and biota: impacts caused by individual pollutants and cumulative impacts exceeding the assimilative capacity of recipient ecosystems, in some cases inducing bioaccumulation.

The strategies to be considered are:

- preventive actions: (i) to establish health and environmental quality criteria, (ii) provide for appropriate treatment technologies, (iii) secure good operation and maintenance of sewerage systems, (iv) monitoring, (v) enforcement of legislation and of established quality criteria; and
- remedial policies: to reduce, as feasible, the% of untreated or partially treated waste water discharged, to reduce waste quantity if applicable, transforming waste into waste products more easily assimilated by recipient ecosystems, to apply the reuse of treated waste water, to consider transferring waste into environments with higher assimilative capacity, to secure a safe sludge disposal...

In addition to proper treatment procedures, technical measures must facilitate assimilation of waste by proper design of waste discharge, aiming at: a) initial dilution, b) dispersion, c) reaction with environment and biodegradation.

The usual technical solution for liquid waste discharge into the marine environment implies the use of submarine outfalls. Their design, length and diffusers in particular should be in accordance with sea currents and other recipient conditions, in order to secure the best possible diffusion of the effluent. The design of submarine outfalls must be supported by a competent EIA report.

In some cases, the treatment is combined with controlled irrigation using treated waters, eliminating the discharge into the marine environment, see for example the Rhodes study (Box 8).

b) Urban solid waste

The process of urban solid waste management includes:

(i) collection;
(ii) handling; and
(iii) waste treatment and disposal.

In case of mismanagement of any single phase or of the entire process, severe non-compliance might be the result.

The urban solid waste collection system might be of a selective or non selective type, and might use a more or less appropriate equipment.

The handling phase in case of a selective collection differs from a non selective one, and might imply: selection from non selected waste, crushing, compacting and temporary disposal.

The treatment process might consist of: recycling of selected waste, thermal treatment, use of compost. The disposal might use non-controlled landfills or sanitary landfills; in many cases of totally non controlled discharge are being reported ("criminal discharge").

Box 8

Preventive and remedial strategies for Domestic Liquid Waste: the Liquid Waste Management General Plan for the island of Rhodes

The MAP CAMP project for the island of Rhodes was implemented in the 1990-1994 period, the concluding phase being supported by METAP/EIB. As well known, the island of Rhodes is one of leading tourism destination in Greece. A number of activities, identified as priority for the protection of the insular environment, prevention of further pollution of natural resources and sustainable development of the island, were implemented within the project. The results of individual activities implemented were integrated in the Integrated Management Study for the island.

Due to the absence of a comprehensive insular system of liquid waste management, and an increased pollution of ground waters and some points of the adjacent sea waters, still below the established HQC and EQC, the preparation of a general liquid waste management plan was included in the project.

The Plan was implemented in three phases:

I. Definition of standards and criteria: water QC, EQC, effluent standards and socio-economic criteria and limitations,
II. Assessment of local conditions: pollution sources, oceanographic data, physical conditions, water resource exploitation facilities, and
III. Planning: Identification of alternatives, guidelines for LWM for small settlements, costs estimates, assessment of impacts of considered alternatives, final analysis and prioritization of alternatives, proposal of best alternatives.

As the optimal solution, the Plan envisages a system of controlled secondary treatment plants (activated sludge), with deep reservoirs as additional treatment, and reuse of treated effluent for restricted irrigation of olive and orange trees. The elaborated system grouped the settlements in 6 groups. For each group a detailed best alternative was elaborated.

(MAP/METAP/EIB, 1994)

Urban solid waste is a heavily contaminated polluter containing pathogenic microorganisms and might induce serious infections and illnesses, similar to those listed for urban waste water. In addition solid waste deposits if not located and/or designed and managed properly, are

affecting the population causing bad odor, deteriorating the aesthetic perception of the area and settlements, inducing frustrations and potentially triggering other health disturbances.

c) Industrial waste and mining waste

This type of waste, if not adequately disposed might result with leaching of heavy metals and organic chemicals, causing contamination of soils and ground water, inducing related health risks and seriously affecting the environment. Large deposits of industrial solid waste are a permanent health risk and their removal or stabilization requires complex and very costly actions. With this regard, the MAP CAMP "Sfax" project, completed in 1998, might be cited as an example (PAP/RAC, 1998).

In case of solid waste, the identification of causes of noncompliance might be sometimes a rather simple task, due to the presence of uncontrolled or badly managed waste deposits and their clear interrelation with impacts in the affected area. But in many others, there is the possibility of having detected the noncompliance due to secondary impacts, the primary ones being hidden and the primary source of noncompliance located faraway. This might be in case of ground water pollution due to leakage from waste in drainage basins of small carstic rivers; the spring water might become polluted after a long period of leakage, and the causative waste deposit miles and miles away.

The direct causes of non-compliance are:

- bad practices of population and waste producers;
- bad practice during waste collection process;
- bad management of landfills or waste deposits;
- poor equipment; and
- uncontrolled or criminal discharge.

The management related strategies to be considered in order to prevent non-compliance caused by unproper solid waste management are:

a) proper waste system design or re-design;
b) enforcement of proper management practices; and
c) regular control.

A proper design understands a careful consideration of siting of landfills, based on hydrological data and applying EIA.

The remedial actions to be considered, in accordance with the results of assessment of non-compliance, must be defined on an area based approach, the area to be taken into consideration larger than the causative and the affected area. The strategy should consider the following principles:

- remedial measures to be defined for each individual source of waste and to be integrated later on at a larger area level;
- selection of proper technology: sanitary landfill, waste transfer, use of advanced technologies (compacting, composting, thermal treatment, gasification);
- recycling to be applied whenever feasible;
- fewer landfills to be envisaged within a larger area approach;
- EIA to be applied for each individual facility and SEA for the entire area;
- establishment of inter-municipal cooperation for joint solutions;
- formulating stepwise programmes, making them economically feasible;
- applying the ICAM framework, using: inputs related to development prospective and larger economical considerations, identifying actual or potential impacts caused by other sources, contributing to non-compliance;
- integration of the remedial programme into national development plans;

- specific solutions to be applied for small islands, hazardous waste, ship generated waste, sanitary waste and the radioactive one;
- raising of public awareness; and
- capacity building.

An example of such a strategy might be illustrated by an EIB/METAP solid waste project in Croatia (EIB/METAP, 1996).

Persistent organic pollutants (POPs)

The impacts of POPs, as source of non-compliance, are among the most serious ones, due to their toxic character and tendency to bioaccumulate. Because of their low degradability, POPs are transported faraway from sources exercising impacts at long distance. The fact that POPs can be transported by waste water, runoff and by air, makes difficult the identification of the primary source.

The strategy to be considered should include: regulatory instruments and their strict enforcement; proper management of waste containing POPs (usually through specialized institutions established at national level); installation of facilities for collection and safe disposal of POPs, monitoring of the measures implemented. The entire remedial process has to be dealt with at national level, applying an integrated approach, careful siting of collection and disposal facilities, involving cooperation, assistance and/or support of relevant international agencies.

Radioactive substances (RAs)

Uncontrolled emission of radioactive substances might exercise impacts on very limited areas as well as on entire regions, depending on source and type of emission. Due to the potential impacts on human health and life, and on biota, each case of non-compliance caused by radioactive substances must be treated as emergency, requiring appropriate intervention at national level. Specific regulation is required, strict enforcement and regular monitoring, remedial interventions to be implemented according to specific contingency plans and techniques. In case of developing countries, international agencies, IAEA in particular, should be requested for assistance. Specialized national agencies should be established in each country, responsible for monitoring, management, contingency planning and emergency interventions.

The general prevention and remedial strategy is usually based on:

- elimination of sources of radioactive discharge;
- safe transport and storage of radioactive waste, according to internationally accepted standards and conventions;
- careful planning of siting for waste disposal;
- siting of radioactive waste in coastal areas to be forbidden;
- the integrated approach to be applied; and
- decontamination and/or isolation of highly contaminated areas to be made according to emergency plans and procedures.

Heavy metals (HM)

In case of non-compliance caused by HM, the remedial strategy should be based on the fact that HM are stable and persistent contaminants, tending to accumulate in soils and sediments, their excessive level affecting human health and marine biota. Contaminated seafood is one of potential sources of impact on humans. When assessing impacts on human health, concentration and exposure threshold (dose/effect relationship) have to be taken into account. The most common sources of HM discharge are:

- point sources: mining, foundries and smelters, tanneries (Cr), electroplating, chloralkali electrolyses (Hg)...; and
- diffuse sources: piping, combustion, traffic...

HM are transported by river runoff, airborne (as volatile or attached to airborne particles), or are directly discharged into the marine environment from coastal industries.

The remedial strategy aims at reduction/elimination of discharge and usually presuppose sophisticated technical interventions.

An integrated remedial strategy should be based on:

(i) identification of the area affected, of population and biota exposed and of relevant impacts, including prospective considerations and applying the precautionary principle;
(ii) identification of sources and interventions t source, including change of practice and technology, up to a temporary or permanent closure of facilities;
(iii) measures for integrated pollution prevention and control;
(iv) application of Best Available Technology, and Best Environmental Practice;
(v) establishment of an integrated management system and facilities for collective disposal;
(vi) change of consumption pattern, for example use of unleaded petrol; and
(vii) raising of public awareness, education campaign for industries, etc.

Petroleum and Hydrocarbons (P/H)

Although the source in some cases might be of geological nature, pollution by petroleum and hydrocarbons is predominantly of anthropogenic origin.

To this category of pollutants belong: mineral oils and various liquid and gaseous hydrocarbons, refined petroleum products and derivatives. Volatile P/H are relatively easily degradable, but are likely to affect larger areas, the non volatile ones are predominantly persistent.

When discharged, P/H are toxic to marine life and ecosystems, their presence damaging respiratory functions, fouling fur and feathers, smothering habitats and aquatic communities, fouling beaches, tainting seafood.

Usual sources of this type of pollution, causing non-compliance, are:

- land-based activities: exploration, exploitation, refining, transport and storage of petroleum hydrocarbons; urban and agricultural runoff; runoff and leakage from industrial facilities; disposal of used lubricating oils into sewerage systems; or
- accidental pollution by offshore activities and navigation; illegal discharge of ballast or bulge waters at sea, etc.

Non-compliance caused by this type of pollutants might be of slight and strictly local significance with a moderate risk, but also can be of a high risk and with the resulting significance at national and/or sub national levels, often with transboundary implications.

The remedial measures, usually applied are:

(i) inventory and control of all potential sources, including coastal refineries, pipelines for oil and gas, SNG and LNG facilities and storage, petroleum products storage, ports, jetties;
(ii) strict control and enforcement of technical standards for ships transporting P/H;
(iii) careful control of ships from port to port to detect criminal dumping into the sea;
(iv) provision of port reception facilities for bulge water and ship waste;
(v) technical measures related to complex waste systems, applying oil decanters, aeration of treated waste waters, etc.; and

(vi) preventive measures, by preparing and implementing contingency and emergency plans, availability of proper equipment.

Simple cases of non-compliance caused by accidental discharge or oil spills of small quantities of P/H are usually dealt with by immediate remedial measures, preventing further discharge or spills and cleaning of affected areas.

In case of large scale pollution, the nature of potential sources and the relevant significance calls for an integrated approach to remedial measures, to be secured at national level and implemented consequently in a top down way. Land use planning, complex economic studies, environment/ development prospective studies, proper siting of facilities, legal and institutional arrangements for emergency planning and interventions, modeling of slick movements in adjacent marine areas, public awareness and capacity building, change of consumption pattern, organized collection of used lubricating oils, economic incentives and application of market instruments are, among the major elements to be integrated into the remedial strategy and actions.

Nutrients

As nutrients are considered nitrogen and phosphorus compounds discharged into the marine environment, the main consequences of such discharge being the eutrophication phenomena. When discharged into the marine environment, under specific conditions (threshold concentration, temperature), nutrients induce over-proliferation of specific species, resulting in excessive algae growth and in reduction of dissolved oxygen content. The final result is the kill of fish and of other biota, reduced biodiversity in the affected area and destruction of entire ecosystems. Eutrophication is in most cases confined to relatively small marine areas, mostly within semienclosed seas and bays, but cases of large affected areas are not rare (for example, the NW area of Adriatic, the NW area of the Black Sea). Cases of proliferation of toxic algae blooms caused by eutrophication are not rare in the Mediterranean region, with high risk on human health, particularly in case of consuming contaminated shellfish.

The usual sources of nutrients discharge are: urban and rural waste disposal, agricultural and forestry runoff (fertilizers), animal farms and aquaculture farms (potentially also causing discharge of contaminants and pathogens), breweries, slaughterhouses, canned fish/food/fruit factories, etc. Large quantities of nutrients are air transported and deposited. Finally, the cumulative effect from multiple sources is often present.

The relevant remedial strategies should be conceived starting with the inventory of input sources, assessment of thresholds of nutrient contents, assessment of incurred and potential danger, delimitation of critical areas affected or at risk, technical and other measures to reduce/eliminate nutrients discharge, and restoration of affected ecosystems/areas. Remedial programmes in case of eutrophication require well designed and targeted research programmes and are at least of a medium term nature.

Remedial programmes include usually combined remedies for a number of sources of pollution: complex data and information are needed (assimilative capacity, threshold concentration, effects and impacts, significance of consequences, hydro-technical studies); reuse of treated waste water if applicable; change of agricultural practices; selection of appropriate type of waste water treatment plants, proper design of facilities discharging waste into the marine environment, proper design of submarine outfalls and diffusers; restoration of degraded habitats.

Sediment mobilization

Natural processes of sedimentation and siltation exercise a balanced impact on coastal and marine ecosystems and habitats, in particular on estuaries, lagoons, wetlands, beaches and the sea bottom. Man induced changes of natural rate of sediment production, transport and deposition affect the established natural balance. Excessive sediment loads are causing negative impacts on benthic communities, in particular on seagrass, on rocky bottoms and

subsoil, and might affect the biodiversity of the area. In case of reduced sediment load the consequence is beach and coastal erosion. In some cases the sediment load might be contaminated, posing specific requests to remedial actions. The effects in most cases are of local significance, in some cases (dams) the impacts are serious, affecting large areas and are of a long term nature.

The most frequent causes inducing this type of pollution are:

- changes in river catchment systems and processes, building of dams in particular;
- construction of large coastal/marine civil engineering structures (ports, harbors, wave breakers, waterfronts, dikes, jetties, barriers, barrages);
- dumping of surplus material from civil engineering works;
- dumping of dredged material;
- mismanagement of freshwater utilization, hydrological modifications, changes in river flow rates, new irrigation systems, over-accumulation of water in dams;
- changes in land use, unproper agricultural and forestry practice, all leading to soil erosion; and
- extraction of sand and pebbles, etc.

The remedial strategy, whenever possible, should aim at re-establishment of the natural processes. The first activity should be the study of the sedimentation process and its dynamics. According to evaluation of risks and significance, strategies have to be defined and adopted. In most cases methods and tools of both ICAM and IRBM will have to be applied. Finally, more or less complex technical solution have to be defined for elimination or reduction of causes and curing of consequences. Curative remedial measures are predominantly focused at reducing the coastal/beach erosion, once induced. In practice, the more serious are the consequences, more complex and expensive solutions have to be applied. Some less complex remedies might be applied in simpler cases of erosion as consequence of change of sediment transport: beach nourishment, beach protection, abandonment and/or no action. A recent study on management of sand resources in Israel, now threatened by negative balance, might be cited as an example of a comprehensive and integrated approach (PAP/RAC, 2000c). A general remedial measure to be implemented at river basin level is enforcement of sustainable practices of freshwater utilization and management. Appropriate management and technical solutions have to be defined and implemented for handling, storage and/or utilization of dredged or excavated material. Monitoring of sediment transport should be part of the remedial programme.

Box 9
Management of Israeli Sand Resources

Within the MAP CAMP "Israel" project, completed in the year 2000, a study of sand management was implemented, to be integrated in an Integrated Coastal Zone Management Plan. The study included a detailed analysis of a) relevant natural processes of sediment mobilization b) coastal erosion along the entire national coast, and c) of the respective man-induced impacts. Finally preventive and remedial measures were elaborated.

The long-term mean rate of longshore beach sediment transport was evaluated at 400,000 m.cu./year at the southern coast, decreasing to about 100,000 m. cu./year at Haifa area.

The long-term mean of antropogenic sand removal (20th century) was estimated at 200,000 m. cu./year, resulting with a negative coastal sand balance. Due to forecasts of a reduced sand input in the future (Aswan dam, coastal structures), the natural sand balance will be under serious threat in the future, likely to induce serious environmental non-compliance and negative socio-economic impacts.

The recommended remedial strategies were:

- establishment of a permanent monitoring of coastal erosion processes,
- prohibition of sand mining at depths below 30 m,
- sand nourishment of affected beach areas,
- prohibition of building of new coastal structures, unless of national interest, and
- would new coastal structures be built, their design must ensure bypassing the natural longshore sand transport, to prevent reflection erosion of neighboring beaches.

(PAP/RAC, 2000c)

Applying ICAM and IRBM framework in case of this type of pollution is the prerequisite for any relevant remedial action. Careful design of projects likely to affect the natural sedimentation balance, detailed land use planning, might prevent causes and consequences; once the process started, larger will be the needed remedial project, higher has to be the level of integration. In many cases non-compliance is caused by several parallel or cumulative agents, requiring good knowledge of development prospective, of expected impacts of climate change, needing integration into national development plans and into relevant international programmes.

Litter

Litter in coastal and marine environments consists of discarded persistent solid material (marine debris), tar and resin pellets, etc., partly floatable.
Litter is causing various types of impact:

- direct physical impact on marine life by entanglement, suffocation, ingestion;
- affecting coastal/marine ecosystems and biodiversity;
- causing visual degradation, repulsive feelings, affecting tourism; and
- a potential impact on public health.

The most frequent sources of litter are: waste deposits in coastal areas, wind blown litter, urban waste and runoff, dumping from ships, dumping or discarding by tourists and coastal population.

The remedial strategy should be oriented at:

- improved management of solid waste;
- preventing litter transport;
- careful siting of waste deposits;

- joint organizational, technical and monitoring measures for nearby coastal communities, appropriate landfill design, measures to prevent transported runoff and wind blown litter;
- specific solutions for solid waste management in small islands and archipelagos of small islands;
- installation of recycling facilities;
- cleaning of beaches and of the sea bed; and
- public campaigns, education and control of behavior of industry, population and tourists.

Uncontrolled burning of collected litter might result in emissions of POPs, of heavy metals and/or hydrocarbons.

The integrated approach is needed when deciding on siting, technology and management of solid waste facilities, including understanding of the broader development prospective.

Physical alteration, destruction of habitats, over-exploitation

The physical alteration and destruction of habitats might be considered as one of most serious types of non-compliance, with heavy impacts and sometimes irreversible consequences for individual ecosystems. In addition to single causes, this type of non-compliance is predominantly the result of a number of simultaneous and cumulative impacts.

Mismanagement might be indicated as a general causative agent of this type of non-compliance, for example: expansion of construction, changes in coastal/marine areas and freshwater ecosystems, over-building along shoreline, over-exploitation of limited/fragile resources (over-fishing), population congestion in coastal areas etc.

Among more specific causative agents the following are only some of the most frequent ones: excavation, sand and gravel extraction from beaches, dunes and sea bed; oil/gas exploration/exploitation; mining; building of large ports, marinas, coastal defenses, dams; urban expansion; uncontrolled aquaculture, destructive fishing (using dynamite, chemicals); intensive/non controlled naval traffic over fragile/sensitive areas, etc.
As illustration, the following might be presented:

- excessive surface water diversion (irrigation, large dams) may, due to transfer of water masses and increased evaporation, decrease the recharge rate of ground water, causing drops of ground water level, increasing salination of affected soils and inducing salt water intrusion into coastal ground waters;
- damming of rivers, inducing also upstream sedimentation changes and affecting downstream conditions, might seriously interfere fish migration, affecting thus bioproductivity and biodiversity; and
- virgin areas might be seriously affected by uncontrolled tourism; only a sustainable tourism development might be allowed there, by applying high standards, Carrying Capacity Assessment and strictly defined and controlled visitors' behavior.

Health impacts of ecosystem degradation, in addition to specific ones caused by individual pollutants, are also caused by: worsening of the quality of life; decreased level of sanitary and hygienic conditions; increased poverty and decreased economic potential of the society; the consequences being a, site and age specific increase of morbidity and mortality.

Water shortage, also a non-compliance as consequence of over-exploitation and/or of mismanagement, is affecting economic development and highly influencing the level of hygienic and sanitary conditions in affected areas.

The increased occurrence of introduction of alien species should also be mentioned (for example, of Caulerpa Taxifolia in the Mediterranean, Mnemiopsis Leidyi in the Black Sea), causing serious risk and damage to indigenous species.

The basic strategies for remedial measures in case of this type of non-compliance are:

- change of management pattern in order to eliminate, reduce and/or control the relevant causes; and/or
- safeguard/restoration of ecosystem functions through conservation, protection and rehabilitation of habitats and biodiversity, and
- elimination/reduction/control of direct causes of non-compliance.

The change of management pattern needs integration of a number of measures and activities:

- full knowledge of ecosystems, causes and consequences, of socioeconomic aspects and of the development prospective;
- favoring of environmentally friendly activities in coastal/marine areas, applying reduction of / restrictions on / dislocation of causative activities, as feasible and affordable;
- establishing protected areas;
- applying ICAM, IRBM or ICARM and tools such as land use planning, EIA, SEA, economic incentives and other economic instruments suitable for coastal/marine area and river basin management;
- integration into national development programmes; and
- international cooperation and support, as appropriate.

Non-compliance caused by erosion phenomena

a) Soil erosion

Soil erosion processes result with multiple impacts: on coastal and marine resources, on economic activities, and is one of possible causes of sediment mobilization described in the preceding sub chapter. In addition to on going soil erosion processes, defined by erosion status, large coastal areas in the Mediterranean basin are erosion prone, the phenomenon being defined as erosion potential.

The consequences of erosion processes are:

- primary impacts: land degradation, loss of productive soil, loss of habitats, increased sediment transport, landscape degradation, increased risk of landslides,
- secondary impacts: loss of productivity, decline of soil related activities (agriculture, cattle raising), silting and deposition of eroded materials, changes of the sediment flux and balance along shorelines, pollution of freshwater and of the adjacent sea,
- tertiary impacts: inducing change in rainfall pattern, affecting biodiversity, social impacts (increasing poverty, inducing migrations), economic impacts (affecting lifetime, economic value and management of dams, affecting tourism in case of eroded beaches).

The remedial strategies should aim at formulation and implementation of complex control management programmes including: (i) mapping of erosion phenomena, (ii) assessment of causes, impacts and significance, (iii) improved land use planning, and (iv) control management and technical remedial measures.

b) Coastal erosion

This type of erosion might cause significant impacts along the coastline and in inter-tidal areas. Stabile coastal areas are under a balanced process of sediment supplied from bank or transported along the coastline and the sediment lost due to natural erosion rate. This type of erosion is often caused by anthropogenic impacts on sediment mobilization. Increased coastal erosion is due to changes affecting the natural balance, the causes being attributed primarily to:

- decrease of sediment transport by rivers due to changes of hydrological regime in river basins;
- change of dynamics and pattern of natural sediment transport along the coastline, due to:
    - building of coastal structures affecting the natural regime of the adjacent marine environment;
    - sand and pebble extraction from beaches, dunes or shallow sea bottom;
    - destruction of natural defenses such as natural beach slopes, marshes, reefs, seabed vegetation in areas nearby the coastline; and
- combined action of the above causes.

The process of coastal erosion is characterized by 4 main phases:

a) waves impact;
b) bank/beach erosion and undercutting;
c) shrimping of the bank; and
d) removal, transportation and deposit of sediment.

The usual consequences of coastal erosion are: loss of sandy and pebble beaches, degraded landscape, loss of land and property, abandonment of coastal structures and activities, increased risk of storm damage, transfer of sediment from eroded areas smothering other ecosystems, filling of navigation channels, negative impacts on tourism.

While most of the coastal erosion processes are progressing slowly, affecting gradually the coastline, other incur almost instantly after the initiation of the causative action. The first category is usually affecting large coastal areas, and require complex remedial actions, while the second group might be of a predominantly local character. Remedial measures in these cases might be applied rather quickly and with better chances of success.

Understanding of the relevant processes and causes, identification of triggering factors and a holistic approach are the prerequisites for the design of remedial measures. The most appropriate remedies are those aimed at the re-establishment of relevant natural processes and their dynamics. Since this often implies large scale and complex interventions in river basins or along the coastline, they are not easily applicable and often not feasible. But in many cases of local coastal erosion, successful remedies were applied by: (i) eliminating local coastal marine structures inducing sediment transport and balance, and/or (ii) applying structural solutions eliminating or reducing the effects of physical constraints to natural processes, allowing thus the re-establishment of natural sea currents along the coastline.

The curative remedial measures to be considered are:

a) no-action, adaptation, relocation of structures and activities;

b) proper design of coastal structures allowing for bypassing the longshore sediment transport and preventing the reflection-induced erosion to neighboring beaches;
c) non-structural stabilization: beach nourishment, marsh creation, regulatory instruments; and
d) structural remedies: shoreline revetment, off shore structural defenses.

Single remedial measures, predominantly being of the structural type, if implemented outside a larger context in many cases were not effective and often inducing secondary impacts along the coastline. On the other hand, non-structural remedies, such as beach nourishment and creation of marshes have proved as effective and environmentally friendly ones.
Concerning beach nourishment, in case of a study on an Italian Adriatic coastal area, it was recommended that the sand used be extracted far from coastline and from depths greater than 8 m (Dal Cin, Simeoni, 1994). The cited Israeli study recommended the sand to be extracted at depths beyond 30 m (PAP/RAC, 2000c).

Some regulatory instruments might be applied as immediate remedial measures, such as: (i) prohibition of sand and gravel extraction from beaches, dunes and shallow sea bottom; (ii) change of consumption pattern – use of finely grinded limestone instead of sand (quarries applying modern equipment offer the product at same price of sand, incentives might be applied); (iii) prohibition of building marine constructions likely to induce changes in the sediment transport, etc.

Non-structural measures have to be applied within ICAM and IRBM:

- zoning of the coastline according to: (i) hydrodynamic and energy characteristics; (ii) beach and seabed morphology; beach dynamics and degree of human intervention; (iii) priority areas to be defined and appropriate remedial measures applied for each area,
- establishment of a strictly protected and controlled coastal strip, with any development excluded, widening as needed the width of the protected belt, usually defined by law, and
- spatial regulation of remedial measures.

In case of river basins, the remedial strategy should aim on establishment of natural dynamics of river flow, on reduction of factors inducing increased sedimentation along or byside the river flow and on defining and enforcing appropriate management measures.

Air pollution

Air pollution is caused by stationary and mobile sources. In addition to air pollution caused by solid waste, its usual causes are:

- SO_2 from combustion of fossil fuels;
- nitrogen oxides from chemical factories;
- suspended particulate matter from: industrial (cement, fertilizers...) and power plants; coal and ore production, handling, transport and processing (coke plants, sintering plants...); and
- lead from leaded petrol used by vehicles, etc.

The most frequent health impacts of air pollution are related to the respiratory system, increasing bronchial and lung morbidity, also causing or aggravating other types of disturbances, such as lacrimation, mucosal irritation and impacts on the nervous system.

Remedial measures related to air pollution are oriented at:

- reduction or elimination of pollution sources by technical and management measures,
- application of economic instruments, the “polluter pays” principle in particular, and

- capacity reduction or closing of polluting facilities, until reducing emissions below limits set up by respective standards and criteria.

In case of high investment costs needed and significant socioeconomic impacts due to reduction or closing of the polluting facilities, medium or long term remedial programmes should be formulated and implemented.

III.3. Strategies in case of non-compliance caused by sectoral activities

Sectoral activities such as industry, energy, and agriculture and fisheries, might be the primary responsible in most cases of non-compliance. In other cases, transportation, forestry, tourism, might contribute to cumulative impacts causing non-compliance. Impacts caused by sectoral activities require specific remedial measures, not mentioned in the preceding sub chapter. In many cases a sectoral approach might be sufficient, in particular during the assessment phase; remedial measures might be targeted at the causative sectoral activity only, requesting nevertheless an integrated approach.

In practice, the approach to remedial actions has to be made by "overlying", as appropriate, the facts presented in this and in the preceding sub chapter.

A review of strategies for relevant sectoral activities is provided below.

Industry

The strategy in case of non-compliance caused by industrial activities, should take into account the following:

- application of immediate restrictive actions, in order to reduce or eliminate the sources of pollution;
- application of short term remedial measures, whenever feasible and appropriate: issuing orders, giving instructions or reaching arrangements for the application of measures aimed at: (i) elimination of sources or mitigation of pollution, or (ii) restoration or rehabilitation of affected areas, or (iii) elimination of other consequences of noncompliance, implementable within a reasonably short term period; (iv) measures to be combined with immediate restrictive actions;
- introduction of proper waste management and pollution abatement methods, such as: (i) recycling, (ii) minimizing industrial waste discharge, (iii) securing proper treatment and disposal, (iv) establishment of a strict control of respective processes, in order to prevent accidental discharges, (v) improving internal plant management;
- consideration of possibilities for substituting polluting technologies with "clean" technologies;
- application of an integrated approach as a conceptual framework, by:
    - applying integrated management and land use planning;
    - promoting, requesting and implementing actions at governmental level: improving the relevant legislation, applying economic disincentives and incentives, applying of the polluter pays principle;
    - substituting/transferring/reducing gradually the capacity of polluting industries;
    - using the results of SSA and of prospective studies on environment/development interrelations, in order to assess the present level of pollution and estimate trends and the potential cumulative impacts;
    - discouraging expansion/establishment of polluting industries;
    - securing correct, transparent and full information to the general public, raising awareness of the population, and implementing public participation programme, increasing pressure to industries;
    - developing initiatives for "greening" of industries, requesting environmentally friendly practices, favoring "green" marketing of the clean industries; and

- developing partnership with industries in preventing and curing cases of non-compliance.

Specific remedial measures have to be formulated and implemented in accordance with the type of industry and technology applied. Here the role and potential assistance of the MAP Regional Activity Centre for Clean Production and Technologies (CP/RAC) should be mentioned. Furthermore, UNIDO (Vienna), and UNEP – in particular its Industry and Environment Programme Activity Center, located in Paris – might be asked for assistance.

Energy production facilities

Among energy producing facilities, impacts of dams were already mentioned. Dams, once in function are causing changes in sediment transport and in hydrological processes, with often excessive peak overflows, disturbing fish migration etc. Other major energy producing facilities, potentially causing non-compliance should be mentioned: nuclear-, thermo- and hydroelectric power plants, facilities for use of renewable energies (solar, wind, biomass, geothermal). While the latter ones rarely cause non-compliance, others might induce severe and long lasting impacts. Acid rain and acid deposition from coal burning thermo-power plants often have transboundary impacts. Non-compliance might be caused not only by sulfur dioxide in combustion gasses but also by emitted suspended solid particles and ash deposited over large areas.

The strategies to be considered in case of non-compliance caused by energy producing facilities are: application of ICAM and land use planning; careful selection of siting of energy production facilities; policies favoring the use of renewable energies; changing the energy consumption patterns by use of less polluting fuels, primarily gas, than oil, and coal only if there are not better alternatives affordable. Other measures of a general nature are: increasing efficiency of energy production, transportation and use; reducing by technical means wasteful use of energy; applying the real prices for energy and eliminating subsidies.

The technical solutions for emission reduction related to abatement and control of emissions, should be based on correctly designed and managed facilities (precipitators, filters, gas purifiers). The use of appropriate pollution abatement technology and good management practice are the best measures for reducing the occurrence and significance of impacts from energy producing facilities, remedies therefore should be primarily sought there.

Transportation

A non-compliance situation might be caused by all types of transportation: by road, railways, navigation and air transport. The most frequent impacts encountered in transportation are: traffic accidents resulting in loss of lives and goods; oil spillage, fire/explosion of transported goods; air pollution; heavy vibration; noise. The proximity of airports, for example due to vibration and noise, might seriously affect historic sites, archaeological and cultural monuments and buildings, a frequently underestimated non-compliance with possible irreversible consequences.

The strategies in these cases should be sought within: (i) establishment of integrated traffic policies and systems; (ii) measures to control/reduce road traffic (stimulation of public transport, establishment of pedestrian zones); (iii) careful land use planning; timely established monitoring and evaluation of impacts, (iv) maintenance of high technical standards of transportation systems.

Among specific remedies, the basic ones refer to: technical improvement of means of transport (catalytic combustion, reduced petrol/power consumption, reduced exhaust emission, reduced noise level); incentives for use of unleaded petrol, noise barriers along roads, etc.

Agriculture and forestry

Agricultural activities might cause impacts on human health due to:

- intensive animal husbandry combined with unproper technologies (the present occurrence of “mad cow” syndrome, with catastrophic consequences, might be cited as one of most unfortunate examples of non-applying the precautionary principle;
- non-controlled disposal of animal waste, resulting in seepage of contaminants into surface and ground water, causing increased risk of zoonoses (brucellosis, tuberculosis, salmonellosis, campilobacteriosis...);
- poor irrigation practices using treated waste water, with risk of spread of human parasites, hepatitis, Escherichia;
- use of pesticides, fungicides, antibiotics, resulting in risk from contamination of soil, water and food;
- non controlled use of fertilizers, resulting in increased levels of nitrate in ground water; and
- inappropriate storage of cereals, causing moulding and increasing the health risk, etc.

In addition to impacts on human health, the impacts on ecosystems caused by agricultural activities might be attributed to practices related to:

- non controlled use of fertilizers, fungicides, pesticides, antibiotics;
- irrigation;
- unproper utilization of treated waste water; and
- unproper use and management of agricultural land, overgrazing, land abandonment, etc.

The consequences of the above impacts are: increased health risk and morbidity, depletion of resources, decrease of land productivity, soil degradation and erosion, and consequently an increased/induced poverty.

Forestry activities likely to contribute to or cause non-compliance are: uncontrolled felling; forest fires; unproper use of fertilizers or of treated waste water; mismanagement – resulting in soil erosion, landslides and mudslides, floods, endangering biodiversity, degrading ecosystems, causing loss of productivity and reduced opportunities for tourism and recreation.

The remedies to be applied for the two sectoral activities are:

- drastic change of present practices in intensive animal husbandry;
- integrated soil/agriculture/forest management, within ICAM and IRBM;
- rational land/soil use and correct agricultural practices;
- strictly controlled use of pesticides, fungicides, antibiotics and fertilizers;
- careful disposal and control of animal wasteload and offal; and
- rational and controlled use, handling and storage of food, avoiding contamination and degradation.

Specific remedies will depend of the type and significance of single causes and impacts; in case of need of international assistance, cooperation with FAO and/or WHO should be established.

Fisheries

The impacts of fisheries on coastal and marine environment are related to:

(i) potential over-exploitation (over-fishing, bycatch),
(ii) pollution by fishing vessels during fishing and/or transportation of goods,
(iii) pollution from processing facilities (effluents, oils, other waste, litter), and

(iv) need for space, both in coastal and adjacent marine areas.

On the other side, fisheries might be seriously affected by non-compliance caused by:

- pollution due to land based activities;
- habitat degradation due to filling, sediment deposits on seagrass beds and sea bottom, dumping of waste and of dredged material; and
- impacts on marine resources caused by urban sprawl, uncontrolled tourism development, navigation.

all decreasing productivity of fisheries and potentially inducing secondary negative impacts.

The remedial strategies should aim at the application of principles of sustainable fisheries' management:

- maintenance of the target stock at a high proportion of biomass that would occur without fishing;
- reducing/eliminating catch of target species and of undersized fish;
- reducing by-catch;
- eliminating destructive impacts on sea bed and sea bottom subsoil;
- reducing the use of large scale pelagic drift net fishing;
- establishment of enforceable regulation for fishing, envisaging penalties for non-compliance, but respecting local customs and perceptions of right and conditions of resource use;
- applying economic incentives; and
- protecting fisheries' activities by regulation within an integrated coastal management.

Aquaculture

Aquaculture is considered as an environmentally friendly activity, if located, designed and managed properly. Aquaculture is highly dependent on healthy fresh water or marine environment, as well as on a number of specific physical, biological and environmental conditions at the micro location level.

Due to a number of specific requirements, sites suitable for a high productive aquaculture are limited and should not be used for other purposes. Such sites have to be safely protected from sources of permanent or accidental pollution, applying integrated planning and land/sea use (FAO, 1992; PAP/RAC, 1996).

The impacts on ecosystems caused by non-properly sited and/or managed aquaculture activities, might be considerable, causing serious non-compliance with both EQC and HQC. The most frequent possible impacts are:

- health risk from contaminated products, shellfish in particular;
- pollution of the marine environment by organic chemicals and input of nutrients;
- genetic pollution of natural fish community;
- transfer of disease and/or parasites to natural fish population; and
- visual impacts on landscape, affecting tourism.

The first measure to prevent non-compliance is a careful monitoring of aquaculture activities. In case of detected non-compliance, the immediate measure should be a thorough re-checking of the condition of facilities and whether the production process is being managed as prescribed and approved. According to the results of the assessment, further remedial measures will be defined and implemented.

A particular attention has to be dedicated to shell growing or harvesting. Strict sanitary control of the production phase and of products prior to distribution has to be maintained, due to the high risk of shellfish being contaminated, including the potential incidence of deadly toxins. With this regard strict standards have to be applied, for the Mediterranean region preferably those prescribed by the EU.

Tourism

Environmental and health problems caused by tourism activities are predominantly due to: (i) its seasonal nature, (ii) potential over-exploitation and disruption of fragile resources, and (iii) potential and or actual improper behavior of visitors.

In receptive areas the local infrastructure often cannot cope with peak demands; in case of facilities satisfying peak demands, their performance might be affected in the low season.

Negative impacts from tourism activities, likely to cause non-compliance might be grouped in 4 categories:

- impacts from pollution and waste: pollution of bathing and coastal waters from increased liquid and solid waste; air pollution by cars; noise; pollution by pleasure boats;
- impacts on use of resources: congestion in coastal areas; overbuilding of tourist facilities along the coastline; loss of scenic beauties; increased fresh water consumption, consequent lowering of ground water level and salt water intrusion; increased risk of forest fires; damage/destruction of fragile systems; fishing and/or hunting of protected or endangered species thus affecting biodiversity; vandalism and destruction, souvenir "collection"; introduction of alien species;
- social and cultural impacts: damage/theft of historical/cultural/values; increased misconduct (crime, drugs, prostitution, socially negative attitudes); negative attitudes due to social, cultural, religious differences between visitors and local population; immigration after seasonal employment; loss of Mediterranean and/or insular identity of small islands and their population in case of over-building and/or over-exploitation, change of demographic and age structure of local population; and
- cumulative impacts of the above categories, resulting in: resource depletion; loss of habitats; endangered biodiversity; increased risks; negative economic, social and cultural impacts.

The above impacts, in particular when combined, may lead to an increased health risk for local population and tourists, loss of image and offer of the receptive destination, ultimately resulting in heavy economic losses and serious social consequences.

On the other side, visitors-tourists are exposed to risks of:

- gastrointestinal troubles, sometimes induced even by change of type of potable water, although fully complying with HQC;
- intoxication caused by use of shellfish (toxins, viruses) or other food of uncontrolled origin and/or quality;
- infections and increased morbidity if bathing in waters not complying with EQC and HQC; and
- infection by litter discharged along beaches (syringes !!!).

As an interesting example of a study on impacts of tourism activities on health aspects, the recent Maltese study, implemented as part of the MAP CAMP "Malta" project might be cited (PAP/RAC, 2000d).

In case of tourism activities being cause of non-compliance, the following strategies might be recommended:

- tourism policies oriented at a prolonged season;
- careful planning and management of tourist facilities and activities, applying Carrying Capacity Assessment for tourism activities as a criterion in cases of non-compliance (PAP/RAC, 1992);
- improved health/sanitary assistance to tourists and sanitary control of bathing areas;
- promotion of activities such as the Blue Flag, stimulating resorts to comply with EQC and HQC;
- promotion of proper behavior of tourists, for example establishing and promoting Codes of Conduct for Tourists;
- enforcement of rules and regulation, securing implementation of standards and criteria for tourism facilities and activities, regulation of conduct of nautical tourists;
- permanent cleaning of beaches, but avoiding mechanical cleaning; and
- promotion of studies on interrelations among tourism activities and health aspects related to both local population and tourists.

III.4. Strategies for river basins

In cases of non-compliance at the level of or within the river basins, the general approach to remedial actions is more or less similar as described in the preceding sub chapters, taking into account specific elements pertaining to water systems.
Potential causes of non-compliance, specific for river basins, are related to:

- pollution of surface and ground water; and/or
- changes of natural processes and their dynamics.

resulting with increased health risk, loss of habitats, endangered biodiversity, degradation and/or destruction of ecosystems.

When analyzing non-compliance within river basins, a complex set of interactions, specific for water systems has to be considered, in particular related to the following (sub)systems:

- surface and ground water;
- land, freshwater, marine ecosystems;
- human activities affecting the quality and use of freshwater resources;
- impacts of development on water resources and on other resources; and
- complex interrelations among the above systems or among individual elements pertaining to them.

The strategies to be implemented should be based on:

- protection/improvement of the freshwater quality; including all elements of the water system preceding its use:
    - inputs;
    - storage, reservoirs;
    - pre-use treatment procedures: flocculation, sedimentation, desalination, disinfecting, chlorination; and
    - distribution.
- securing that the discharge of used/ treated (waste)water is in compliance with EQC and HQC, by:
    - designing and implementing correct waste water collection systems;
    - applying appropriate waste water treatment technologies;
    - designing appropriate reuse of treated waste water, and securing safe reuse; and
    - designing appropriate and safe discharge.
- taking into account the high importance of the ground water systems, in particular regarding:

    - pollution;
    - their dependence on hydrological regime and on flow regime of surface waters; and
    - potential lowering of ground water level, usually resulting with severe impacts on ecosystems and biota.
- selecting measures not inducing secondary impacts in the river basin or in coastal areas, and not influencing other aspects of water availability and quality;
- regarding time frame of processes, dynamics, interlinking of causes and resulting impacts:
    - impacts with immediate consequences to be treated primarily; and
    - care to be taken of the fact that impacts with a long term crypto period, such as ground water pollution and level lowering usually result with large scale, high intensity or even irreversible consequences.
- securing intensive control measures on large reservoirs and irrigation systems in order to decrease the risk of waterborne or vector borne diseases.

IV. REMEDIAL ACTIONS

After the selection of the most appropriate strategy(ies), remedial actions have to be formulated. The remedial actions might be classified in two categories:

a) those suitable for immediate interventions, likely capable to secure a quick re-establishment of compliance status; and
b) actions implying a medium- or long-term remedial programme.

IV.1. Immediate interventions

A large number of remedial actions implemented belongs to this category. These are the cases when a quick and clear identification of causes and a rapid assessment of non-compliance can be made. The causes of non-compliance in these cases are prevailingly of the point source type, such as accidental pollution and discharge, or belong to diffuse sources of pollution of a temporary nature, all affecting predominantly smaller areas and being of a minor or moderate significance. In most cases the remedial action can be implemented immediately or after a short preparatory period, the results achieved immediately.

Actions pertaining to this category are being dealt with primarily by inspectors and local authorities and institutions, applying regular procedures and using regular funds.
Although such actions may look as the “simple” ones, this might be dangerously misleading. Some of those “simple” remedial actions might:

- require high expenditures to be incurred by polluters or causative activities;
- result in reduction or temporary or permanent closure of the production plant, with serious economic and social consequences for the polluter and the labor force employed;
- exercise negative impacts of regular performance of other activities (transportation, fisheries, tourism...);
- cause secondary impacts or transfer of primary impacts, inducing secondary non-compliance; and
- be oriented in a wrong direction, would the assessment fail to identify the cause or all the causes, misinterpret or fail to identify the impacts or under-evaluate their significance.

A high responsibility lies therefore on inspectors and bodies responsible for detection and rapid intervention.
Remedial strategies to be considered and recommended in case of this type of action are as follows:

- a careful approach to the identification and assessment phase;
- consideration of the wider context, securing integration and application of the precautionary principle;
- coordinated, harmonized and joint work with other sectoral inspectors, as appropriate;
- consultations to be made with higher authorities and the scientific community;
- prompt, quick and timely intervention;
- monitoring the implementation of remedial actions prescribed; and
- monitoring of impacts in affected areas after implementation of the remedial action and feedback re-adjustment, if needed and as appropriate.

The recommended procedure, after detection of non-compliance caused by incidental pollution, is the following one:

- rapid assessment, verification of non-compliance, reporting;
- identification and control of causes;
- action to mitigate or eliminate causes;
- identification of impacts and prescription of remedial measures and regulation, even provisional;

- definition and implementation of permanent remedial measures; and
- monitoring the post-remedial situation.

IV.2. Medium- and long-term remedial programmes

In most cases compliance with EQC and HQC cannot be re-established by quickly implementable remedial actions. This refers predominantly to non-compliance caused by long-lasting and heavy pollution processes, for example by deposition of organic/industrial waste into the marine environment and creation of thick layers of sediment of such waste on the sea bottom, by pollution by POPs, HMs, radiation emissions, mismanagement of fragile resources, over-exploitation. Impacts heavily affecting the coastal and marine environment, surface and ground water, eutrophication, degradation by erosion processes, disruption of ecosystems, require complex remedial measures with a medium- or long-term period for implementation. Identification and assessment of this type of non-compliance is often hampered by gaps in information and knowledge on ecosystems and their dynamics. The need to understand future development options and their implication on environment requires the preparation of prospective studies and SSA, as well as of those related to impacts of global change.

The scale of affected areas, the nature and significance of impacts, the funds needed for implementation – all together require thorough and comprehensive preparatory activities. In most of these cases international cooperation and/or support is recommendable and needed. In such cases, complex remedial actions must be formulated, well prepared, and implemented as medium (3-5 years) or long term (5 years or more) remedial programmes.

Preparation of remedial programmes does not exclude the need for and obligation to implement immediate remedial actions, if applicable and feasible, as part of the initial phase of the remedial programme.

Remedial programmes have to be formulated within the concept of sustainable development and applying the ICAM (or IRBM or ICARM, as appropriate) methodology and tools. The entire process follows the ICAM procedure, as presented in chapter II (see Table 3 and Figure 1), with modifications to be explained in the subsequent chapter.

Any remedial programme will be case specific, depending on:

- scale of the area involved;
- level of decision making needed;
- significance of impacts;
- nature of remedial measures;
- need for further monitoring and/or research prior to the selection of remedial strategy;
- level of funds needed, their availability in terms of amount and cash flow; and
- type of international cooperation, if any.

Each programme will require a specific preparatory phase, an appropriate legal context (decisions and approvals) and institutional arrangements. The process of its formulation, preparation, adoption, and implementation should be based on an integrated approach.

The preparation of remedial programmes is a complex job, requiring experience and high skills, and should be implemented by multidisciplinary teams. A recent assesment (METAP/MAP, 1997) presents examples of large management programmes ended with only partial success, due mainly to the fact that responsible teams and authorities involved were not able to meet and/or create the requirements and prerequisites needed for programme implementation. Concerning activities usually pertaining to the preparatory phase, the analysis of MAP CAMP projects, implemented during the 1989-94 period, might be cited (Pavasovic, 1996, 1996a, 2000).

V. REMEDIAL PROGRAMMES: PROCEDURE AND IMPLEMENTATION

V.1. The recommended procedure

The procedure to be recommended for the formulation and implementation of remedial programmes consists of 3 stages and a number of phases, presented below.

Stages of the remedial programme

The stages of the remedial programme and the relevant phases are:

(i) initiation;
(ii) formulation, including the following phases:
  (ii-a) assessment;
  (ii-b) definition of policies, strategies and preparation of the Programme Outline; and
  (ii-c) detailed planning: design of the Remedial Programme.
(iii) implementation, including the phases:
  (iii-a) organization, establishment of institutional arrangements, meeting prerequisites;
  (iii-b) implementation; and
  (iii-c) post implementation phase: monitoring, evaluation and feedback.

The main stages and phases, activities to be implemented within each phase, the resulting outputs and decisions to be approved are presented in Table 4 and on the flowchart in Figure 5.

V.2. The initiation stage

This stage consists of: (i) detection of non-compliance, (ii) implementation of immediate interventions, and (iii) creation of conditions for the start of the remedial process.

The initiation stage of the process is induced by action of triggering factors, such as:

- monitoring results, indicating non-compliance;
- other sources indicating non compliance:
  - inspectors;
  - initiatives from the general public, NGOs, scientific community;
  - initiatives from local or higher level authorities; and
- international initiatives.

The initiation stage is considered as one phase stage, containing the following steps:

- identification and rapid preliminary assessment of non-compliance;
- immediate remedial intervention, if possible and feasible;
- reporting of non-compliance, reporting on immediate interventions implemented, and on the need for a remedial programme;
- decision/approval of the start of the remedial procedure; and
- implementation of needed organizational, institutional and other preparatory activities.

The usual procedure related to this stage was described in chapters I, point 4, and IV, point. 1.

Table 4: Formulation and implementation of the Remedial Programme

Inputs	Stages	Phases	Activities	Outputs	Decisions
Triggers: • monitoring • inspectors • other interventions • international initiatives	Initiation	Initiation	Detecting non-compliance On site inspection Rapid Assessment, immediate, if feasible Proposal for remedial action(s) Reporting	Non-compliance Assessment Report Intervention(s) Proposal for action	Immediate interventions approved Start of remedial action approved
Monitoring Analysis of non-compliance Remedial measures available	Formulation of Remedial Programme	Assessment	Problem identification: causes, areas affected, significance of impacts. Identification of information gaps and of prerequisites needed. Definition of priorities. Assessment Report	Assessment Report	Assessment Report approved
Assessment Report Criteria for evaluation of strategies		Defining policies and strategies	Definition of policies, goals, objectives; definition of alternative strategies Selection of strategies Adoption of strategies Programme Outline	Alternative strategies The most appropriate strategy Programme Outline	The most appropriate strategy approved Programme Outline approved
Programme Outline		Defining the Remedial Programme	Identification of individual activities. Planning of individual activities, adoption of individual plans. Framework organizational structure. Framework of the Remedial Programme	Detailed programmes of individual activities Remedial Programme	Individual activities approved Remedial Programme approved
Remedial Programme Individual plans	Implementation	Meeting prerequisites	Establishment of the organizational structure Preparing executive projects Permits, land acquisition, contracting	Organizational structure Projects, permits, land acquired. Contracts	Organization projects approved Contracts approved
Remedial Programme Individual projects		Implementation	Implementation of individual activities, projects, phases of the Remedial Programme Monitoring implementation, Evaluation Feedback. Readjustments, if needed	Structural and non-structural outputs Implementation, monitoring reports	Progress Reports on implementation and Monitoring Reports approved
Post-implementation monitoring		Post-implementation monitoring and feedback	Monitoring of results achieved Assessment, feedback, follow-up programme	Reports on assessment of results Follow up programme	Assessment Report approved Follow up programme approved

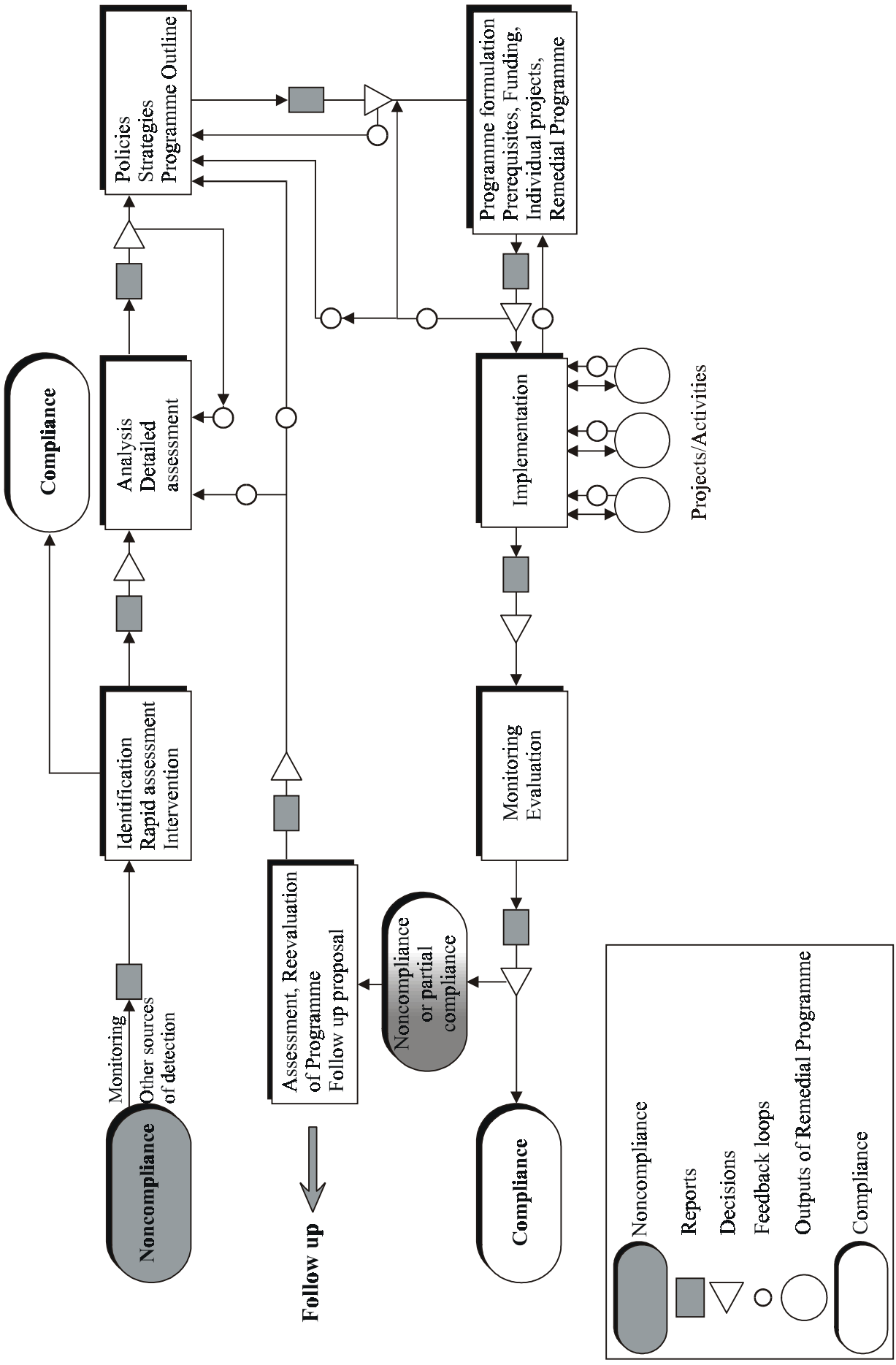


Figure 5: Flowchart for formulation and implementation of Remedial Programmes

V.3. Programme formulation

As indicated in point 1 of this chapter, this stage consists of three phases: a) the assessment phase, b) definition of policies and strategies, and c) definition of the remedial programme.

a) The assessment phase

This phase includes the following steps:

- problem identification;
- identification of causes of non-compliance;
- identification of affected areas;
- assessment of the significance of impacts;
- identification of information gaps, if any, and of the prerequisites for implementation;
- definition of priorities;
- definition of programme structure and of initial institutional arrangements;
- reporting to authorities;
- informing: the general public; stakeholders involved or affected; the scientific community and NGOs;
- formulation and implementation of the public participation programme related to this phase; and
- decisions/approval for further action, by the responsible authorities.

The approach to this phase has to be based on general principles of sustainable development and integrated management. In case of non-compliance affecting coastal and marine ecosystems and freshwater systems, an integrated approach including all relevant elements should be provided for.

Problem identification is related to:

- presentation of: the general information concerning the affected area; of results of previous monitoring programmes and of immediate remedial activities implemented, if any;
- assessment of impacts of identified non-compliance on human health, on ecosystem health, on coastal and marine resources and on economic and social conditions, including the cultural ones; and
- assessment of actual or potential impacts on food security, poverty, biodiversity.

Identification of causes of non compliance understands a detailed scrutiny of existing and/or potential causes, according to:

- types of pollutants and sources;
- forms, intensity and significance of impacts; and
- possible multiple sources and cumulative impacts.

as presented in chapters I, III and IV.

Delimitation of affected areas should be made in accordance with the monitoring results.

For the identification of the area which might later on be primarily or secondarily affected, a number of elements should be considered:

- the ecosystem structure and boundaries;
- risks of transfer of impacts;
- risks of secondary impacts due to new situation in the affected area;
- administrative boundaries; national jurisdiction and potential transboundary implications; and
- development prospective.

The assessment of significance of non-compliance has to be made considering the impacts on:

- human health and health risk;
- ecosystems and resources;
- present economic activities and well-being of the population;
- future (sustainable) development of the affected and of the larger area;
- number of population involved and structure of affected segments of population; and
- other country and site specific criteria, if any.

In order to identify information gaps and prerequisites for implementation, a careful analysis has to be made of:

- available data, information and knowledge on ecosystems and processes, on development prospective, impacts from climate change;
- legal, technical, organizational and financial aspects relevant for the planning and implementation phase; and
- apacity building requirements, if any.

The programme structure and the initial institutional arrangements needed for the implementation of subsequent phases will have to be defined taking into account the actual institutional arrangements and other country and area relevant factors, as well as the final organizational structure needed (see point 3. of this chapter).

In case of several interrelated or individual remedial actions or programmes needed or envisaged, priorities should be proposed and adopted according to:

- significance of impacts and consequences of non-compliance;
- current and future local, sub national and national development plans and programmes; and
- feasibility and "implementability" of envisaged actions.

When implementing this step, the participatory programme has to be fully applied, the priorities proposed to be widely discussed with and evaluated by stakeholders, the feedback comments and proposals to be considered by the programme implementing team, finally the priorities should be approved by decisions of authorized bodies.

b) Definition of policies, strategies and of the programme outline

The objectives of this phase are:

- to provide a sound basis for the detailed elaboration of the remedial programme, the principal criteria being protection of human health, of ecosystem health and biodiversity; feasibility and affordability of the selected strategy; and
- to formulate and adopt the outline for the remedial programme document.

The phase includes the following steps:

- definition of policies and objectives;
- elaboration of alternative strategies;
- selection of the most appropriate strategy(ies), by applying selection criteria;
- reporting, informing, considering the feedback inputs, amending strategies, if needed and as appropriate;
- deciding on: a) strategy to be implemented and b) detailed planning procedure to follow; and
- preparing the programme outline, presenting to authorities and public, evaluating comments, finalizing the outline, adopting it by competent authorities.

Definition of policies

Defining policies for a remedial programmes presuppose the formulation of management and remedial strategies and actions.

Policies for remedial programmes, in general:

- should be based, as appropriate, on principles of sustainable development and integrated management;
- need to be realistic, consistent and adapted to specific national (legal, institutional, socio economic) and coastal area relevant conditions; and
- should be transparent, accessible and understandable to stakeholders, interested private groups and the general public.

Depending on the way the policies are formulated, some goals might be already included in the policy formulation.

By their character, goals of remedial actions may be general, area specific and/or sectoral. General and area specific goals are usually of a multisectoral character.

Some general goals to be attained by remedial actions might be mentioned:

- protection of health and amenities;
- sustainable use of coastal and marine resources; protection of ecosystems, habitats, biodiversity;
- involvement of local authorities and population, of NGOs and of the scientific community; partnership with private sector; raising of public awareness; and
- upgrading of institutional and human capacities through the remedial process.

Definition of objectives

Programme and activities' objectives should be action oriented, with predominantly short and medium term horizons, expressed whenever possible in a quantitative form (for example: in % of reduction of the present pollution, or defining limits of concentration of pollutants, or quantities per time unit; the % of the urban solid and/or liquid waste in coastal areas to be treated, or the treatment level; the % of coastal/marine area to be protected/conserved, the rate or level of development of priority sectors or activities to be attained, etc.). Each objective should contain achievement deadlines (time horizons).

Definition of strategies

Strategies for remedial programmes are cyclical processes of planning and actions, with emphasis on managing progress towards elimination of causes and consequences of non-compliance. Strategies should focus on priority issues, comprising major processes and key problems; usually they are medium- or long-term oriented.

When defining strategies, the best methods and means available have to be proposed in order to achieve the goals and objectives at affordable costs and in foreseen terms. Depending of the nature of non-compliance, the area affected, and the significance of impacts, strategies might be in some cases rather simple, in most cases they are a set of interrelated policy instruments.

A set of strategies includes individual strategies at various levels:

- the general strategy understands the basic approach to programme implementation, taking into account the regional/national/sub national contexts, in accordance with:
    - ongoing or in preparation international/national/local action plans, and the conventions and protocols ratified or signed, see for example SAP MED (UNEP, 1999);
    - the actual national and area related institutional, legal and other specific arrangements; and

    - the concept, methodology and tools of integrated management.
- the cross sectoral strategies, related to remedial actions involving, for example:
    - management towards an overall sustainable development of the area affected or of a larger area;
    - pollution control;
    - protection of natural habitats and biodiversity;
    - protection from natural hazards;
    - response to global change;
    - river basin management; and
    - integrated land and sea use planning, etc.
- sectoral strategies, related to actions within a single/individual sector and/or activity: industry, agriculture, fisheries and aquaculture, tourism and recreation, maritime transport and navigation, renewable energy sources, urban liquid and/or solid waste management, etc.

Within a complex remedial strategy, sectoral strategies have to be mutually supporting and complementary.

The strategic actions to be envisaged by complex remedial strategies should include, among others, key issues, such as:

- policy, legislative, institutional and organizational interventions needed;
- institutional and human capacity building, exchange of experience, transfer of knowledge; and
- phasing of the programme, identification of pilot and regular actions, of studies needed, of executive projects needed.

Remedial strategies should include also monitoring and evaluation of the results achieved. With that respect, achievement indicators and criteria have to be defined when defining the programme objectives and strategies. The monitoring strategy should envisage both monitoring of the implementation of the remedial programme and monitoring of its achievements after the implementation phase.

The SAP MED, as a regional, long-term strategy for reduction/elimination of non-compliance caused by pollution, might be cited (UNEP, 1999), and the Operational document for its implementation as an implementation instrument (UNEP, 2001)

In case of large remedial programmes, alternative strategies should be formulated, and the most appropriate strategy defined, using selection (evaluation) criteria.
Strategy evaluation

After the formulation of alternative remedial strategies, the most appropriate one has to be selected by applying standard evaluation criteria and country and coastal/marine area specific criteria.
The evaluation might be implemented by applying complex tools, such as, for example, the multicriteria analysis using an appropriate software; in most cases the expert opinion method will be applied.

Three basic groups of evaluation criteria and a fourth, deduced group will have to be taken into consideration:

a) basic evaluation criteria,
b) risk criteria,
c) other criteria, and
d) qualification criteria, selected among the first three groups.

Usually, as basic evaluation criteria the following ones are applied:

- expected immediate results and medium- and long-term benefits;
- effects on public health and state of environment;
- implementation costs (by applying cost-benefit analysis or cost effectiveness analysis),

- "implementability" – meeting the needed financial, legal, administrative, capacity... prerequisites;
- "win-win" effects (if achieving multiple effects by implementing the strategy evaluated);
- compatibility with local strategies of sustainable development and integrated management, compatibility with national development strategies;
- contribution to social equity and elimination of poverty;
- contribution to capacity building and institutional strengthening;
- beneficial impacts on economic, social, cultural and other condition, strengthening local identity; and
- others, as appropriate.

As risk criteria the following ones should be taken into consideration:

- effects of evaluated strategy on reduction or elimination of risks:
    - on human health;
    - on environment; and
    - significance of potential impacts of the strategy under consideration.
- level of risk and scale of area under risk.

Other criteria to be taken into consideration are:

- political compatibility, "acceptability" and public opinion;
- time needed to accomplish effects and achieve tangible benefits;
- possibility of controlling the implementation procedure; and
- others, as appropriate.

Qualification criteria: these criteria include those among the above and/or other criteria, which if relevant, eliminate the strategy from further consideration (may be called elimination criteria as well):

- incompatibility with national development strategies;
- global negative effects on wider environment;
- possible unforeseen/unpredictable impacts in the future (application of precautionary principle); and
- low "implementability": absence of financial/technical/other indispensable prerequisites; preparatory activities not implemented ...

The most appropriate strategy, selected applying the evaluation procedure, should define: (i) strategic actions to be implemented, (ii) the time frame, (iii) costs estimate and (iv) the legal, institutional and other prerequisites.

Programme Outline

Finally, on the basis of the selected and approved programme strategy, the Programme Outline has to be prepared, presented to authorities and stakeholders, discussed, finalized and approved. The application of the participatory approach is essential in this step. Feedback information and comments have to be analyzed and readjustments made, if needed and as appropriate.

The Programme Outline should contain all elements needed for further elaboration of the Programme: backgrounds, programme objectives, assesment of impacts and significance, remedial measures available and considered, strategy and strategic actions envisaged, orientative timetable and costs estimate, institutional arrangements and organizational and other prerequisites for detailed planning, design and implementation.

c) Detailed planning: defining the Remedial Programme

This phase corresponds to the "detailed planning" phase of ICAM, as presented in chapter II, and should be implemented on the basis of the previously adopted strategy and Programme Outline. The main steps of this phase are:

- disaggregation of strategy and Outline into individual programme activities;
- detailed elaboration of each individual remedial activity;
- preparation, revision, adoption of technical and other documents for each individual programme activity;
- definition of programme structure and of the needed institutional arrangements;
- harmonization among individual activities and their integration into the remedial programme; and
- adoption of the Remedial Programme, by decision of authorized national bodies.

Disaggregation of strategy and outline

Strategic actions and all activities to be performed prior to the implementation phase have to be identified on the basis of the adopted strategy and Outline. Each individual activity will have to be identified, annotated as appropriate, to be used as input for the subsequent step.

Detailed elaboration of each individual activity

Detailed description of each individual activity, including: objectives; nature and impacts of relevant non-compliance or logical interrelation with non-compliance; contents of activity; type, nature and extent of remedial measures envisaged; expected results and achievement indicators; workplan, budget, timetable; feasibility and prerequisites for implementation.

Some individual activities might be of a technical nature and immediately implementable, others will need some preparatory activities, thirds will consist of monitoring, research or complex studies needed for the final formulation of the activity(ies) and/or projects. For structural technical activities technical designs or executive projects have to be prepared; the non-structural activities will need individual activity programmes only. The nature of individual activities will largely influence the structure of the remedial programme.

Adoption of individual activities

Documents related to each individual activity, those related to large and costly ones in particular, must be presented, discussed, amended as appropriate and finally adopted. The participatory approach must make part of the procedure.

Definition of the institutional arrangements needed for implementation

The institutional arrangements needed for a successful and cost efficient implementation of the programme will depend on the programme scale, complexity and significance. The organizational/implementing arrangements should secure:

- the needed integrated approach;
- multidisciplinarity;
- compatibility with national conditions and practices; and
- efficient and timely formulation, implementation and monitoring of the programme, as well as the approval of relevant decisions after respective steps/phases.

Institutional arrangements, predominant in the Mediterranean basin were described in chapter I.

When approaching the design of the institutional arrangements, it should be emphasized again: remedial programmes are not sectoral civil engineering projects, although the major part of physical interventions envisaged might be of that nature.

Integration of individual activities into a remedial programme

All individual activities, previously elaborated in detail, have to be harmonized among themselves and integrated into a logical and coherent programme, considering:

- the priorities established; and
- the affordability, implementability, as well as other aspects of the programme and of each individual activity.

A large remedial programme has to be divided in phases, each phase might contain several activities usually formulated as projects. Projects to be implemented first have to be included in the programme elaborated in detail. The subsequent activities/projects, might be elaborated in more general lines. In all cases the final situation and expected results have to be elaborated.

The phasing of the Programme should be structured respecting the long-term strategy and objectives, taking into account the specificities of the administrative system, the financial implications, international standards/ requirements in case of international cooperation and support, etc.

Phasing the programme should take into account:

- the degree of prerequisites met for individual activities and the Programme as a whole;
- the technical and financial aspects of implementation;
- priorities adopted and the logic of sequence of activities;
- limiting the time frame over which specific tangible results might be achieved; and
- other criteria, programme and country specific.

Finally, the adopted phasing of the programme and its timetable might be readjusted during the implementation phase, according to progress implementation monitoring.

Programme adoption

The Remedial Programme should be presented as a proposal, discussed, evaluated, amended and finalized, to be adopted by responsible and authorized bodies, in accordance with the national legal and institutional arrangements.

V.4. Implementation

This stage includes the following phases:

a) definition and approval of institutional arrangements;
b) implementation of the programme; and
c) post implementation phase: monitoring, evaluation and feedback.

a) Definition and approval of institutional arrangements

As mentioned earlier the institutional arrangements for the implementation of remedial programmes will be country and programme specific. For a large scale multi phase programme, with high implementation costs, a general framework of the implementation structure might be as follows:

a) (High Level) Programme Steering Committee;
b) Lead Agency;
c) Programme Manager;
d) Programme Advisory Network; and
e) Implementing Unit.

Smaller programmes would require a simpler organizational scheme.

The general organizational scheme, as defined above, is presented in Figure 6.

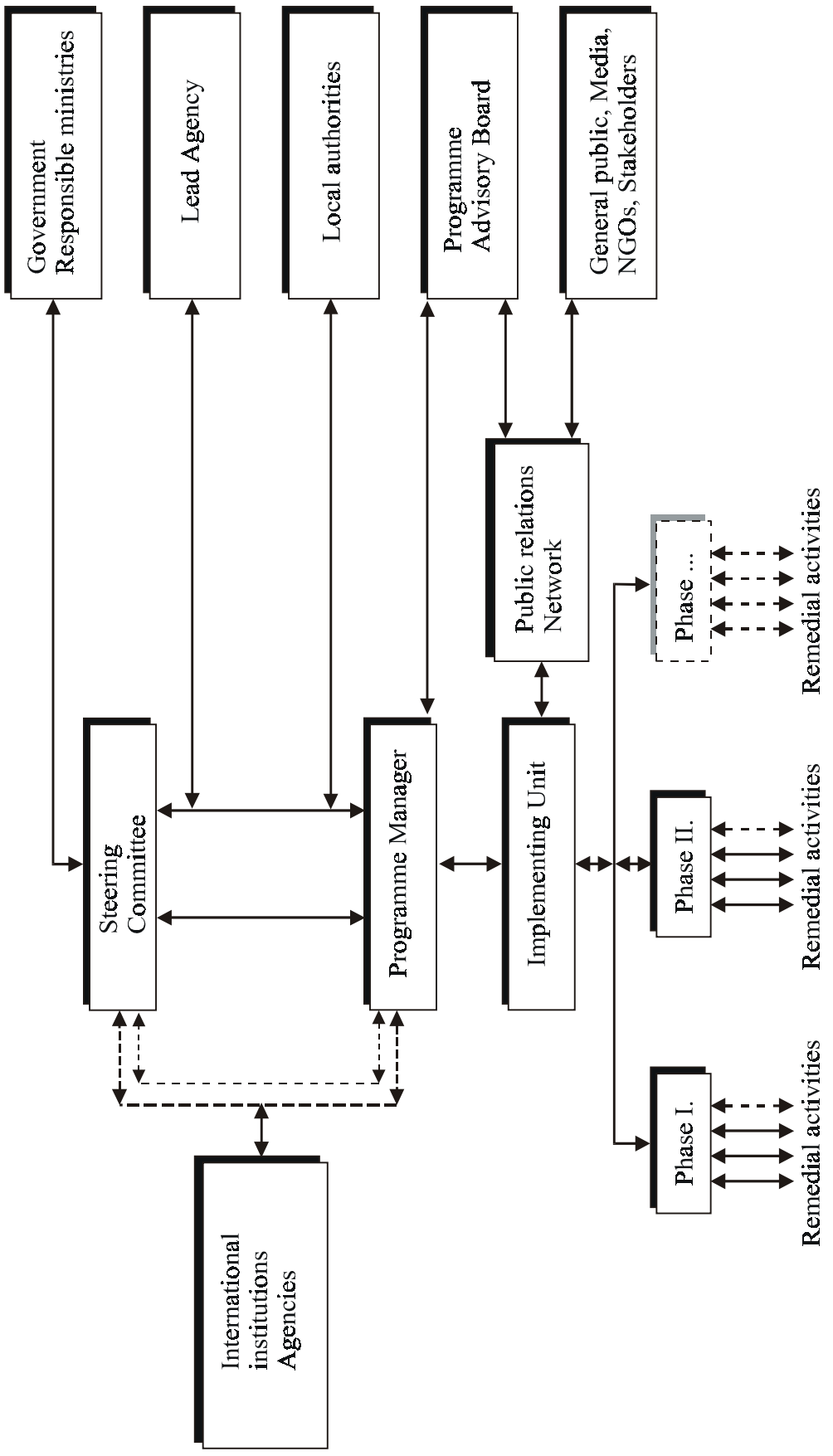


Figure 6: Remedial programmes – Institutional arrangements

The role and responsibilities of the bodies and functions listed above, might be as follows:

The responsibilities of the (High Level) Steering Committee are:

- to secure horizontal integration of policies and decisions and of implementation of programme activities at national and area levels;
- to decide on major policy issues and strategies of the programme, to approve the project document, or to present it to the government as appropriate, to follow its implementation;
- to nominate or propose the nomination of the Programme Manager; and
- to control programme implementation, provide policy instructions to the Programme Manager, evaluate the programme results, and approve the follow up proposals.

The Committee might consist of:

- high level representatives of involved/responsible Ministries and State Agencies, up to 5-6 members;
- one or more high level representatives of responsible local authorities;
- other members, as appropriate; and
- Programme Manager, without voting/deciding rights.

The Steering Committee and its Chairman are nominated by the government or by the responsible ministry/authority, the logistical support for its work should be secured by the Lead Agency. The Committee might meet once or twice a year, and at the start and after the completion of each phase of the programme.

The Lead Agency should be the national (in some cases the level might be sub national) institution/agency/ authority, directly or predominantly responsible for the type of non-compliance, its causes and/or impacts. In countries with defined responsibility for ICAM, a practical solution might be the lead agency for ICAM to be nominated also as the Lead Agency for the remedial programme; in cases of river basin management it might be the relevant Water Authority or Water Resource Management Agency.

The Lead Agency is responsible for operational and professional assistance and supervision of the remedial programme, as well as for the provision of data and information on changes occurring in the programme area, potentially to affect the programme or its results. Furthermore, the Lead Agency should provide logistical support to the Programme Steering Committee. The appointment of the Lead Agency should be made by the Government as part of the decision for the approval and initiation of the programme.

The Programme Manager should act as the chief executive, responsible for the formulation of the programme and its implementation in accordance with: the programme/project document, and operational decisions adopted by the Steering Committee. The Programme Manager reports and is responsible to th Lead Agency and to the Steering Committee. He will be responsible for the establishment, organization and work of the Implementing Unit/Agency and for the appointment of the Unit staff. The Programme Manager should be appointed by the Government or by the Lead Agency.

The Programme Advisory Board. The role of this body should be of a consultative nature, its function as part of the participatory programme. The Board members might be: representatives of major stakeholders, of competent NGOs, of the scientific community, and/or individual reputed scientists/professionals/experts. The tasks of the Board would be to consider, discuss, evaluate and provide consultancy on major scientific and professional issues related to formulation and implementation of the programme, including evaluation of results and proposals for the follow-up. The activities of the Board might be partly organized on a network base, using communication and feedback through e-mail and ordinary mail, with meetings in plenary or in thematic groups, according to the issues to be considered. Members of the Board should be confirmed by the Lead Agency or by the Steering Committee.

The Programme Implementing Unit or Agency. For large programmes the Implementing Unit might be organized as an independent Agency with a particular legal status or as an Implementing Unit as part of an existing but competent and relevant institution/organization/agency. The Implementing Unit should be located in the

programme area and at the lowest institutional/administrative level still securing the needed institutional capacity and efficiency of programme implementation. The professional team of the Unit should be multidisciplinary. The servicing of the Board, public relations and communication with media and with the general public should be secured within the Unit.

The function of public relations should not be downgraded, its major task being raising of public awareness and creating support for:

(i) the programme in general;
(ii) contribution to creation of political will and willingness to pay for remedial activities; and
(iii) fund raising.

The public relations officer therefore should be competent, responsible, realistic, and should not be involved in local "politics".

Professionals/experts should be affiliated to the implementing unit, capable to monitor and interpret changes in the programme area during its initiation and implementation, likely to influence the implementation or expected achievements. Many changes during the implementation of a programme will have to be detected, monitored and interpreted; some of them likely to require adaptations of the programme or other types of interventions.

After the definition of institutional arrangements needed, the relevant approval should be part of the programme approval.

b) The implementation of the Remedial Programme

This phase consists of following steps:

- meeting prerequisites for implementation;
- implementation; and
- post-implementation activities.

Meeting prerequisites for implementation

The activities to be implemented within this step are:

- establishment of the approved institutional arrangements;
- completion of data, information and knowledge needed as inputs for projects design, if not completed earlier;
- securing of the funds needed, financial arrangements, contracting financial arrangements;
- preparation of executive projects/designs for structural activities, programmes for non-structural ones, if not prepared in the preceding phases;
- obtaining permits;
- acquisition of land, if needed, for the implementation of structural activities;
- contracting implementation projects and programmes; and
- other, as needed and appropriate.

The implementation process is to be carried out applying policy instruments as appropriate, first of all the regulatory and policy instruments for implementation. EQC and HQC should be considered as part of basic regulatory instruments to be applied. By a timely application of regulatory instruments – land use planning in the first instance, in some cases sea use planning – the spatial prerequisites for the implementation of the remedial programme have to be met. Voluntary agreements among involved authorities, the private sector and other stakeholders should be made, in particular related to the joint and individual obligations related to the implementation, funding, management and control of the remedial programme and of its individual phases or projects. Such agreements should also regulate the post-project obligations related to the use and

maintenance of systems and facilities constructed, to the monitoring and assessment of the degree of compliance achieved, as well as obligations for follow up activities.

Policy instruments for implementation, as part of the Remedial Programme, or accompanying it, or as part of the voluntary agreements, should be based on principled presented in chapter II. In particular, the polluter pays principle should be applied and charges for use of restored resources or improved services defined.

When preparing executive projects, EIA, in some cases SEA, and CBA for larger projects should be applied as mandatory.

As a specific form of completion of the knowledge needed for formulation of large remedial/development programmes, MAP CAMP projects, implemented in areas with detected non-compliance, might be cited.

Other activities listed above are more or less pertaining to the preparatory phase of almost any large investment programme, and should be implemented in accordance with national practices and regulations, respecting international procedures and/or standards in case of international funding or cooperation.

Implementation

The implementation phase consists of: (i) the physical implementation of structural projects (for example, building of remedial systems or facilities) and (ii) preparation/implementation of non-structural ones (monitoring, evaluation, capacity building, public participation programme, communication and information...). The implementation phase is determined by the phasing of the programme and of its individual activities/projects. Ammendments of the planned implementation workplan might be needed, in accordance with the progress of implementation and monitoring results.

The implementation process will follow the standard project management practice and the relevant national legislation, and will be also country and programme specific.
One important component of this step is the monitoring of the implementation process. This monitoring is related to:

- the progress of the ongoing phase and of individual activities/projects;
- the changes and trends in the project area and within a larger context, factually or potentially influencing the programme; and
- the factual and potential impacts, foreseen or not, of the implementation process on the project area, ecosystems and population.

Two different types of monitoring will have to be implemented: monitoring of structural implementation and relevant activities, and monitoring of environmental and other impacts on ecosystems and population. The formulation and implementation of progress monitoring will have to be implemented by technical teams, the monitoring of impacts on environment and population by a multidisciplinary team of experts.

The monitoring results will be used for a comprehensive assessment and management of each individual activity, and of the programme or its phase as a whole. At the same time, monitoring will contribute to the integration of activities, and will be used as feedback input to the original Programme, or to ongoing projects or individual activity programmes. Feedback inputs have to secure a continuous re-evaluation and updating of the strategy and of the Programme, as well as of individual projects. In case of significant adjustments needed, the cost and benefit analysis and evaluation of changes should be applied.

c) Post implementation activities

This, the last step of the implementation phase includes:

- monitoring of results achieved by the Programme phase/project;
- assessments of the results achieved;
- feedback to remedial programme; and

- preparation of proposals for follow up activities.

Monitoring of the results achieved by the Programme will be implemented as a logical follow up of the monitoring initiated in the preceding step. The assessment of the results achieved will have to be prepared and evaluated by interdisciplinary teams and should be presented to all interested, also through the participatory programme.

The post-implementation monitoring has to be conceived as a medium-term activity.

Achievement indicators, previously set up, have to be compared with results of the post-implementation monitoring, and the respective findings interpreted and reported.

The feedback to the Remedial programme will be implemented according to the results of monitoring and assessment; proposals for ammendments of the Programme will be formulated if needed, presented, evaluated and approved accordingly.

The proposal for follow up activities will be formulated and reported in the same way as the assessment and feedback.

VI. RECOMMENDATIONS

Finally, some general recommendations might be formulated, based on facts and procedures presented in the document:

1) A remedial action in case of non-compliance with EQC and/or HQC has to be considered as a complex task, requiring careful approach, implying usually a combination of immediate and medium- or long-term activities and measures, structured in programmes/projects, with priorities to be given according to the significance of non-compliance impacts and implementability criteria.

2) Each case of non-compliance should be regarded as a particular one, differing from others; however:

a) analogies and experiences from similar situations might be useful, and
b) guidelines and procedures recommended by this document should be applied as appropriate, in particular related to:

(i) the application of the integrated approach;
(ii) identification of the prerequisites needed;
(iii) consideration of measures available according to identified causes and impacts;
(iv) use of procedures, tools and techniques presented; and
(v) formulation and phasing of the remedial programmes.

3) Prompt reaction to non-compliance, the effectiveness and efficiency of measures undertaken are strongly dependent on national and local governance system and management practices. Therefore, a certain level of institutional, organizational and legal conditions in the country, relevant for identification of non-compliance and implementation of remedial actions, a system of pollution control and monitoring, constitute the operational framework for all remedial initiatives. Its improvement and/or adaptation to needs of remedial actions should be a permanent task of the responsible authorities and of all other actors involved. But in principle the programmes should be formulated respecting as much as possible the actual institutional and other national conditions.

4) Principles of sustainable development and integrated management as part of national development and economic policies in coastal areas, including the protection of environment, should be consequently applied, the responsibility for it pertaining to authorities; the relevant initiatives and support being expected from stakeholders, the scientific community, and the general public, in particular by the affected population.

5) Compliance control and prevention of causes, likely to result with non-compliance, are the best and most efficient remedial measures; an appropriate implementation of recommendations given above in points 3) and 4) would provide the needed conditions for it.

6) Immediate remedial measures, if applicable and as appropriate, should be the first reaction after identification of non-compliance; nevertheless before being implemented they must be carefully considered, in particular related to: (i) whether the knowledge available provides sufficient ground for the selection of measures to be implemented, (ii) meeting of essential prerequisites for implementation, and (iii) need to avoid potential negative secondary impacts, transfer of impacts, or impacts on remedial activities to be implemented as follow up, if any.

7) The recommendations and procedures presented in this document might be used as an optional framework for the formulation and implementation of remedial programmes, in particular of the medium- and long-term ones.

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