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Marine pollution

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PREFACE

By resolution 34/183 of 18 December 1979, the United Nations General Assembly requested the Governing Council of UNEP to report to it at its thirty-sixth session, through the Economic and Social Council, on the problems relating to marine pollution[1/].

As a response to this request, the Executive Director of UNEP prepared this report which was considered, as document UNEP/GC.9/5/Add.3, by the ninth session of the Governing Council (Nairobi, 13 - 26 May 1981).

The Governing Council authorized the Executive Director of UNEP to submit the report, on its behalf, to the General Assembly, through the Economic and Social Council (UNEP/GC.9/15, Decision 9/10A, paragraph 6).

The Secretary-General of the United Nations transmitted the report to the thirty-sixth session of the General Assembly as document A/36/452.

1/ The definition of marine pollution long employed by the United Nations, as set forth in the General Principles for Assessment and Control of Marine Pollution used at the United Nations Conference on the Human Environment, is "the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water, and

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I INTRODUCTION

1. Problems of marine pollution have not altered greatly in the last decade, but man's perception of them has changed markedly. Improvements in marine environmental quality have been achieved in many coastal areas through pollution control, and severe degradation in some areas has been avoided through the application of stringent restrictions on waste discharges. Regional agreements aiming at the protection of enclosed and semi-enclosed seas, such as the Helsinki, Barcelona and Kuwait Conventions, have entered into force providing the legal basis for co-operation among States on this subject.

2. National priorities have shifted since the 1960s and the early 1970s. The acute energy shortages in many parts of the world have necessitated measures to provide new sources of energy, and these have sometimes introduced new pollution problems, and at other times required relaxation of existing strict regulatory controls.

3. Protection of coastal waters, in particular those in closed and semi-enclosed seas, against environmental damage deserves high priority. The impact on the marine environment of conventional energy sources, for example through the exploitation of different sections of the continental shelf for fossil fuels, the transport of liquid and gaseous hydrocarbons by tanker and pipeline, and the use of coal for thermal power, must be fully understood. The environmental effects of nuclear power reactors located on rivers discharging into coastal waters, constructed on the coast or mounted on offshore structures must be carefully evaluated before construction proceeds, and these impacts should be minimized by careful selection of sites and development of design to incorporate environmental requirements.

4. The main thrust in the 1980s must continue to be towards protection of coastal waters, estuaries and other inland waters, along with restoration of already degraded coastal marine environments. Most of the living resources of the sea are found in these vulnerable coastal zones. Coastal resources could be severely reduced by pollution long before adverse trends can be detected in the open oceans. Human populations are generally growing throughout the world, and pressures on the coastal zones are increasing as a larger proportion of the population moves to the coast. Coastal developments for industry and for human habitation can permanently destroy vital estuarine and inshore coastal habitats for marine organisms. The impact can be especially severe in sensitive coastal ecosystems, such as sea-grass beds, mangrove swamps and coral reefs. Often the effects are of a chronic nature, and their impact can only be assessed after long-term studies.

5. The choice of alternative energy sources may lead in the next decade or two to utilization of the sea as a source of energy. Tidal power is already being harnessed in significant quantities in at least two coastal areas of the world. Preliminary feasibility studies have demonstrated that energy can also be generated by wave action, coastal winds, salinity gradients and vertical temperature gradients. The utilization of marine biomass (large algae) for methane production

6. Finally, the effects of marine pollution on human health and the quality of life must be fully considered. The elimination of possible transmittal of pathogens through sea-water and seafood must receive high priority. The aesthetic quality of coastal waters should not be ignored. Sewage treatment and improved methods of waste disposal into the sea should be introduced whenever necessary to make the use of coastal regions safer for residents and visitors and more attractive for tourism.

II SOURCES OF MARINE POLLUTION AND POSSIBLE TRENDS OF CHANGES IN THEIR OCCURRENCE

7. The chief sources of marine pollution are land-based and may reach the sea through rivers, direct coastal out-falls, coastal urban and agricultural runoff, and precipitation of atmospheric emissions. Pollutants may also be introduced by shipping and by structures such as oil drilling rigs mounted on the continental shelf.

8. Because of the paucity of reliable baseline data on the levels of major marine pollutants in the world oceans, the trend in their occurrence is barely understood. However, intensive regional baseline studies carried out during the last decade in some areas (e.g. the North Atlantic, the Baltic, the Mediterranean) are shedding more light on the situation in the areas studied.

9. The major categories of pollutants which may have a long-term impact on the global oceans are: petroleum hydrocarbons, halogenated hydrocarbons, metals, radionuclides and persistent solids.

Petroleum hydrocarbons

10. Petroleum hydrocarbons reach the sea through various routes, with only a small part of the total coming from ships, even though catastrophic oil spills from large tankers are most dramatic. The total amount of oil introduced into the sea annually has been estimated at 6.113 million tonnes, of which 2.133 million tonnes come from various sources involved in transportation of oil by sea; only 0.2 million tonnes of that is attributable to tanker accidents. Rivers introduce about 1.6 million tonnes annually, while natural seeps are estimated to contribute 0.6 million tonnes of petroleum hydrocarbons annually, the same amount reaching the sea from the atmosphere. The balance of the annual input is contributed by various sources, including coastal refineries and coastal municipal wastes.

11. There has been an increase during the last decade in the amount of petroleum hydrocarbons transported on the world oceans. The number and volume of spills have also grown. Nevertheless, the amount of oil introduced into the oceans in 1980 has probably not increased greatly since the early 1970s.

Halogenated hydrocarbons

12. Halogenated hydrocarbons in the sea originate largely from terrestrial application of chlorinated hydrocarbon pesticides in agriculture and forestry. These synthetic chemicals may reach the sea through agricultural runoff and rivers,

13. In the northern hemisphere, at least at middle latitudes, the use of such halogenated hydrocarbons as DDTs and PCBs was curtailed around 1972 (although other pesticides, e.g. toxephene, have taken the place of DDTs) and they have thus generally shown decreased concentrations in estuaries and coastal waters along the North Atlantic and Pacific during the last decade. Their application in tropical and subtropical areas has, however, not substantially abated, and in the southern hemisphere it has increased, particularly in South America. Therefore, it can be expected that concentrations of these compounds may increase in southern hemisphere and low-latitude northern hemisphere sea-waters.

Metals

14. Pollution by metals arises from various land-based operations such as mining, milling and smelting activities, metal plating and assorted manufacturing processes. Some of the metals may enter the sea through the aquatic route, while a certain proportion reaches the oceans via the atmosphere and is washed out by rain. The amount of iron, manganese, copper, zinc, lead, tin and antimony entering the sea through river discharges is by an order of magnitude higher than the amount discharged through natural geological processes. Smelter emissions may transmit substantial quantities of metals into the atmosphere. The same holds true for coal-burning thermal plants and metallurgical industries. Nevertheless, seawater concentrations of metals in oceanic areas are still regarded essentially as at "background" levels. The problem of mercury is discussed below.

15. Lead is the only metal whose natural geochemical cycling has been clearly altered by man, leading to concentrations of lead in the surface waters of some parts of the oceans at above background levels. The use of tetraethyl-lead as an anti-knock agent in gasoline and the emissions from steel plants have increased the flux of lead to the atmosphere by an order of magnitude (0.44 million tonnes per year) over the natural flux. Other metals may exhibit comparatively high local concentrations in nearshore waters, where there may be industrial or urban sources of these metals, but their global budget has not been significantly altered.

Radionuclides

16. Radionuclides have been reaching the sea through fallout from atmospheric testing of nuclear weapons. The annual deposition of fission products from nuclear tests reached a peak in 1963, but since the partial Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water of 5 August 1963, this source of radionuclides has been steadily declining, although there have been a few small peaks superimposed on the decreasing trend as a result of atmospheric tests of nuclear weapons by countries which were not signatory to the Treaty.

17. Radioactive contributions to the marine environment from peaceful uses of radioactivity have been comparatively small, and reach the sea through rivers or direct coastal discharges. New nuclear power reactors, when operating normally, release little radioactivity into the atmosphere or into nearby waters. Consequently, emissions of radionuclides from nuclear power reactors have not substantially increased during the last decade. However, reactor accidents may lead to unpredictably high releases.

18. Low-level radioactive wastes sealed in containers were dumped in the Atlantic

continued, and is now being conducted under the auspices of the European Nuclear Energy Agency. Ocean dumping of low-level and intermediate-level radioactive wastes from European sources will probably continue under the Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, 15 February 1972 (the Oslo Convention), and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 29 December 1972 (the London Dumping Convention).

19. As plans for new nuclear power reactors are implemented in many countries to supplement existing energy sources, it is expected that the entry of radioactive materials into the sea will increase. Reprocessing of nuclear fuel from power reactors may also add some radioactive materials to the sea.

Persistent solids

20. Persistent solids, such as plastics, may have undesirable ecological effects in the sea and hinder maritime operations. In general, much of the persistent plastics and other litter entering the sea from land-based sources comes from garbage disposal and ordinary human refuse. Solid wastes, of which persistent plastics form only a part, are at present being introduced into the oceans in ever increasing amounts. Approximately 6.4×10^6 tonnes of shipboard litter are discarded annually into the world's oceans. At present, only 0.7 per cent of this litter is plastic. However, plastics production is doubling every 12 years, so that the amount of plastic litter can be expected to increase substantially unless controls are applied.

Other pollutants

21. Nearshore marine pollution problems can also arise from a host of other agents that are not included in the above categories. While having perhaps little impact globally, they can have serious consequences in local areas. These are the materials that normally undergo degradation in the natural marine environment, but are often introduced in such quantities as to exceed the assimilative capacity of the local receiving waters. If there is a continuous discharge of such agents, chronic pollution can arise. These materials can be classified as: