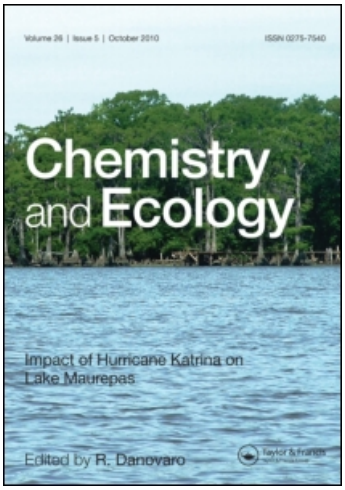

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CONTROL CRITERIA AND ACTIVITIES IN DUMPING MANAGEMENT IN ITALY

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In Italy, two different types of wastes can be dumped in the seas: industrial wastes and dredged material. There are no cases of sludges from urban treatment plants being discharged into the sea.

The sea dumping of harbour dredging sludges is a long standing practice, while the disposal of industrial wastes dates back to 1965.

Two specific laws regulate these two activities, although they do not establish quality standards for the receiving sea environment. Careful evaluation must be made, case by case, of possible effects of discharge with regard to physico-chemical characteristics of materials, to general oceanological characteristics of the dumpsite and to the uses to which such a dumpsite is designated.

The analysis of different cases of industrial waste dumping, carried out at the pre-operational level and during discharge, revealed some potential for negative long-term effects on the sea environment. This, as well as the increasing public sensitivity to environmental problems, led the management agencies in Italy to take several measures aimed to stop all forms of sea dumping of industrial wastes and to revise the general criteria in issuing permits for the discharge of dredged material.

KEY WORDS Dumping, waste disposal, dredging spoils

1. INTRODUCTION

In Italy the disposal of waste in marine waters is regulated by two different procedures according to the discharge modalities.

The disposal of sewage and industrial effluents in marine waters directly from the coast or by outfalls are regulated by law no. 319/1976 (Legge 1976) establishing standards for effluents. The standards for industrial wastes, relating to 51 physical, chemical microbiological and toxicological (acute toxicity test) parameters, are the same throughout the country. As far as sewage wastes are concerned, the standards are established by Regional Authorities. No particular authorization is required for this kind of disposal.

In contrast, the disposal of industrial effluents or dredged materials by barges or ships (in Italy there are no cases of sludge from urban treatment plants being discharged into the sea) is subject to specific authorization by the National Authorities (CITAI, 1978; CITAI, 1980).

The general criteria for issuing the permits, established by two specific laws, are as follows:

Industrial Waste

The sea dumping of effluents of any kind or origin is prohibited:

– if technically viable alternative treatment or land disposal facilities exist;

– if they contain substances indicated in Annex 1 of the London Dumping Convention (unless such substances can rapidly be rendered harmless at sea by physical, chemical or biological processes) (IMO, 1982);

– in the case of products or substances listed in the EEC Directive no 78/319 and classified as "toxic and noxious", either in single cases or cumulatively, if they exceed a predeterminated concentration (EEC, 1978);

– if it causes physical, chemical or biological changes in the sea environment such as to upset ecological equilibrium or to preclude the legitimate use of the sea.

Dredged Material

It is prohibited to dump any materials in areas:

– if intended to be used for farming edible species of fish and shellfish;

– where the operation could interfere with commercial and recreational shipping;

– where there is particular cultural, biological and scientific interest;

– where waste dumping could cause temporary changes in water quality such:

* that the initial water conditions cannot be restored within an acceptable period of time (hours);

* as to produce significant increases in pollutant concentrations (or so as to have a detrimental effect) along the coasts or in protected (or specially sensitive) sea areas.

2. EVALUATION CRITERIA AND ENVIRONMENTAL ASSESSMENT METHODS

Since there is no mention in the existing legislation of quality standards for the receiving sea environment, a careful evaluation must be made, case-by-case, of the possible effects of the discharge with regard to the physico-chemical characteristics of the materials, to the general oceanological characteristics, as well as to the present and future use of the receiving site. (Figure 1).

According to the national regulations, the Minister for the Environment is responsible for issuing dumping permits, while the technical and scientific evaluation of impact on the environment and monitoring is entrusted to governmental scientific agencies having nationwide responsibilities, such as the Water Research Institute of the National Research Council, and the National Institute of Health and the Central Hydrobiology Laboratory of the Ministry of Agriculture and Forestry.

The technical and scientific evaluation is carried out in two stages: at the pre-operational level and during discharge.

2.1. *Pre-operational Level*

A preliminary evaluation of the characteristics of the areas to be used for discharge and of the materials to be discharged should be made.

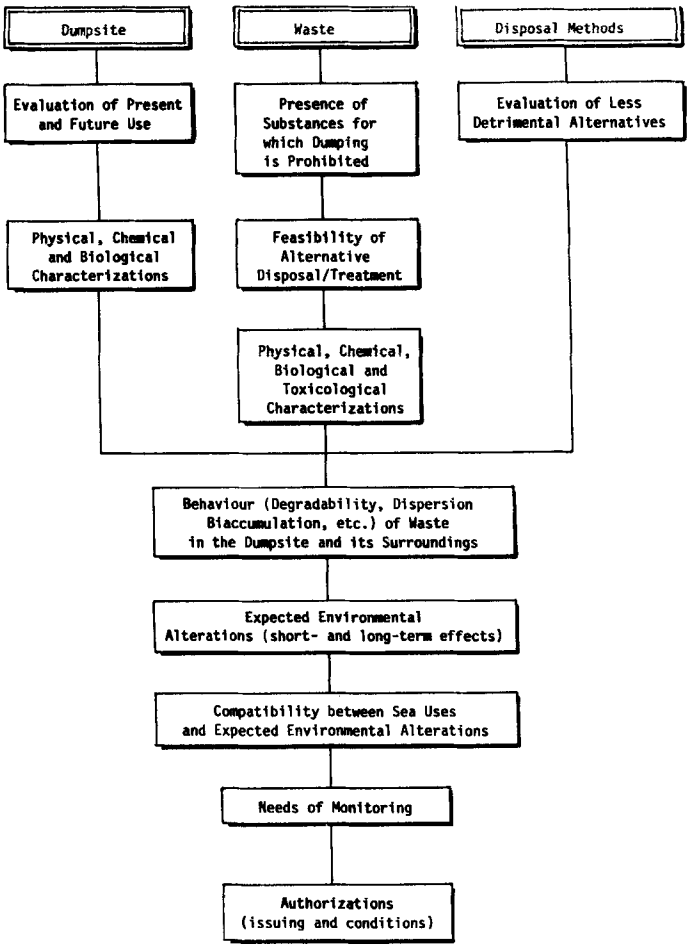

Figure 1 Scheme of the operational procedures for issuing dumping authorizations in Italy.

The discharged site is classified on the basis of its fundamental oceanological characteristics as inferred from the data in the relevant literature. These data are normally available on sufficient scale and, when needed, can also be obtained by surveys commissioned to gather more detailed information about the discharge site at a local scale.

A complete physico-chemical analysis is made of the waste to be dumped, with special reference to the elements and substances listed in the London Dumping Convention (particularly heavy metals) and listed in annexes 1 and 2 thereto, as well as of any other chemical element likely to have an undesirable effect on the environment (i.e. nutrients in potentially highly trophic areas).

In the specific case of dredged materials, analysis is extended also to include micro-organisms indicative of faecal contamination and/or pathogens.

Another important discharge evaluation criterion is the acute toxic effects that dumping can have on marine life. In general, individual discharges are deemed

acceptable when:

– the materials involved are not classified as toxic according to the GESAMP standards (LC_{50} (96h)<100 ppm) (GESAMP, 1982);

– it can reasonably be assumed that the immediate dilution achieved at the time of discharge is such that the prescribed safety limits are not exceeded either by individual components of by the discharge as a whole.

2.2. *Environmental Surveying and Monitoring of Ongoing Discharges*

In the last 15 years, more than 60 research and monitoring cruises were performed at the different Italian dumpsites.

These field surveys have had two separate and complementary aims:

a) to ascertain both the dilution undergone by the waste and its components in time (minutes and hours) immediately following the discharge operation and the effects of discharge on the phyto- and zoo-planktonic communities;

b) to ascertain the spread of the dumped waste within the receiving basin (water and sediment) and to investigate the effects produced on the main structural and functional characteristics of the biological components of the marine ecosystem (plankton, benthos and demersal fish populations).

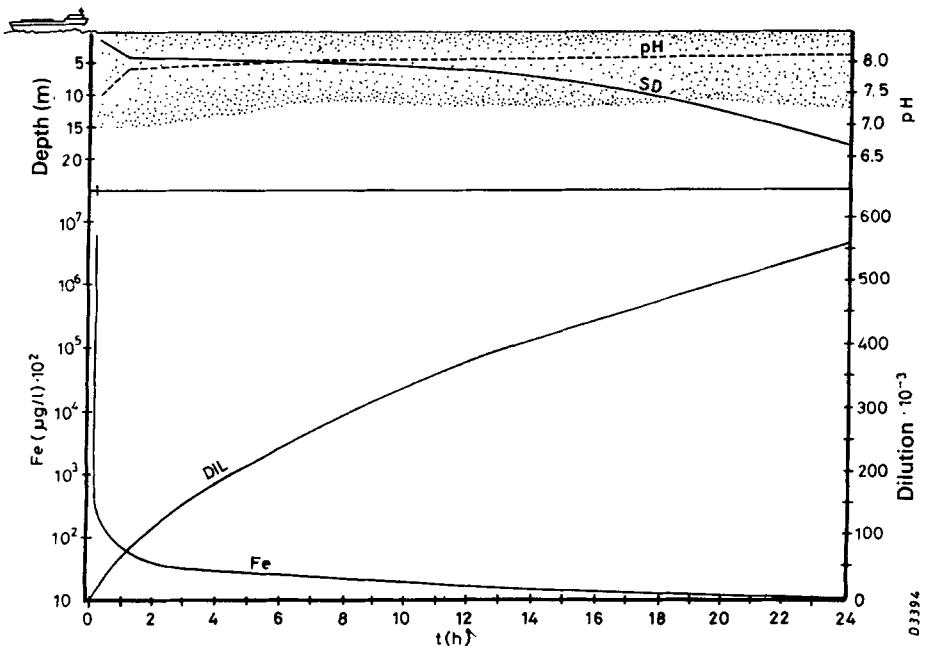

Figure 2 Dumping of acid ferrous wastes from TiO_2 manufacturing plant. Mean dilution and Fe concentration following discharge at the time of surface water stratification in summer. Dotted area show the sinking depth of wastes. SD indicates the Secchi disk transparency.

With regard to (a), in order to ascertain the immediate dilution, investigation was carried out in the wake caused by the moving ship (Figure 2).

This kind of examination was carried out by taking successive samples of water and phytoplankton at different depths, together with zooplankton samples.

In this way, it was possible not only to trace the dilution dynamics of the dumped waste, but also to relate this to observations made on organisms (e.g. structure and abundance of phyto- and zooplanktonic populations, primary production, presence of morphologically modified biological specimens, etc.).

This type of analysis was carried out also in the case of dumping from barges with trap-door bottoms, but it was not applied to deep discharges using flexible hoses.

With regard to (b) above, the large scale effects were investigated at a network of stations selected to monitor the dispersion of materials and its effects on the biota over a large geographic area.

Within this network, seasonal or yearly determinations were made of the physico-chemical characteristics of the water (at different depths (Figure 3) and of the phyto- and zooplankton populations.

In the case of sea dumping of insoluble particulate matter likely to form deposits at the sea bottom, additional surveys were carried out to measure the size and thickness of the deposits, the chemical alterations occurring in the upper layer of the sediments (Figure 4), and any effects produced on the characteristics of the benthic biocoenoses.

In the case of large scale textural changes in the sediments, this type of investigation has sometimes revealed the existence of a parallel change in benthic

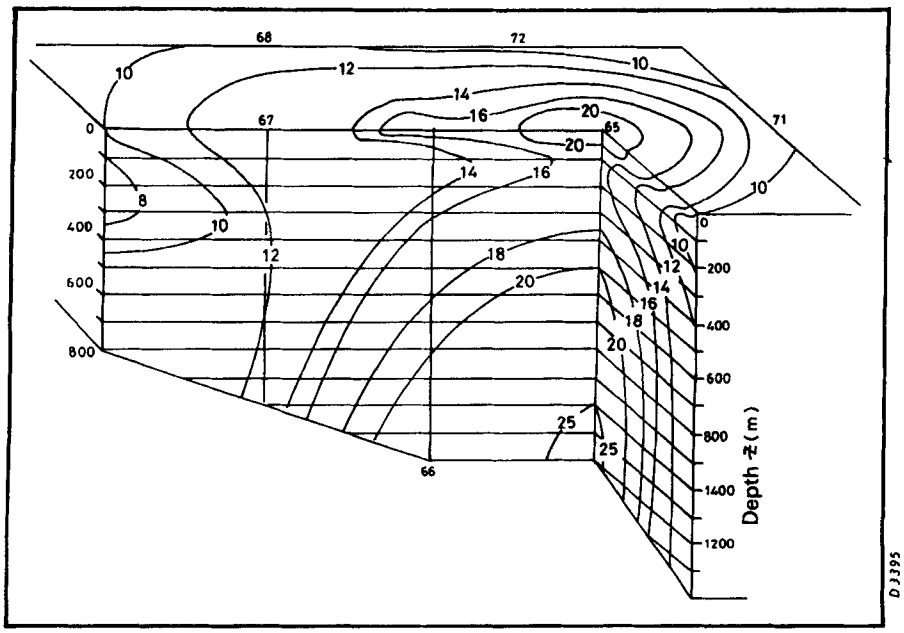

Figure 3 Dumping of neutralized waste from TiO_2 manufacturing plant. Isopleths show the mean values of total Fe (μg/l) between 1982 and 1985 on the surface and at different depths.

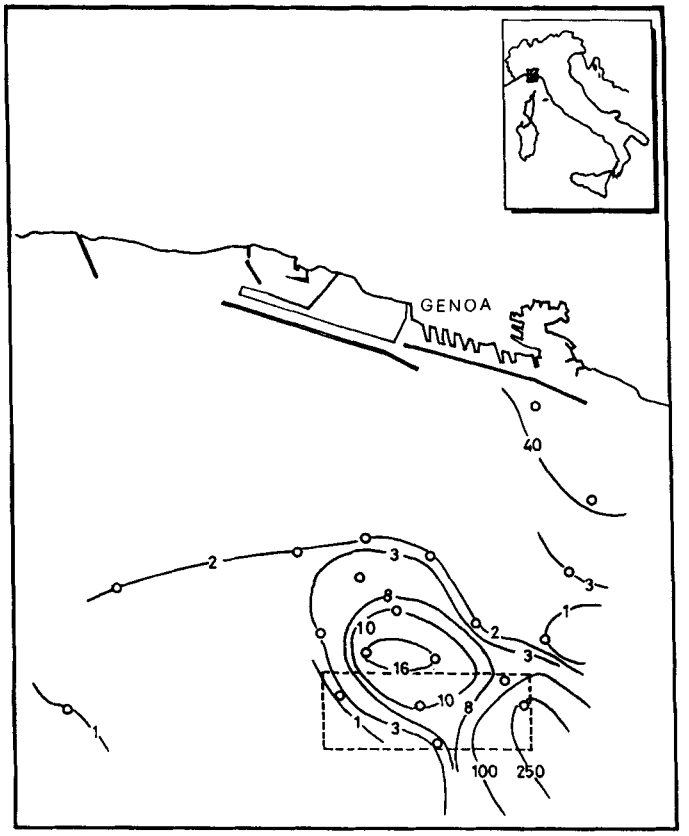

Figure 4 Dumping site of effluents from chromium mineral treatment industry and dredged materials. Isopleths show the behaviour of the "enrichment factors" of a pool of analyzed metals (Fe, Ti, Ni, Cr, Zn, Pb, Cu, Cd, Hg) in surface sediments at the outlined dumpsite and its surroundings. "Enrichment factors" represent the sum of the ratios found between values and background levels for the different metals in the investigated area.

population structure due, for example, to the enrichment of fine particulate matter on the sea bottom.

A further step in the evaluation of the effects of dumping on the receiving environment is the study of bioaccumulation phenomena. The method used varies according to the characteristics of the dumping area and the nature of the waste dumped.

In the case of discharges accumulating at the sea bottom, the study was extended to include also benthic organisms, with special reference to those of commercial interest. In the case of operations carried out in deep waters, the analyses were preferably performed on zooplanktonic or micronectonic organisms, which tend to absorb or incorporate the substances contained in the waste during their typical vertical migrations.

3. USE OF RESULTS FOR DECISION MAKING

The criteria and experimental procedures described above have been applied to several cases of sea dumping in the following types of waste:

A—waste from titanium dioxide manufacturing plant (Panella, 1974; LCI/MAF, 1986a)

B—waste from phosphorus fertilizer and hydrofluoric acid production (LCI/MAF, 1987)

C—sludge from chromium mineral treatment (LCI/MAF, 1985)

D—alkaline sludges from aluminium manufacturing plants (LCI/MAF, 1982)

E—effluents from a caprolactam manufacturing plant (LCI/MAF, 1986b)

F—dredged material derived from many Italian harbours. (LCI/MAF, 1986c)

With regard to quantity, in 1988 about 3 million cubic metres of dredged materials were discharged, while the maximum quantity of industrial waste dumped was reached in the first years of the '80s (about 2.4 million tons).

The results obtained in several instances revealed the existence of some potential for negative long-term effects on the sea environment indicating that measures should be adopted in order to minimize risks for the receiving environment. These measures concerned the modification of the manufacturing processes, setting up new waste treatment/disposal systems and selection of less detrimental disposal methods.

In detail, the following examples illustrate measures undertaken in relation to the different wastes listed above.

- Case A: land disposal of ferrous sulphate, neutralization of free acidity and disposal of resulting sludges at a depth of 100 m below sea surface. With regard to this kind of waste, the Italian Authorities enacted the provisions of EEC Directives no 176/1978 and 883/1982.
- Case B: reuse in the form of building materials using phosphogypsum produced by hydrofluoride minerals.
- Cases C and D: selection of new dumpsites with a higher potential receiving capacity (for both C and D) and disposal of waste at a depth of 100 m below surface (D).
- Case E: establishing procedures for treatment on land.
- Case F: use of dredged sediments as building material for new structures in harbours (i.e. docks).

4. THE PRESENT STATE AND THE OUTLOOK FOR THE FUTURE

Increased public sensitivity to environmental problems and above all the concern over the potential for long-term negative effects of dumping (although not easily quantifiable) in the marine environment has led the environmental agencies to take measures aimed to stop sea dumping of all forms of industrial waste.

By the end of 1988, no kind of dumping of industrial waste was licensed in Italy. Even if a specific law banning the dumping is not yet promulgated, it is likely that no permits will be issued in future for dumping industrial waste.

The discharge of dredged materials represents at the moment a real problem in Italy, considering the quantity of materials to be disposed of, the level of contamination reached in some cases by such materials and, finally, the specific characteristics of the Mediterranean Sea.

A revision of the general criteria for the management of this kind of discharge is underway.

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