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THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY'S ROLE IN CONTROLLING AQUATIC DEBRIS

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Unightly and environmentally damaging debris is an ever present problem for waterways and beaches around the world. This debris has numerous sources, and is comprised of materials ranging from metal and wood to plastics and paper. The aesthetic, economic, and environmental impacts of debris have been well documented over the past several years. In an effort to control the release of trash and debris into our waters, there are many activities ongoing in the US. One such activity is a coordinated effort between the US Environmental Protection Agency (EPA), other federal Agencies (National Oceanic and Atmospheric Administration (NOAA), United States Coast Guard (USCG), United States Navy (USN), National Park Service (NPS), Department of Interior (DOI)), industry (the Society of the Plastics Industry, INC. (SPI)), environmental, and local groups. This paper describes the results of field assessments, and the other activities undertaken by EPA as part of this coordinated effort to control the release of debris to our nation's waterways.

KEY WORDS: Debris, EPA, beaches, waterways

INTRODUCTION

Plastic debris in the marine environment is a serious problem. Previously, plastic and other forms of litter on the beaches was regarded solely as an eyesore, unpleasant to look at but harmless in its impact. In an EPA Report to Congress (1990b), however, plastic debris in the marine and other aquatic environments is described as a significant environmental problem. Wildlife is being strangled and starved to death by floating plastic (NOAA, 1988; EPA, 1990b); coastal economies are having to cope with lost revenue resulting from beach closures (NOAA, 1988; EPA, 1990b); fishermen are losing hundreds of thousands of dollars annually to expensive repairs to propellers and engines fouled by plastic debris (NOAA, 1988; EPA, 1990b). The threat to wildlife, especially endangered species, is the most disturbing environmental impact of aquatic debris.

Studies show that mortality due to entanglement in marine debris of northern fur seals is contributing significantly to a declining trend of the population on the Pribilof Islands (Fowler, 1987) and that five species of sea turtles, all of which are threatened species, ingest plastic articles which can lead to blocked intestines and painful ulcers (Balazs, 1985). At least 50 species of sea birds are known to ingest plastic debris (Day *et al.*, 1985) and many other studies and reports exist which reveal similar impacts on wildlife encountering debris in the aquatic environment.

Aquatic debris is a problem with no geographical boundaries. Although various countries have had a more publicized problem, persistent aquatic debris can be found on just about every coast and waterway in the world. This ubiquity of aquatic debris combined with its deleterious impact on wildlife provide two of the most significant motivators behind US Government efforts to control aquatic debris.

Coordinated US efforts to mitigate aquatic debris really took form after the release of a report by the Interagency Task Force on Marine Debris. This task force, formed by the White House Domestic Policy Council and chaired by NOAA, was convened to assess the problem and the need for research.

The Final Report of the Interagency Task Force on Persistent Marine Debris (NOAA, 1988) describes the potential sources of marine debris, and separates these sources into two categories: ocean-sources and land-based sources. Ocean sources include commercial fishing vessels, recreational boating, merchant vessels, cruise ships, military and research vessels, and offshore oil rigs and supply vessels. Land-based sources include plastic manufacturing and processing activities, combined sewer overflows (CSOs) and sewage treatment plants, solid waste management practices, and litter. The report then discusses existing authority to address specific sources of debris. The Task Force report also includes recommendations for potential reduction measures that the United States Government should focus efforts on. The recommendations are:

1. Federal agencies should provide leadership and continue formal and informal coordination activities related to marine debris with international, state, and local governments.
2. Federal agencies should develop comprehensive educational materials on problems caused by marine debris and ways to solve them.
3. Various Federal agencies should work towards implementation of the Marine Plastic Pollution Research and Control Act and other laws to reduce plastic pollution in the marine environment.
4. Federal agencies should carry out research to identify deleterious effects of marine debris, identify land-based sources and assess potential impacts of by-products from degradable materials.
5. Federal agencies should encourage coordination with Governmental and public agencies to remove marine debris from beaches and other parts of the marine environment and conduct systematic monitoring.

EPA and other agencies have taken action to implement these recommendations. Several existing statutes provide EPA with the authority to address certain sources of debris. Other sources which cannot be specifically approached under legislative authority have also been addressed by EPA through research and educational efforts.

The approach includes several field assessment studies designed to collect data describing the types of debris present on beaches and floating in US waters, and to characterize the debris from specific sources such as CSOs and storm sewers. These characteristics will help EPA to control the release of debris from these sources. A statistically designed beach debris sampling program is also being developed and tested to monitor trends in beach debris. This statistical beach sampling will supplement the national volunteer beach clean up which is co-sponsored by EPA.

The EPA program also includes other activities such as industry coordination efforts, public education efforts (including preparation of a school curriculum),

regulation development and enforcement (including a Bay Keeper programme). Many of these activities are being conducted in cooperation with other Agencies with the hope that by combining limited resources, the release of debris to the environment can be controlled, and our beaches and waterways can be kept clean.

Some of EPA's activities under specific legislative authority are briefly described below.

These legal instruments are:

1. Marine Plastic Pollution Research and Control Act, 1987
2. Shore Protection Act
3. Clean Water Act
4. Marine Protection Research and Sanctuaries Act

MARINE PLASTIC POLLUTION RESEARCH AND CONTROL ACT, 1987

The Marine Plastic Pollution Research and Control Act (33 U.S.C. 1901 *et seq.*) (MPPRCA) contains several sections pertaining to plastics and marine debris. Some of the activities being carried out by EPA under the requirements of MPPRCA are described below:

Public Awareness/Citizen Monitoring

EPA is working with NOAA, the USCG and other Agencies in developing citizen monitoring/cleanup patrols and a public awareness programme on marine debris (EPA, 1990b; Cottingham, 1988). Examples of activities within this program include: financial support of the "Coastweeks" national beach cleanups organized by the Center for Marine Conservation (CMC) and of a national marine debris information office operated by CMC (CMC, 1990a; O'Hara, 1989); funding for a PSA featuring the cartoon character Popeye alerting boaters of the potentially harmful effects of trash thrown overboard (CMC, 1990b); development of a grade school curriculum that educates about the types, sources, and effects of marine debris and encourages individual and group prevention efforts; development of methods for statistical volunteer cleanup efforts; and creation of a Pilot Beach/Bay Keeper in Annapolis, Maryland.

New York Bight Restoration Plan

A New York Harbor Floatables Action Plan (EPA, 1989a) was developed as part of the New York Bight Restoration Plan. This Floatables Action Plan describes the routine and responsive monitoring and cleanup activities that will occur in New York Harbor to remove floating debris that may cause environmental, aesthetic, or economic damage.

EPA has prepared a Report to Congress on plastics in the New York Bight (EPA 1989c) describing (1) the types and sources of floatable debris; (2) the fate of floatable material; (3) the effects of floatable debris on the environment and on commercial and recreational activities; (4) control programs; and (5) recommendations for research, monitoring, and control.

Methods to Reduce Plastic Pollution

Report to congress: EPA prepared a report to Congress (EPA, 1990b) which includes discussion of:

1. the sources, fate and effects of plastics in the marine environment;
2. an evaluation of potential solutions such as source reduction, use of degradable plastics, recycling, and substitution; and
3. recommendations for action, such as:
 - EPA will ensure that all permits for CSO discharges include technology-based limitations for the control of floatable discharges.
 - EPA recommends that Federal and State agencies should enter into agreements with the US Coastguard to enforce Annex V of MARPOL.
 - EPA will continue to work with NOAA and other Federal Agencies to distribute educational materials to consumers on marine debris.
 - EPA will provide technical assistance and general information to the public on plastics recycling, will examine potential incentives and disincentives to recycling, and will call on the plastics industry to continue to research and provide technical and financial assistance to communities on plastics collection, separation, processing and marketing.

Field studies

In assessing the potential sources and fate of plastics for this report to Congress, EPA has funded several field investigations. One series of studies has been the CMC beach cleanups previously mentioned. The data collected during the cleanups will help to determine the distribution of plastic articles on our nation's beaches and will be useful in determining which items are most prevalent and where EPA must focus more effort. These data will also be a useful baseline in estimating the effect of the US regulations to implement MARPOL Annex V and other mitigation efforts. Future beach surveys will continue to be used in an attempt to indicate trends and possibly show the effectiveness of the new controls on shipboard sources of plastic debris.

In an effort to provide beach cleanup data with more statistical validity, EPA is developing standard data collection protocols to be used by cleanup volunteers. These methods will include the use of a manual outlining debris collection procedures and criteria (e.g. standard survey area is 500m in length), and identifying specific debris items with photographs. Use of standardized procedures will help prevent problems such as volunteers identifying the same item differently. These developments, however, may not alleviate the problem of determining which plastic articles found on beaches come from shore based sources versus vessels.

EPA has also conducted field investigations of the specific items comprising the floating debris in several US harbours to determine the variability of plastic items in these inshore waters and to assess the harbours as potential sources of debris to other coastal areas. Harbours surveyed include: Boston, New York, Philadelphia, Norfolk, Houston, Baltimore, Miami, Seattle, Tacoma, San Francisco, Oakland, and Puerto Rico. These surveys were conducted by towing surface nets through slicks of floating debris and then sorting, identifying, and counting the contents. Plastic items 0.3 mm and larger were studied, yielding information not only on the larger plastic items readily observed on beaches, but also on the smaller plastic pellets which are not so obvious to a casual observer. The final EPA report of some

of these surveys has been recently completed (EPA, 1990a). Findings of these surveys indicate that the presence of certain plastic items can be directly linked to the presence of CSOs where storm water and street runoff combine with sewage at times of heavy rain, and are discharged directly into receiving water.

A wide variety of floatable debris was found during this study. Many items, such as plastic buckets, glass marbles, etc., were found only once or twice. There were, however, a total of 26 items that were found in all cities surveyed. Seven of these 26 were items of concern because they pose risks to marine life or human safety or cause aesthetic or economic damage (EPA, 1990a). These items included plastic pellets/spherules, plastic bags, plastic filaments, rope lengths less than 2 feet, and two types of polystyrene spheres.

Sewage, medical, and drug related debris was found to be most abundant in several cities. Cities with greater than 0.25% (by number) items of sewage-related debris were New York, Boston, Philadelphia, and Baltimore. These cities, do not have upgraded CSO systems, and raw sewage discharges into the harbours are common. A possible explanation for the higher percentage of sewage, medical and drug related items could be periodic CSO and storm sewer discharges.

The apparent correlation between certain debris items and the presence of CSOs is the basis for an ongoing study in which the materials released from several of the CSOs in two cities, Philadelphia, PA, and Boston, MA, are being identified and quantified. To do this, EPA placed nets around the outfalls from selected CSOs in these cities (May–June 1989) to collect the materials discharged from the system during dry weather and during rainy conditions. The results of this study will directly address CSOs as a source of debris. Storm drains were also sampled during this study to determine their contribution to marine debris.

EPA also sampled floatables in several sewage treatment facilities in these cities to determine the composition of debris entering treatment facilities that could be released to the environment during CSO events. This information will also be used to describe how well various technologies remove debris from incoming waste water. For example, in the three Philadelphia facilities sampled, bar screens removed almost 100% of the tampons from the influent water but virtually none of the tampon applicators, which were removed by the subsequent scum removal. The bar screens also did not remove syringes whereas the scum skimming process did remove them. This shows that bar screens alone are not effective at removing tampon applicators or syringes and are thus not an appropriate mechanism to remove these items from wastewater.

EPA has initiated another field study designed to trace the loss of plastic pellets, the raw form of plastic used by manufacturers, into the environment. This study is being coordinated with the Society of the Plastics Industry, Inc., and involves observing and defining the pellet handling process from the point of manufacture through transportation and use. Points in the process where pellets are lost to the environment are being documented. These observations will aid in the determination of how and why pellets are released into the environment and will be used to recommend control measures. Site visits have been conducted to facilities manufacturing pellets, to facilities transporting and repackaging pellets, and to facilities using pellets to produce goods.

SHORE PROTECTION ACT

The Shore Protection Act (33 U.S.C. 2601 *et seq.*) provides for controls on operations relating to the vessel transport of certain solid wastes (i.e. municipal or commercial waste) so that these wastes are not deposited in coastal waters.

EPA is developing guidance with the USCG to minimize deposition of solid wastes into coastal waters during loading, transporting, or unloading. A permit and enforcement program was developed by the Department of Transportation (DOT) such that all vessels transporting solid wastes would require a permit from the US Coast Guard. It is estimated that about 400 vessels will need permits (i.e. about 100 in New York harbour area and 300 in the Gulf of Mexico, plus a few in other locations).

Under this Act, EPA is also preparing a report to Congress describing the need and effectiveness of a tracking system for vessels transporting wastes in US waters. Such a tracking system could be used to monitor the movement of wastes in US waters and provide the Agency with a mechanism for assuring that no wastes are illegally discharged.

In New York harbour, an area where large volumes of trash are transported by barges, the State and City of New York have strengthened the requirements for trash barges. The implementation of these requirements are helping to minimize the loss of trash during the marine transport process. The new requirements include:

1. limitations on load heights in barges;
2. the placement of booms around marine transfer facilities;
3. the use of scavenger vessels at marine transfer facilities to collect trash which falls into the water;
4. the use of covers over barges to keep trash from blowing off.

CLEAN WATER ACT

As amended by the Water Quality Act of 1987, the Clean Water Act (33 U.S.C. 1251 *et seq.*) requires EPA to establish regulations which treat stormwater and CSOs as point source discharges which must be regulated under the National Pollutant Discharge Elimination System (NPDES). Accordingly, EPA has issued a regulation for stormwater (EPA, 1990c) which requires municipalities with populations of 100,000 or greater, and many industrial facilities, to obtain NPDES permits to discharge stormwater. The permits will prohibit non-stormwater discharges into storm sewers, while leading to improved control techniques and best management practices. The best way for municipalities and industries to meet the stormwater regulation and protect the quality of our waters is to prevent floatable pollution before it washes into the storm sewers.

Under the same Water Quality Act, EPA issued a "National CSO Control Strategy" (EPA, 1989b) which also treats CSO discharge points as individual point sources, subject to NPDES permit requirements. The EPA Strategy sets forth three objectives:

1. To ensure that all CSO discharges occur only as a result of wet weather,
2. To bring all wet weather CSO discharge points into compliance with the technology-based requirements of the Clean Water Act and applicable State water quality standards, and

3. To minimize water quality, aquatic biota, and human health impacts from wet weather overflows that do occur.

EPA's "National CSO Control Strategy" confirms that CSOs are point sources independent of the publicly owned treatment works (POTW) and reaffirms that both technology-based and water quality-based requirements apply to CSOs. The Strategy also emphasizes that CSO point sources which are discharging without a permit are unlawful and must be issued permits or be eliminated. Additionally, the Strategy requires that all CSOs be identified and categorized according to their status of compliance with regulations. There are about 1200 combined sewer systems in the United States serving an estimated population of 43,000,000.

Pursuant to the EPA Strategy, most States have begun developing State-wide strategies complete with measures to ensure that the most severe CSO discharges are eliminated first. CSO discharges to marine and estuarine waters are given highest priority. By controlling the effluent from CSOs and storm drains, the Agency hopes to curtail significantly the discharge of sewage, sewage related plastics, and street litter into the marine environment at times of heavy rain.

MARINE PROTECTION RESEARCH AND SANCTUARIES ACT

The Ocean Dumping Regulations (40 CFR parts 220–229), which implement the Marine Protection, Research and Sanctuaries Act (33 U.S.C. 1401 *et seq.*), were promulgated in 1977. These regulations prohibit the transport for the purpose of dumping into the ocean of any "Persistent inert synthetic or natural materials which may float or remain in suspension in the ocean in such a manner that they may interfere materially with fishing, navigation, or other legitimate uses of the ocean". Activities involving transport of material for the purpose of disposal at sea are regulated under this Act, and permits granted by the Agency prohibit the dumping of floatable plastics. Any unauthorized activity involving the transport of any material including floatable plastics or debris out to sea for the purpose of dumping, is subject to the fines and penalties described under the Act.

Under this authority, EPA Region II initiated an enforcement action against three municipalities and a sewage sludge transporter for the disposal of sludge containing plastics at the 106 mile sewage sludge disposal site. The Agency received a total of \$25,000 in fines for this violation of the MPRSA.

CONCLUSION

There is no doubt that beaches receive tons of unsightly and ecologically harmful debris each year. What this says about the current state of our planet's waterways is not encouraging. This debris is not only aesthetically unpleasant and financially damaging but also threatens wildlife, including some endangered species. EPA recognizes the serious environmental costs of aquatic debris and is working to address the problem.

EPA's long-term solution to this problem is to control non-degradable debris before it becomes aquatic debris, that is to control it at source. Efforts should continue to move towards source reduction and recycling as well as general forms of pollution prevention. These efforts must simultaneously involve industry, waste

transport and disposal companies, all levels of Government, and consumers. Education about the problem also needs to be a vital component of control or prevention efforts. It will be necessary not only to create an awareness of the impacts of aquatic debris but also to provide information on the concrete ways individual citizens can become part of the solution.

As demonstrated by recent international conferences addressing the issue, efforts to control the release of aquatic debris are underway in the United States and in other areas of the world (Shomura and Yoshida, 1985; Shomura and Godfrey, 1990). As awareness to the problem grows, so does the support of programmes and organizations working towards a solution. In the US, this growth of support is indicated by the increased volunteer participation which has occurred every year at the "Coastweeks" National Beach Cleanups. National beach cleanups in the US are also gaining worldwide recognition. This is encouraging for it depicts an emerging interest of other nations to control and deal with the aquatic debris problem.

The nature of aquatic debris and its many different sources necessitate a coordinated worldwide action if truly effective solutions are to be achieved. All Federal, State, and local agencies should continue to combine and coordinate efforts and to educate the public further on pollution prevention techniques. Working together, perhaps we can build a world ethic that will help restore and preserve water resources for the enjoyment of present and future generations.

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