

ESTIMATES OF OIL ENTERING THE MARINE ENVIRONMENT IN THE PAST DECADE: GESAMP WORKING GROUP 32 PROJECT

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ABSTRACT: *The Joint Group of Experts on the Scientific Aspects of Marine Protection (GESAMP) Working Group on Estimates of Oil Entering the Marine Environment: Sea Based Activities (Working Group 32), began meeting at International Maritime Organization (IMO) headquarters in London in November 1997 to discuss a new approach to evaluating all available data sources on the input of oil into the marine environment from sea-based activities. The group will collect and analyze data on oil inputs over the last decade from shipping (tankers and other vessels), off-shore and coastal exploration and production, pipelines, atmospheric emissions from sea-based activities, coastal refineries and storage facilities, oil reception facilities, materials disposed of at sea, and natural seepage.*

The group, sponsored by the United Nations, IMO, United Nations Environment Program, Food and Agriculture Organization, United Nations Educational Scientific and Cultural Organization, World Health Organization, World Meteorological Organization, and International Atomic Energy Agency, will compare its oil input estimate model to estimates made by GESAMP in previous decades to determine if there have been significant reductions in oil input in order to evaluate the efficacy of IMO conventions and other pollution reduction efforts in the past decade. The group will consider the amounts of oil entering the sea through operational and

accidental spillage in relation to the quantities of oil transported by ship and through pipelines, and in relation to off-shore and coastal oil production. The group will also consider temporal and spatial variability in oil inputs, as well as evaluate the accuracy of input estimates. These results will be presented in the poster presentation

Introduction

In November 1997 the GESAMP Working Group on Estimates of Oil Entering the Marine Environment: Sea Based Activities met at IMO Headquarters, London, U.K.. GESAMP Technical Secretary Manfred Nauke noted that after the publication in 1993 of GESAMP's study *Impact of Oil and Related Chemicals and Wastes on the Marine Environment*, IMO's Marine Environment Protection Committee (MEPC) had requested GESAMP: to carefully evaluate all available data sources of input of oil into the marine environment from sea-based activities, i.e., those related to shipping and off-shore activities; to develop approaches that might be used for the provision of input data; and to focus particularly on estimates of oil entering the marine environment from transportation sources as a test of the efficacy of IMO conventions on the prevention of marine pollution and safety of life at sea.

Previous estimates made by the U.S. National Academy of Sciences (Figures 1 and 2) were based on the assumption that ships flying the flag of or registered in a state party to MARPOL 73/78 do fully comply with the requirements of that Convention and the MEPC was concerned that there was sufficient error inherent in this assumption and in other oil input estimations that the data and data collection methodology should be re-evaluated and new estimates of oil input should be calculated.

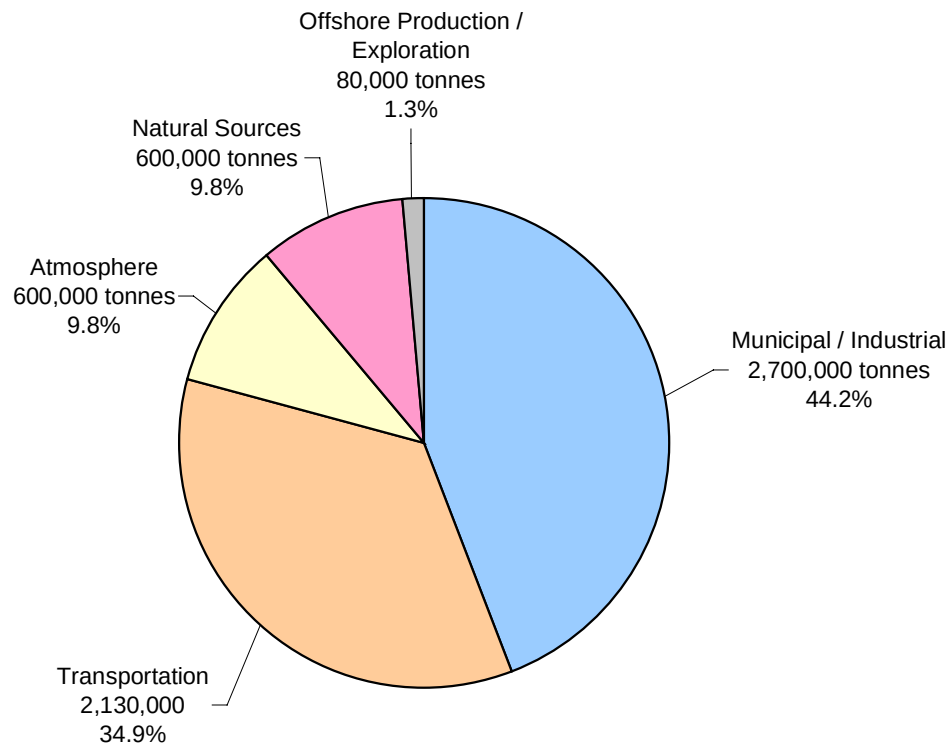


Figure 1. 1973 Estimated annual input, total: 6,110,000 tonnes, Source: National Research Council 1975

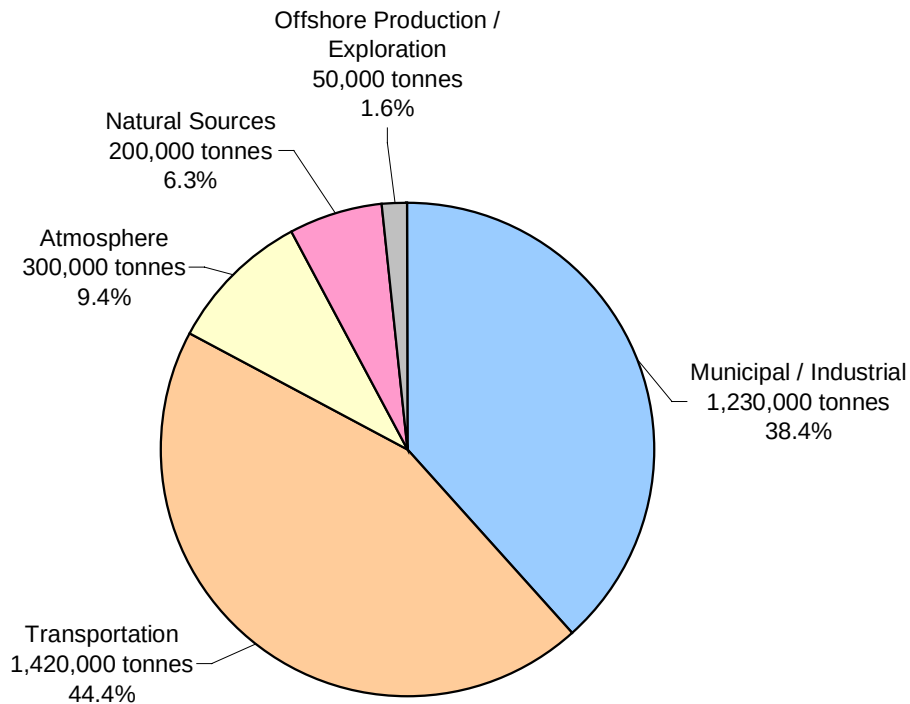


Figure 2. 1981 Estimated annual input, total: 3,200,000 tonnes, Source: National Research Council 1985

The group also agreed to consider the amounts of oil entering the sea through operational discharges and accidental spillages in relation to quantities transported or in relation to off-shore and coastal oil production.

Discussion

The group determined the overall scope of its task to be: to estimate current annual inputs of oil entering the marine environment from sea-based activities, taking into account that: oil would be defined as in Annex I of MARPOL 73/78 Regulation 1 and Appendix 1; sea-based activities would include all forms of shipping, especially oil tankers and carriers, other commercial and non-commercial ships, off-shore and coastal exploration and production, marine pipelines, atmospheric emissions from such sea-based activities, coastal refineries and storage facilities, materials disposed of at sea; and natural oil seeps; the annual input estimates would consider both historical and extant data, and the measurement and statistical uncertainties of making such estimates; and the annual input estimates would consider the amounts of oil entering the sea through operational discharges and accidental spillages in relation to quantities transported by ships and pipelines, or in relation to off-shore and coastal oil production, and related industrial operations. The group agreed to focus primarily on improving the estimates of oil entering the marine

environment from transportation sources, as one test of the efficacy of Annex I of the MARPOL 73/78 Convention, and others where appropriate, pertaining to the prevention of marine pollution from oil, and the safety of life at sea.

The group agreed to: determine the sources of oil that should be evaluated; determine the availability of data, information, and expertise needed to carry out quantitative estimations authoritatively; consider novel approaches (e.g., oil accounting before and after shipment; monitoring of tar balls or dissolved hydrocarbon levels) and models for the estimations; consider the challenges in developing estimates in some categories; consider specific questions posed by the task, such as: How variable are the oil sources, temporally and spatially? Can trends in oil inputs be reliably determined, particularly from operational discharges and accidents? Are some input types impossible to estimate with accuracy (e.g., discharges from non-tankers, overall losses from tankers)? Can accurate total annual inputs be predicted?

The group agreed to use the list of transportation sources as set out in the previous evaluation carried out by the United States Academy of Sciences in 1990 (Figure 3) as follows: operational discharges from oil tankers; dry docking; marine terminals, including bunkering operations (accidental spillages); bilge and fuel oil from all ships; accidental spillages (tanker and non-tanker accidents); and scrapping of ships.

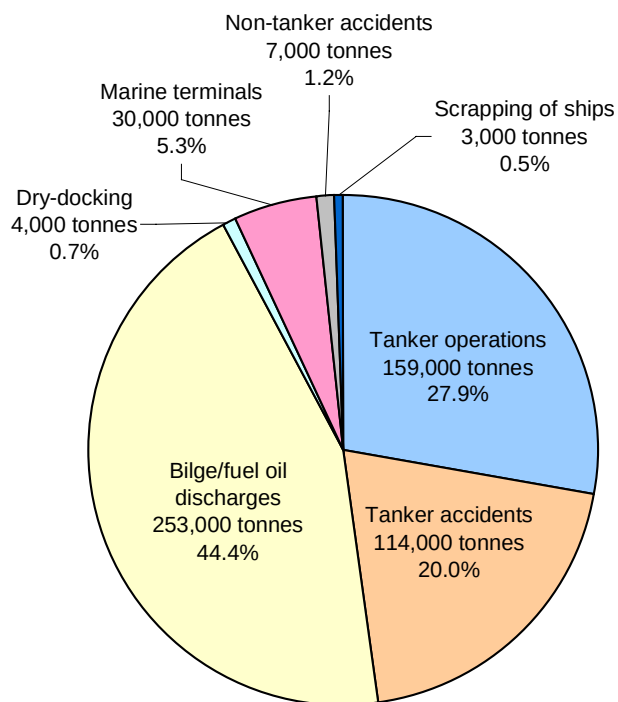


Figure 3. 1989 Estimated annual input from marine transportation, total: 570,000 tonnes, Source: IMO 1990

In considering the above study, the group acknowledged that even ships registered in States party to MARPOL 73/78 face problems in effectively complying with MARPOL 73/78 requirements due to the lack of appropriate reception facilities in many countries, enforcement measures, and adequate training of many ships' crews.

The group also identified a number of assumptions made in evaluating oil discharges, including oil sludges, from tankers and non-tankers into the sea, as these may have changed since 1990. The group agreed to include the amounts of sludges and residues incinerated onboard ships in its evaluation.

Accidental spillages. The group noted the variability of spillages in relation to geographical areas, routes, seasons, etc., and that both the number of spillages and the amounts of oil spilled at sea provided valuable information. It proposed to evaluate trends in relation to the introduction of new tanker types (e.g., double bottoms and double hulls). The group considered available data on accidental spillages of oil into the sea from tankers and non-tankers and to report the number of spillages together with the amounts of oil entering the marine environment.

The group agreed to include oil amounts contained in sunken ships and to evaluate whether these are considered spills or slow seeps over time.

Spillages from bunkering operation incidents in marine terminals into the marine environment, e.g., due to tank overflow, hose breaks, fractures, pump, valve and gasket

failures, will be extrapolated from well-documented areas such as the U.S., Canada, and/or Europe.

The group noted accidental spillages from pipelines and releases that occur during commissioning processes.

Input of oil into the marine environment from offshore and coastal activities are due to discharges of cuttings, production water, and accidental spillages. The oil industry, as well as non-governmental regional organizations, will be invited to provide much of the relevant information. The group was aware that for some regions for which data were not available very careful extrapolations were required, not least because each area has its own geological and production characteristics. Several members drew attention to discharges from off-shore installations, such as input from flaring and drill cuttings dumped at sea.

Data on atmospheric emissions of hydrocarbons from shipping activities are available as are data on input of volatile organic compound (VOCs) into the North Sea and Japan from off-shore activities and coastal facilities.

Data on oil/hydrocarbon inputs are available from a number of sources. Regional organizations in Canada, Japan, Netherlands, Norway, and the U.K., and international bodies will be contacted.

The group noted that there are cases where dredged material dumped at sea has been contaminated with oil. The Secretariat will evaluate this input on the basis of dumping statistics made available by parties to the 1972 London Convention.

Conclusion

The GESAMP Working Group on Oil Inputs Into the Sea will collect and analyze data from the various databases, relevant government and industry sources, as well as consider novel approaches, such as oil accounting in shipping, tar ball surveys, and dissolved hydrocarbon levels, to develop models and estimates of the total oil input into the marine environment from sea-based activities. The group will determine whether oil input from various sources has significantly changed in the last decade in various geographic regions and in the world as a whole in order to assess the efficacy of IMO pollution prevention conventions and other preventive measures. The group will present its preliminary data at the 1999 International Oil Spill Conference and will present its final report to GESAMP and the various sponsoring UN agencies in 2000. At a later date, the same Working Group or another similar group will evaluate the input of oil from land-based sources, including oil that enters rivers and estuaries that eventually run into the marine environment.

Biography

Dagmar Schmidt Etkin (B.A. Biology, U. Rochester; A.M., Ph.D. Biology, Harvard U.) is Senior Research Analyst/Consultant for *Oil Spill Intelligence Report* and Cutter Consortium, and a member of the UN/IMO Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection Working Group on Oil Discharges into the Marine Environment. She maintains the International Oil Spill Database and consults on oil spill issues and Y2000 problems.

References

1. Baker, J.M. 1983. *Impact of Oil Pollution on Living Resources*. Comm. Ecology Paper No. 4. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland.
2. Freedman, B. 1989. Chapter 6: Oil Pollution. In *Environmental Ecology*, edited by B. Freedman, et. al., Academic Press, San Diego, California, U.S., pp. 135–158.
3. GESAMP (IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution). 1993. *Impact of Oil and Related Chemicals and Wastes on the Marine Environment*. GESAMP Reports and Studies Vol. 50: pp. 180.
4. IMO. 1990. *Petroleum in the Marine Environment*. Document MEPC 30/INF. 13 submitted by the United States: International Maritime Organization, London, U.K.
5. Kornberg, H. 1981. *Royal Commission on Environmental Pollution*. 8th Report. Her Majesty's Stationery Office, London, U.K.
6. National Research Council. 1975. *Petroleum in the Marine Environment*. National Academy of Sciences, Washington, DC, U.S. pp. 107 pp.
7. National Research Council. 1985. *Oil in the Sea: Inputs, Fates, and Effects*. National Academy Press, Washington, DC, U.S. pp. 601.