

Assessing trends in marine pollution : Are the data good enough ?

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The assessment of levels and trends of chemical contaminants in the marine environment is an essential component in any strategy to control and abate pollution. The practical application of all experimental or monitoring data depends upon their quality measured in terms of accuracy and precision. Data Quality Assurance (QA) programmes have the aim of making sure that the measurements are good enough for a particular purpose (such as for food safety or studying long-term trends). Quality control (QC) programmes are designed to maintain the data to a sufficient quality and assure their comparability between different laboratories using different techniques.

Intercomparison exercises on marine samples, first performed in the late 1960's, revealed large disparities in the results obtained by different laboratories. At about the same time, analytical techniques began to improve. "Best estimates" of trace metal concentrations in oceanic seawater, for example, decreased dramatically with time as analytical accuracy improved (3 orders of magnitude for lead in 4 decades, 1 order of magnitude for mercury in one decade). As a consequence our perception of what are "real" and "apparent" pollution problems also changed dramatically.

From the early 1970s, regular intercomparison exercises were organized on a World-Wide and regional scale by the Monaco Laboratory of IAEA (the International Atomic Energy Agency) frequently in cooperation with UNEP (the United Nations Environment Programme), and occasionally with IOC (the Intergovernmental Oceanographic Commission of UNESCO). In parallel, ICES (the International Council for the Exploration of the Sea), organized regular exercises between countries in the Baltic, North Sea and North Atlantic regions. These two data bases, covering organic and inorganic contaminants and radionuclides in sediments, water and biota, have served as a barometer to test the current status of data quality in pollution monitoring programmes. Despite considerable improvements in data quality, the data for some basic parameters remains surprisingly poor. For example, in a recent 24 laboratory World-Wide exercise on sediments the coefficient of variation for total petroleum hydrocarbons (as the fluorimetric chrysene equivalent) was 74%. In other words, measurements of 200 µg/g and 800 µg/g would be statistically indistinguishable from one another! On the other hand the coefficient of variation for plutonium, mercury or some PCB congeners is now below 20%, a remarkable achievement.

If a major objective of regional monitoring programmes is to detect long-term pollution trends (to see, for example, whether new legislation is effective) then the precision of the data must be much better than the expected environmental variation. Intercomparison exercises alone are insufficient to ensure data quality, as quality control is a continuous process which is a basic facet of the work of any credible environmental laboratory. Unfortunately, many laboratories are still not prepared to accept this common responsibility and their data are often inadmissible for regional and global marine pollution assessments. In the Mediterranean, the Mediterranean Action Plan, with the support of the Marine Environmental Studies Laboratory of IAEA-MEL and the World Bank, has initiated a concerted effort to improve data quality. This includes training of technicians, intercomparison exercises, the provision of reference methods and materials, joint monitoring exercises, equipment supply, installation and maintenance and regular methodological workshops. Data from the MEDPOL programme will then be used to prepare regular reports of "levels and trends" of marine contamination. The ultimate objective of the programme is to provide the Mediterranean countries with a valid scientific basis for managing the marine environment and to effectively control and abate marine pollution and assure the harmonious sustainable development of marine resources in the future.

The present report critically assesses progress on data quality assurance, future challenges and current obstacles for resolving them.