NATIONAL ENVIRONMENTAL MANAGEMENT PROJECT

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TECHNICAL ASSISTANCE OF THE ASIAN DEVELOPMENT BANK
TO THE DEPARTMENT OF TOWN AND COUNTRY PLANNING
MINISTRY OF HOUSING AND URBAN DEVELOPMENT
FIJI

NATIONAL ENVIRONMENT MONITORING PROGRAM

DISCUSSION PAPER

— THE WORLD CONSERVATION UNION

in association with

ENVIRONMENTAL SERVICES AUSTRALIA

NATIONAL ENVIRONMENT MONITORING PROGRAM

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PRELIMINARY NATIONAL ENVIRONMENTAL MONITORING PROGRAM
DISCUSSION PAPER

Ian Irvine
Pollution Specialist
National Environmental Management Project

1. INTRODUCTION

One of the principal tasks to be carried out during the National Environmental Management Program was the development of a program to monitor the health of the nation's water, air and soil resources, and particularly the water resources, since the available evidence suggests that these are most at risk from increasing population, urbanisation and development. The aim of this paper is to present a preliminary outline of the proposed National Environmental Monitoring Program for Fiji. It is emphasised that the program is preliminary, as it has been prepared while the review of local data and the site visits were still underway. The main reason for providing the outline at this stage is to seek feedback, comments and criticisms of the program at as early a stage as possible. The final program for inclusion in the National Environmental Strategy Report will be prepared in the second quarter of 1992.

Before setting out to monitor, or even to design a monitoring program, it is important to consider the question - Why monitor at all? What is the point of monitoring? Very often monitoring seems to be an end in itself. It is carried out because it has always been done, or because it is required to be done, or even because it seems to be a good idea that it be done. Monitoring should be done for the following reasons:

(a) In order to find out the condition of the environment (air, water, soil, sediments, organisms) at the present time, so that existing pollution problems can be identified and classified in terms of the types of pollutants (metals, pesticides, bacteria etc; degradable or resistant to breakdown); the severity of pollution (ranging from minor to potentially threatening human life, an industry or an ecosystem); the extent of pollution (from a very local incident to pollution of a major part of a river system or a lagoon). This enables the people charged with the management of these resources to rank polluted areas in order of severity or other priority and to undertake measures to manage and reduce pollution. Alternatively monitoring will indicate resources which are unaffected by pollution and management can then institute measures to protect these resources in the future;

(b) To provide a baseline that will allow the detection of

future changes in the quality of the nation's air, water, soil or biological resources (particularly adverse changes); and

(c) To provide managers (including forestry and fisheries officers, industries, operators of waste disposal facilites etc as well as managers in the environmental protection authority) with a tool for managing, and determining how effectively they are managing, their operations and these resources.

Deterioration in the quality of the environment has many costs the direct financial costs of increased health care due to air pollution, the lost production from polluted fishing grounds and soils, or inability to sell contaminated produce in international markets; the increased cost of treating drinking water etc as well as indirect costs (ill-health, destruction of ecosystems, loss of environmental amenity etc). Environmental monitoring is an investment. It provides the data necessary for the proper management of these resources.

2. CURRENT MONITORING IN FIJI

At the present time there is a relatively small amount of environmental monitoring carried out in Fiji and all of it is directed toward specific pollution sources. There is virtually no general monitoring carried out.

The Public Works Department undertakes monitoring related to its statutory functions of water supply and wastewater treatment. This includes regular monitoring of effluent quality from all of its sewage treatment plants. The program is described in detail in a brief paper by Chandra (1991). It concentrates on faecal bacteria, BOD and nutrients, these being the principal contaminants of concern from sewage treatment plants.

The PWD also carries out some environmental monitoring of Laucala Bay and adjacent sections of the lower Rewa River. This program is undertaken by staff of the National Water Quality Laboratory at the Kinoya Sewage Treatment Plant, and is a continuation of an environmental monitoring program originally established in the early 1980's by Australian consultants (Caldwell Connell 1981, 1982a,b, 1984). With some interruptions the program has been going since 1981, and represents by far the most complete set of environmental monitoring data in the country. The program concentrates on sewage bacteria, BOD and nutrients but other parameters are included, though less frequently. The Caldwell Connell reports include relatively comprehensive audits in 1982 and 1984. Since that time no review of the data has been carried out and they are not publicly available, although it is known that the levels of sewage bacteria in parts of Laucala Bay are considerably in excess of standards for bathing waters. The Kinoya Laboratory is not known to have any formal Quality

Assurance program for sampling and analysis.

Some monitoring of waters in the Suva Harbour area (including Laucala Bay) has also been carried out by the University of the South Pacific (USP) and its Institute of Natural Resources (INR). Much of this data has been collected as part of student field training exercises and is unpublished, however some of the data is summarised in Naidu et al (1991). The data show some quite high levels of heavy metals in water, as well as high sewage bacteria, including at bathing beaches, and high nutrients.

A number of other studies of pollution have been carried out in this area, and some data are reported in Fujita Corp. (1988), IEC (1989), Ports Authority (1991), Gangaiya and Green (1991) and others, however these are essentially one-off studies rather than monitoring programs.

INR is also involved in other environmental monitoring programs on a consultancy basis, including monitoring the effluents and water quality in the vicinity of the Tropik timber mill at Drasa. INR also carried out the baseline water quality monitoring program for this operation (Gangaiya et al, 1988).

Long-term monitoring of the Emperor Gold Mine at Vatukoula is carried out by the chemical laboratory of the Department of Mineral Resources as well as by the mine itself. Samples are taken by both organisations at the same time but analysed in separate laboratories, and consultation initiated where there are discrepancies. Parameters measured including basic water quality parameters, heavy metals and cyanide. Arsenic is sometimes found in excessive levels. Apart from a small amount of data presented in a report in 1984 (McDermott & Loosely, 1984) none of this data is publicly available. The Mines Department laboratory is not known to have any specific Quality Assurance program.

Other laboratories which have some responsibility for monitoring include the Ministry of Primary Industries laboratory (although to date they have not undertaken any environmental monitoring), the microbiological laboratory at the CWM hospital which carries out some bacterial testing of seafood, and the Department of Forestries laboratory which undertakes some measurement of residues from wood treatment with copper-chrome-arsenate.

Of these laboratories the only one which regularly includes some Quality Assurance procedures in its analytical program is the laboratory at INR. As far as is known this is the only laboratory to take part in regional or international Interlaboratory Calibration Programs. Although it appeared that all laboratories used good methodology and laboratory practice, INR therefore is the only one where the accuracy of the results is reasonably well established.

3. INSTITUTIONAL FRAMEWORK

At this stage it is too early to make recommendations as to one kind of institutional setting for the monitoring program. This will be covered by the work of other consultants. However for any Environmental Protection Authority to be effective (whether part of an existing department or a new one) it must have a specific mandate to carry out monitoring and to make the results publicly available, it must not be a part of a department which is responsible for pollution (to avoid conflicts of interest in which the more powerful or better funded section inevitably wins) and it must occupy a high position in the overall structure of government (an environmental protection authority which operates at a much lower level of government than the ministries which it is intended to oversee will not be successful).

4. KINDS OF MONITORING

At this stage it is useful to consider what monitoring really is, and is not. The kind of pollution investigation which involves going to a location and collecting samples for analysis on one or two occasions is not monitoring, although it is frequently called that. Monitoring involves the regular and systematic sampling of a location or series of locations over a period of time, generally years. It is also customary for the data, and the program itself, to be reviewed periodically. Monitoring can include baseline monitoring, on-going or long term monitoring and pollution monitoring.

Baseline monitoring involves the collection of data about the condition of some compartment of the environment (air, water or soil quality) in a particular area prior to a development. The baseline condition cannot necessarily be equated with a pristine environment. If a development is to take place in an urbanised location, for example, it is probable that the water bodies adjacent will already be contaminated to some degree. The data will reflect that condition and will provide a baseline against which further changes in that compartment (in the absence of other influences, changes due to the project) can be measured.

On-going or routine monitoring involves monitoring over the lifetime of a project or with the progressive development of an area such as a city, an agricultural area, industrial subdivision etc. In the latter cases the monitoring program can be assumed to have a beginning but no end, unlike project-based monitoring, eg for a mine which will eventually be worked out. On-going monitoring can also include monitoring of pristine areas to determine if long-term changes are occurring, or regional, national or international programs (such as monitoring world-wide changes in levels of

carbon dioxide in the atmosphere).

Pollution monitoring generally involves measurement of pollutants being emitted from a site, such as quality of effluents, air emissions etc. It generally involves point source emissions, such as those from outfalls, drains, smokestacks etc but non-point source emissions are sometimes monitored as well (eg vehicle exhausts, seepage from waste dumps, urban runoff).

It is recommended that the National Environmental Monitoring Program should include apects of all these components, but for pollution monitoring its role should be that of an overseer. The principal components are described below:

(a) Self Monitoring. Regular monitoring of pollutant emissions and ambient quality in the vicinity of large projects eg gold mine, timber plants, sewage treatment plants, canneries etc. In many cases this is already done. eg the gold mine has a monitoring program which is overseen by the Ministry of Mineral Resources. Self monitoring should be extended to all industries listed above and others such as sugar mills, the cement plant and large hotels and resorts; and large municipal dumps. In the long term all large point-source polluters should be responsible for monitoring their emissions and discharges. Data and reports should be submitted to the Environmental Protection Authority (EPA) at three-monthly intervals;

(b) Independent checking of above industries. Where this is already done by other departments as part of their statutory function this should continue. In other cases this would be done by the EPA. This would include unannounced site visits and sampling by the EPA.

(c). Regular Long-term Monitoring. This would comprise a range of localities selected because of their regional or national importance. This would be the main work of the national Monitoring Program.

5. WHERE TO MONITOR

Long-term monitoring is very costly and therefore it is particularly important that the number and location of sites are selected carefully to reflect national concerns and priorities. One way of doing this would be to prepare a Pollutant Source Inventory for Fiji and then rank the sources or localities in order of perceived importance. Alternatively, and probably equally effectively, since there seems to be some consensus about where most of the problems lie, would be to have the monitoring group meet with other concerned Authorities and develop a priority list that way. Excluding the specific industries listed above, the currently identified problem areas

it include the cities and large towns such as Suva-Lami, Nadi-Lautoka, Ba, Labasa, Nausori; the main agricultural areas such as the Sigatoka valley, the Ba valley and other areas generally surrounding urban areas.

Although the tourist areas do not, at present, appear to be significantly affected by effluent discharges this could change the future with increased density of development in certain areas particularly the Nadi and Coral Coast areas. Other overseas states eg Bali, Mauritius, already have pollution problems which are affecting the viability of the tourist industry in important tourist locations.

Initially it is recommended that 36 localities be monitored, This number has been selected taking into consideration the principal areas of concern as well as logistic and cost considerations. Equally important, considering the current shortage of trained and experienced professional and technical staff, is the amount of samples that can physically be collected, prepared and analysed. When the relatively rigorous preparation, documentation and Quality Assurance/Quality Control procedures are taken into account it will be found that 36 locations represents a considerable workload. The locations are distributed as follows:

Suva-Lami Area	10 locations
Nadi-Lautoka Area	8 locations
Sigatoka Area	4 locations
Ba Area	4 locations
Labasa Area	3 locations
Coral Coast	3 locations
Nausori Area	3 locations

The areas as listed should be regarded as very broad, ie in most cases indicating the general region rather than a specific location. For example, the eight locations in the Nadi/Lautoka area may include cane growing or forestry locations as well as urban/industrial or tourist localities. It must be understood that because of cost and other constrainst, not all locations that perhaps should be monitored can be. Locations will be selected so that all important sources, whether urban, industrial, tourism, agriculture or forestry will be represented. Should some particular industry or area or pollutant be identified by the monitoring program as requiring more detailed study, because of higher than expected pollution levels, eg pesticide pollution from farming areas, sediment from logging, then further monitoring locations can be located to properly investigate these.

The actual sampling locations are not further specified at this stage, and cannot be, but detailed guidelines as to what constitutes an acceptable monitoring location will be provided in the final monitoring plan. Site selection is absolutely critical to obtaining useful environmental data. Each of the

This would include one or more control locations.

6. WHAT TO MONITOR

The detailed monitoring plan will be devised after receiving input as to the appropriateness or otherwise of the outline plan. The following provides a general listing of the monitoring considered likely to be required.

At all locations a basic set of water quality data will be collected. This will include pH, temperature, conductivity, dissolved oxygen, water colour and clarity and suspended solids. In addition, basic environmental data such as sampling time, weather conditions, tide stage, whether heavy rainfall or flooding has recently occurred, flow estimate for streams and rivers, and presence of freshwater layering in estuaries and lagoons, will be recorded. This information is basic to understanding the reasons for fluctuations in the main parameters which are the real object of the monitoring program.

The other parameters that will be required will depend on the locality, however it is anticipated that nutrients (nitrate, nitrite, ammonia, total nitrogen; orthophosphate and total phosphorus) and microbiological data (total coliforms. faecal coliforms) would be required on most if not all samples. In some localities chlorophyll data may also be needed to determine productivity.

Pesticides (the major ones used in Fiji, from the following groups) (organophosphates, carbamates, synthetic pyrethroids, fungicides, herbicides) would be determined in samples from agricultural areas only. If significant levels were found then monitoring could be extended to the lower reaches of affected rivers and adjacent estuarine or lagoon areas. In practice, monitoring work elsewhere in the world has shown that these chemicals are rarely detected in the aquatic environment except immediately adjacent to where they are used. (Except where aerial spraying or other high volume spraying is used. However it appears that most of the spraying in Fiji is done by hand or with relatively smallscale mchinery). Where insecticides are used frequently on garbage dumps the adjacent waters should be tested for these pesticides.

Sediment samples should be taken from zones of fine sediment accumulation near major agricultural areas and tested for the common group of organochlorine pesticides, some of which will still be present from past agricultural or pest control uses eg DDT for mosquito control.

Sites located to monitor industrial pollution may need to include a variety of possible contaminants including metals, hydrocarbons, organics, phenols, solvents etc. Only the key pollutants should be selected for monitoring otherwise there

will be an unacceptibly high cost and use of laboratory resources. The actual parameters to be monitored cannot be specified at this stage, although it is expected that metals and hydrocarbons, being ubiquitous in such environments, would require monitoring in all cases.

Marine and estuarine water should not be routinely tested for heavy metals unless a certified Clean Room is available and appropriate sampling and sampler decontamination facilities, because the results are unlikely to be meaningful. At the present time no such facility is available in Fiji, although INR laboratory has gone to considerable effort to exclude contamination from their instrument laboratory. The natural levels of most heavy metals in uncontaminated lagoon waters should be less than 1 ppb, for mercury and cadmium significantly less, whereas without a Clean Room it is almost impossible to reliably detect metals in seawater below 2-5 ppb. Instead, sediments or appropriate sentinel organisms such as oysters or giant clams should be used.

7. SAMPLING FREQUENCY

The sampling frequency is proposed to be monthly for all parameters in water. This interval has been selected as a compromise between the need for sufficient data to detect short, medium and long term trends and the greatly increased cost, laboratory and manpower requirements of more frequent sampling. For some parameters, however, monthly monitoring may be too far apart. Serious consideration should be given to this question by those who are preparing a response to this preliminary program.

For monitoring of metals, organochlorines and other toxic contaminants in sediments the sampling frequency should be yearly. For monitoring of metals, organochlorines and other toxic contaminants in biota sampling should be carried out twice yearly; at the same times each year. The size, sex etc of biota must be standardised.

8. SAMPLING AND ANALYTICAL METHODOLOGY

Standard methods must be used for all aspects of the monitoring program. This includes protocols for precleaning of sampling devices and sample containers, sample collection, preservation, storage and analysis. It is recommended that the UNEP Reference Methods be used as these are widely used by island nations in the Asia-Pacific Region, available free, regularly updated and have been designed for use in developing countries where the laboratory facilities are of moderately good standard. Other methods such as AOAC, Standard Methods and the USEPA Methods are sometimes designed for laboratories with a higher standard of equipment and expertise that is widely

available in Fiji. The UNEP methods are used at INR which already takes part in regional Interlaboratory calibration exercises, an important part of a laboratory's Quality Assurance and Quality Control program

The UNEP Reference Methods now comprise about 60 documents covering virtually all of the analyses that would be required in the monitoring program, as well as sampling protocols (including for biological monitoring, quality assurance and laboratory quality control. The USP has a set of the Methods. A summary of the reports available is attached to this report.

9. DATA MANAGEMENT

It is recommended that a simple data management system be set up using a PC-based data base system such as D-Base. The virtues of such a system are that it is widely-available, inexpensive, can be used on most office computers and there are a large number of people around who know how to use it.

One of the primary responsibilities of the EPA would be to produce an annual report and audit of the quality of the nation's water resources, including a discussion of trends in water quality parameters and the reasons for them. The data would be compared to relevant quality criteria for that water body, as well as to other data for comparable locations (clean and polluted) elsewhere. The reason for this is to place the data in perspective (It is important that the people who have to manage these resources understand how polluted [or clean] they are, compared to other places, including overseas localities), instead of just looking at their own data. If necessary recommendations should be made to improve quality of polluted areas, including greater supervision of polluters, tighter standards or discharge limits, better management or even prosecution of offendors. The annual Report would be publicly available.

Provision should be made in the program for it to be reviewed every few years (say 3-5), however the reviewers should try to ensure that changes to locations or methods do not result in later data not being comparable, as this will defeat the purpose of the program.

It is believed that such a program, if implemented and the recommendations arising from it enforced, will be one of the major means of combatting the increasing pollution of the environment in Fiji.

10. REFERENCES

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Naidu, S et al (1991). Water Quality Studies on Selected south Pacific Regional Seas Lagoons. #3. Laucala Bay & Suva Harbour. UNEP Regional Seas (in Press).

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University of the South Pacific
P.O. Box 1168, SUVA, FIJI.

REGIONAL SEAS

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Catalogue

of Reference Methods

for Marine Pollution Studies

ccred in co-operation with

IAEA

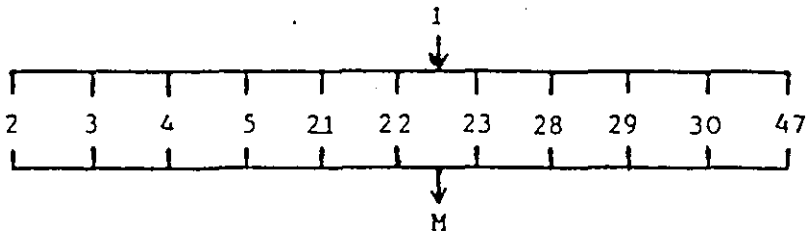
UNEP 1986 9

ANNEX 1. A CATALOGUE OF REFERENCE METHODS

This catalogue shows the Reference Methods currently available, those in revision (shown by numbers and "in preparation") and those planned for 1989-90 (shown by letters and "in preparation"). Translations are indicated by letters (E-English, F-French, S-Spanish). The methods are available free of charge from OCA/PAC or MESL at the addresses shown on the inside, back cover.

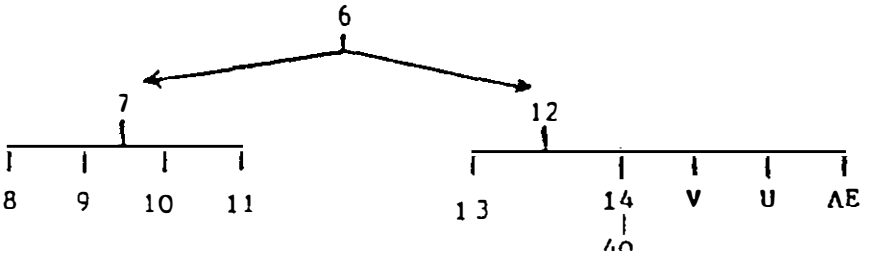
Sanitary quality of coastal recreational and shellfish-growing waters

No. 1	UNEP/WHO: Guidelines for monitoring the quality of coastal recreational and shellfish-growing waters.	Rev 1(E) 1988 Rev 1(F) 1988 Rev 1(S) 1988
No. 2	UNEP/WHO: Determination of total coliforms in sea water by the membrane filtration culture method.	Rev.1(E) 1983 Rev.1(F) 1983
No. 3	UNEP/WHO: Determination of faecal coliforms in sea water by the membrane filtration culture method.	Rev.1(E,F) 1983
No. 4	UNEP/WHO: Determination of faecal streptococci in sea water by the membrane filtration culture method	Rev.1(E,F) 1983
No. 5	UNEP/WHO: Determination of faecal coliforms in bivalves by multiple test tube method.	Rev.1(E,F) 1983
No. 21	UNEP/WHO/IAEA: Determination of total coliforms in sea water by multiple test tube (MPN) method.	draft(E) 1985 draft(F) 1987
No. 22	UNEP/WHO/IAEA: Determination of faecal coliforms in sea water by multiple test tube (MPN) method.	draft(E) 1985
No. 23	UNEP/WHO/IAEA: Determination of faecal streptococci in sea water by multiple test tube (MPN) method.	draft(E) 1985
No. 28	UNEP/WHO/IAEA: Determination of staphylococcus aureus in sea water and sewage by the membrane filtration culture method.	draft(E) 1986
No. 29	UNEP/WHO/IAEA: Determination of pseudomonas aeruginosa in sea-water and sewage by the membrane filtration culture method.	draft(E) 1986
No. 30	UNEP/WHO/IAEA: Isolation/enumeration of salmonella from sea water and sewage.	draft(E) 1986
No. 47	UNEP/WHO/IAEA: Determination of faecal coliforms in estuarine waters, suspended matter and sediments.	draft(E) 1988
M	UNEP/WHO/IAEA: Statistical methods for the evaluation of results from monitoring the quality of coastal recreational and shellfish -growing waters.	in preparation
"AC"	UNEP/WHO/IAEA: Determination of selected neurotoxins in marine organisms.	in preparation



2. Chemical contaminants in marine organisms

No. 6	UNEP/FAO/IOC/IAEA: Guidelines for monitoring chemical contaminants in marine organisms.	in preparation
No. 7	UNEP/FAO/IOC/IAEA/: Sampling of selected marine organisms and sample preparation for trace metal analysis.	Rev.2(E) 1988 Rev.2(S) 1988
No. 8	UNEP/FAO/IOC/IAEA/: Determination of total mercury in selected marine organisms by cold vapour atomic absorption spectrophotometry.	Rev.1(E) 1984 Rev.1(S) 1987
No. 9	UNEP/FAO/IAEA: Determination of total arsenic in selected marine organisms by hydride generation atomic absorption spectro -photometry.	draft(E) 1985
No. 10	UNEP/FAO/IAEA: Determination of total selenium in selected marine organisms by hydride generation atomic absorption spectrophotometry.	(E) 1984
No. 11	UNEP/FAO/IOC/IAEA/: Determination of total cadmium, zinc, lead and copper in selected marine organisms by flameless atomic absorption spectrophotometry.	Rev.1(E) 1984 Rev.1(S) 1984
No. 12	UNEP/FAO/IAEA: Sampling of selected marine organisms and sample preparation for the analysis of chlorinated hydrocarbons.	Rev.1(E) 1984 Rev.1(S) 1987
No. 13	UNEP/FAO/IAEA: Determination of methyl-mercury in selected marine organisms by gas chromatography.	(E) 1984 (S) 1988 -Rev.1 (in prep)
No. 14	UNEP/FAO/IOC/IAEA: Determination of DDTs and PCBs in selected marine organisms by packed column gas chromatography.	Rev.1 (E) 1986 Rev.1 (S) 1988
No. 40	UNEP/IOC/IAEA: Determination of DDTs and PCBs in selected marine organisms by capillary column gas chromatography.	(E) 1988



"V"	UNEP/IAEA/IOC/FAO: Guidelines for the determination of organohalogen contaminants (other than DDTs or PCBs) in selected marine organisms.	in preparation
"U"	UNEP/IAEA/IOC/FAO: Determination of organotin compounds and total tin in selected marine organisms.	in preparation
"AE"	UNEP/FAO/IOC/IAEA: Organophosphorus compounds in marine organisms.	in preparation

Chemical contaminents in sea water

No. 16	UNEP/IOC/IAEA: Determination of DDTs, PCBs, PCCs and other hydrocarbons in sea water by gas chromatography.	Rev.(1) in prep.
No. 18	UNEP/IOC/IAEA: Determination of total dissolved cadmium in sea water by differential pulse anodic stripping voltammetry.	Rev.(1) in prep.
B	UNEP/IOC/IAEA: Monitoring of petroleum hydrocarbons in sea water.	in prep.
"T"	UNEP/IAEA/IOC: Determination of organotin compounds in seawater.	in prep.
"AB"	UNEP/IAEA/IOC: Determination of methyl-mercury in seawater.	in prep.

Chemical contaminants in marine sediments and suspended matter

"R"	Guidelines on the sampling and preparation of sediments for marine pollution monitoring.	in preparation
No. 17	UNEP/IOC/IAEA: Determination of DDTs, PCBs, PCCs and other hydrocarbons in marine sediments by gas-liquid chromatography.	in preparation
No. 20	UNEP/IOC/IAEA: Monitoring of petroleum hydrocarbons in sediments.	in preparation
No. 26	UNEP/IAEA: Determination of total mercury in marine sediments and suspended solids by cold vapour atomic absorption spectrophotometry.	draft(E) 1985
No. 27	UNEP/IAEA: Determination of total cadmium in marine sediments by flameless atomic absorption spectrophotometry.	(E) 1985
No. 31	UNEP/IAEA: Determination of total chromium in marine sediments by flameless atomic absorption spectrophotometry.	(E) 1985

No. 32 UNEP/IAEA: Determination of total cobalt in marine sediments by flameless atomic absorption spectrophotometry. (E) 1985

No. 33 UNEP/IAEA: Determination of total copper in marine sediments by flameless atomic absorption spectrophotometry. (E) 1985

No. 34 UNEP/IAEA: Determination of total lead in marine sediments by flameless atomic absorption spectrophotometry. (E) 1985

No. 35 UNEP/IAEA: Determination of total nickel in marine sediments by flameless atomic absorption spectrophotometry. (E) 1985

No. 36 UNEP/IAEA: Determination of total vanadium in marine sediments by flameless atomic absorption spectrophotometry. (E) 1985

No. 37 UNEP/IAEA: Determination of total iron in marine sediments by flame atomic absorption spectrophotometry. (E) 1985

No. 38 UNEP/IAEA: Determination of total manganese in marine sediments by flame atomic absorption spectrophotometry. (E) 1986

No. 39 UNEP/IAEA: Determination of total zinc in marine sediments by flame atomic absorption spectrophotometry. (E) 1986

"W" UNEP/IAEA/IOC: Determination of organohalogen contaminants (other than DDTs or PCBs) in marine sediments. in preparation

"Z" UNEP/IOC/IAEA: Determination of aluminium in sediments. in preparation

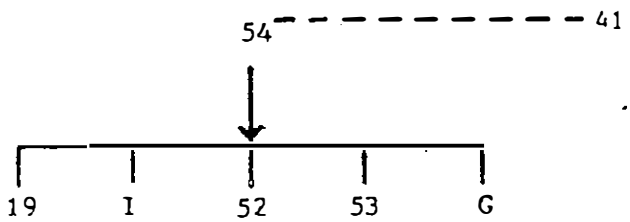
"AA" UNEP/IAEA/IOC: Determination of methyl-mercury in sediments. in preparation

Chemical contaminants in estuarine waters and suspended matter

No. 19 UNEP/IOC/IAEA: Determination of total mercury in estuarine waters and suspended sediment by cold vapour atomic absorption spectrophotometry. draft(E) 1985

No. 41 UNEP/IOC/IAEA: Guidelines for the determination of riverine inputs of contaminants to estuaries. (E) 1987

No. 54	UNEP/IOC/IAEA: Guidelines for monitoring of estuarine waters and suspended matter.	(E) 1988
No. 52	UNEP/WHO/IOC/IAEA: Determination of phosphorus in suspended matter and sediments.	in preparation
No. 53	UNEP/WHO/IAEA: Determination of nitrogen in suspended matter and sediments.	in preparation
G	UNEP/WHO/IOC/IAEA: Determination of BOD_5 and COD in estuarine waters.	in preparation
I	UNEP/IOC/IAEA: Determination of total cadmium in estuarine waters and suspended matter.	in preparation

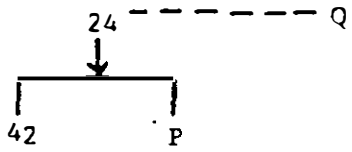


Chemical contaminants floating or on beaches

"X"	UNEP/IOC/IAEA: Guidelines for quantifying persistant synthetic materials which may float, sink or remain in suspension.	in preparation
No. 15	UNEP/IOC/IAEA: Monitoring of tar on marine beaches.	draft(E) 1985

Atmospheric chemical contaminants

No. 24	UNEP/WMO/IAEA: Sampling of aerosols and wet precipitation for analysis of chemical pollutants.	draft(E) 1985
No. 42	UNEP/IAEA/WMO: Guidelines for the determination of selected trace metals in aerosols and in wet precipitation.	draft(E) 1988
P	UNEP/IOC/IAEA: Determination of halogenated hydrocarbons in aerosols and in wet precipitation.	in preparation
Q	UNEP/WMO/IOC/IAEA: Sampling of dry deposition.	in preparation



8. Radionuclides in the marine environment.

"RA"	UNEP/IAEA: Determination of radiocaesium in seawater, sediments and marine organisms.	in preparation
"RB"	UNEP/IAEA: Determination of iodine-131 in selected marine organisms.	in preparation

9. Effects on marine organisms and ecosystems

No. 25	SPC/UNEP: Coral reef monitoring handbook.	(E) 1984 (F) in prep.
No. 51	UNEP: Sampling and identification of common Mediterranean Scyphomedusae and evaluation of their occurrence.	draft(E) 1988
No. 43	UNEP/FAO/IAEA: Test of acute lethal toxicity of pollutants to marine fish and invertebrates.	draft(E) 1987 draft(S) 1988
No. 44	UNEP/FAO/IAEA: Estimation of the toxicity of pollutants to marine phytoplanktonic and zooplanktonic organisms.	draft(E) 1987 draft(S) 1988
No. 45	UNEP/FAO/IAEA: Comparative toxicity test of water-soluble fractions of oils and oil dispersants to marine organisms.	draft(E) 1987 draft(S) 1988
J	UNEP/IOC/FAO/IAEA: Biological non-acute toxicity tests.	in preparation
"AG"	UNEP/IOC/IAEA: Guidelines for evaluating the effects of thermal discharges on the marine environment.	in preparation
"AH"	UNEP/IOC/IAEA: Guidelines for detecting and monitoring eutrophication in the marine environment.	in preparation

10. Standard physical, chemical and meteorological observations

No. 48	UNEP/IOC/IAEA: Determination of basic oceanographic conditions.	(E) 1988
No. 49	UNEP/IOC/IAEA: Determination of basic meteorological conditions.	(E) 1988
No. 50	UNEP/IOC/IAEA: Determination of standard physical and chemical parameters. PH, DO, H_2S, phosphate (diss), silicate (react), ammonia nitrate, nitrite, Total N, Total P.	(E) 1988

11. Quality assurance procedures

"QA"	UNEP/IOC/IAEA: Guidelines for quality assurance procedures I. Planning and organizing sampling and monitoring programmes.	in preparation
"QB"	UNEP/IOC/IAEA: Guidelines for quality assurance procedures II. Sampling, sample storage and sample workup for pollution monitoring.	in preparation
"QC"	UNEP/IOC/IAEA: Guidelines for Quality Assurance Procedures III. Good laboratory practice and internal quality control.	in preparation
"QD"	UNEP/IOC/IAEA: Guidelines for Quality Assurance Procedures IV. Data management for contaminant monitoring programmes.	in preparation

12. Miscellaneous methods

No. 0	UNEP/IAEA: Guidelines for the use of Reference Methods in marine pollution studies.	(E) 1988.
"AD"	UNEP/IOC/IAEA: Guidelines for monitoring the presence of used lubricating oils in the marine environment.	in preparation
"AF"	UNEP/IOC/IAEA: Reagent and laboratory ware clean-up procedures for low-level contaminant monitoring.	in preparation
No. 46	UNEP/WHO/IAEA: Determination of methylmercury, total mercury and selenium in human hair.	draft(E) 1987

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