



United Nations  
Environment  
Programme



UNEP(OCA)/MED WG.72/1  
23 October 1993

Original: ENGLISH

---

**MEDITERRANEAN ACTION PLAN**

**UNEP/IAEA Consultation meeting on  
Guidelines on Analytical Data Quality Assurance**

Monaco, 21-23 October 1993

**REPORT  
OF THE UNEP/IAEA CONSULTATION MEETING ON  
GUIDELINES ON ANALYTICAL QUALITY ASSURANCE**

In cooperation with:



IAEA

---

IAEA/UNEP  
Monaco, 1993

## TABLE OF CONTENTS

Administrative report

page 1-2

Annex I

Conclusions and recommendations

Annex II

Agenda

Annex III

List of participants

Appendix I

Statements by invited participants

### Administrative Report

1. The meeting was convened on 21 October 1993 at 10:00 am. Participants were welcomed by the Director of IAEA-MEL, Prof. M.S Baxter and the representative from the Co-ordinating Unit for the Mediterranean Action Plan in Athens, Mr. G. Gabrielides. L.D. Mee acted as chairman of the meeting and Ms. M. Horvat as a technical secretary.
2. The agenda of the meeting, as adopted, is attached as Annex II to the present report and the list of participants as Annex III.
3. The meeting considered and reviewed two documents entitled "*Data Quality Review for MED POL: Nineteen Years of Progress*" and "*Instrument Maintenance in the MED POL Programme*". These are presented separately as amended.
4. In addition to the written reports, the chairman presented a brief overview of the development of Mediterranean Quality Assurance programme sponsored by the World Bank under the METAP agreement. This was considered as a good model for holistic quality assurance support and an exercise in capacity building (targeted on those countries of the region which the World Bank is currently supporting).
5. The participants in the meeting each presented a brief overview of the current situation regarding quality assurance for chemical measurements of marine contaminants in their countries. The substantial discussion that ensued forms the basis of the final conclusions of the meeting. The individual reports submitted in writing are included as Appendix I to the present report.
6. There was a full discussion of the objectives and specific needs of future activities in support of Quality Assurance (including Quality Control). There was general agreement on the need for such a programme as a central element in the present MED POL Phase II strategy and for future strategy for the Phase III which will meet the requirements of the Contracting Parties (as defined in the report of Eighth Meeting of the Contracting Parties, Antalya, Turkey, 12-16 October 1993) The full conclusions of this discussion are presented in Annex I.

7. It was agreed that the report of this meeting, Particularly Annex I, should be submitted to the next meeting of the Scientific and Technical Committee for MED POL with the recommendations that the conclusions should be considered carefully when addressing the future monitoring strategy.
8. In the short term, it was agreed that the recommendations of this meeting would be used as the basis of MESL's contribution to the MED POL in 1994. The financial limitations of the programme approved by the Contracting Parties would be fully recognized in the formulation of the detailed workplan.
9. The meeting was closed at 10:30 on 23 October 1993.

## Annex I

### CONCLUSIONS AND RECOMMENDATIONS

#### **I. General strategy**

The quality Assurance (QA) programme for MED POL will have the following *general objectives*:

1. The programme should assist the Contracting Parties to the Barcelona Convention to fulfill the present and future objectives of the MED POL programme by ensuring that the data generated by national participating laboratories is of a quality sufficient to address the stated goals for marine environmental management.
2. The QA programme should be holistic including all the elements necessary to achieve good quality data. Such elements cover the monitoring strategy, sampling, sample handling, chemical analyses, data evaluation and interpretation. This holistic approach should encourage scientists to participate in all stages of the monitoring programme including strategic planning and data interpretation.
3. A major emphasis of the programme will be to build the capacity of the laboratories currently unable to produce good quality data in order to eventually achieve full self sufficiency.
4. The QA programme should be mandatory and form an integral chapter of each MED POL Monitoring Agreement. The approach used should be fully compatible between countries in order that data be comparable on a regional basis.
5. The weight of responsibility for data Quality Control (QC) should be with the participating laboratories. They should set up internal QC procedures using reference materials of appropriate matrices, preferably obtained from the region. Resulting QC charts should be submitted to MEDU together with data reports. MESL will submit the reports from intercomparison exercises.

## **II. Components of the support programme**

6. The following essential strategic elements are included in the supporting activities of MESL (the *support programme*).
  - (i) On job training (within the selected national monitoring laboratories).
  - (ii) In-house training (in MESL where strictly required).
  - (iii) Intercomparison exercises
  - (iv) Joint monitoring exercises (with split sample analyses in the national laboratory and in MESL).
  - (v) Distribution of Certified Reference Materials and calibration standards on request.
  - (vi) Preparation and distribution of Reference Methods for Marine Pollution Studies (including methodological workshops).
  - (vii) Instrument maintenance.

Wherever possible, regional expertise will be used in the development and implementation of these elements.

## **III. Priorities**

### **Training**

7. Priority should be given to on-job training.
8. A major emphasis should be given to holistic support (including training) initially in those countries which have not benefited from previous activities of this kind., notably Lebanon, Morocco, and Syria. This should not imply that the other countries will be ignored through the assignment of priorities.

9. Within each country, focal point laboratories should be nominated by the National Coordinator. These will be the immediate recipients of on-job training courses but should agree to invite the staff of other appropriate national institutions to participate in each training exercise.
10. On-job training should normally include sampling and split-samples which would be analyzed at the national laboratories and MESL.

#### Intercomparison

11. The intercomparison exercises should continue with the widest possible participation encouraged. The role of the MED POL National Coordinators is considered essential in promoting this work. Contacts will be established directly between MESL and participating MED POL laboratories in all cases.
12. At least one intercomparison exercise per year shall be organized (for materials relevant to the MED POL programme).
13. Additionally, for a trial one-year period, samples of known composition will be distributed as "blind samples" to all focal-point laboratories every six months. The results of these analyses will be transmitted to MESL by letter within two months of receipt and the "correct" values will be provided by return mail.
14. For countries with several institutions, in-country QC exercises should also be encouraged.
15. The GESREM intercomparison materials will be made available for all MED POL laboratories requesting them (free of charge)

**Instrument maintenance**

16. The instrument maintenance programme should continue but be clearly focused on the countries building their capacities to participate in MED POL and should be an integral part of the capacity building strategy. Continued user training courses are also considered to be highly desirable.



## Annex II

### AGENDA

1. Welcoming address
2. Opening remarks
3. Adoption of the agenda
4. Review of the quality of chemical monitoring data in the Mediterranean, 1973 - present
5. Review of the Mediterranean Analytical Data Quality Assurance Programme, 1987-93
6. Instrument maintenance in the MED POL programme: review of the programme since the beginning of MED POL Phase I (1976 - present)
7. Statements by invited experts and national MED POL coordinators on the current situation, future plans and requirements
8. Common programme and workplan for future action and support required
9. Adoption of the meeting report
10. Closure.

Annex III

LIST OF PARTICIPANTS

ALBANIA

Mr. Kosta Koci  
University of Tirana  
Chair of Organic Chemistry  
Tirana

Tel. No: (355) 42 27669

Fax. No: (355) 42 28204

CROATIA

Mr. Nenad Mikulic  
National Coordinator for MED POL  
Ministry of Civil Engineering and  
Environmental Protection  
78 Avenija Vukovar  
41 000 Zagreb

Tel. No: (385) 41 633 444/613 063

Fax. No: (385) 41 612 131/537 203

CYPRUS

Mr. Loizos Loizides  
Ministry of Agriculture & Natural Resources  
Department of Fisheries  
Aeolou 13  
Nicosia

Tel. No.: (357) 2 303 576

Fax. No: (357) 2 365 955

Tlx. No: 4660 MINAGRI CY

EGYPT

Mr. Ali Ibrahim El-Beltagy  
Director  
National Institute of Ocean. and Fisheries  
Kayet-Bey  
Alexandria

Tel. No: (20) 3 801 553  
Fax. No: (20) 3 801 174

GREECE

Mr. N. Friligos  
Acting Scientific Director  
National Centre for Marine Research  
Aghios Kosmas Hellenikon  
166 04 Athens

Tel. No: (301) 98 20 214  
Fax. No: (301) 98 33 095

ISRAEL

Mr. Yuval Cohen  
Director General  
Israel Ocean. & Limnol. Research Ltd.  
Tel-Shikmona  
P.O. Box 8030  
31 080 Haifa

Tel. No: (972) 04 515 202  
Fax. No: (972) 04 511 911

LEBANON

Mr. Hratch Kouyoumjian  
Director  
Marine Research Centre/NCRS  
P.O. Box 123  
Jounieh

Tel. No: (961) 9 918570/934763  
Fax. No (357) 9512578 through Cyprus  
1 212 478 2736 through NY  
Tlx No 494-41 002 (for attn. Kouy)

MONACO

Mr. A. Veglia  
Service de l'Environnement  
Dépt. des Travaux Publics et des  
Affaires Sociales.  
Ministère d'Etat  
Place de la Visitation  
MC-98000 Monaco

Tel. No: (33) 93 158 148/49  
Fax. No: (33) 93 159 233

MOROCCO

Mr. Mohamed Dahhou  
Laboratoire Nationale de la Surveillance de la  
Pollution  
C/u Direction de la Surveillance et del  
Evaluation, Sous- secretariat d'Etat  
Auprès du Ministre de l'Interieur chargé  
de la protection de l'environnement  
Rabat

Tel. No: 212 7 76 39 33  
Fax. No: 212 7 76 23 09

SYRIA

Mr. Abdul Latif Youssef  
Director  
Marine Research Institute  
Tishreen University  
Lattakia

Tel. No: (963) 41 225 658  
Fax. No.: (963) 41 228 504  
Tlx. No. TUNIV 451 084 SY

**TURKEY**

Mr. I. Salihoglu  
Middle East Technical University  
Institute of Marine Sciences  
Erdemli 33731  
IÇEL

Tel. No: (324) 521 2406 / 521 2150  
Fax. No: (324) 216 173 26 22

**REPRESENTATIVES OF SPECIALIZED AGENCIES**

**CO-ORDINATING UNIT  
FOR THE MEDITERRANEAN  
ACTION PLAN (MAP)**

Mr. G. Gabrielides  
Senior Fishery Officer (Marine pollution)  
FAO Project Office  
Mediterranean Action Plan  
P.O.Box 18019  
48, Vassileos Konstantinou Avenue  
116 10 Athens

Tel. No: (30) 1 725 3190-5  
Fax. No: (30) 1 725 3197  
Tlx. No: 222564 MEDU GR

**IAEA - MARINE ENVIRONMENT  
LABORATORY IN MONACO  
(IAEA-MEL)**

Mr. M. Baxter  
Director  
IAEA-MEL  
19, avenue des Castellans  
B.P. N°800  
MC 98 012 Monaco Cedex

Tel. No: (33) 92 05 22 22  
Fax. No: (33) 92 05 77 44  
Tlx. No: 479 378 MEL

IAEA - MEL  
MARINE ENVIRONMENTAL  
STUDIES LABORATORY (MESL)

Mr. L.D. Mee  
Head, Marine Environmental Studies  
Laboratory

Ms. Milena Horvat

Mr. Tihomir Barisic

Mr. J.-P. Villeneuve

IAEA-MEL (MESL)  
19, avenue des Castellans  
B.P. N°800  
MC 98 012 Monaco Cedex

Tel. No: (33) 92 05 22 22  
Fax.No: (33) 92 05 77 44/92 05 39 63  
Tlx. No: 479 378 MEL

## Appendix I

### STATEMENTS BY INVITED PARTICIPANTS

#### **ALBANIA**

There is no uniform code of "Good Laboratory Practice" for QC/QA that applies to all analytical laboratories in Albania engaged in the chemical analysis of environmentally important samples from terrestrial, fresh-water or salt-water sources. Therefore, only the practices utilized for organic parameters in the Laboratory for Organic Analysis, within the Faculty of Natural Sciences at the University of Tirana and to a lesser extent those of the laboratory associated with the Division of Analytical Chemistry, Faculty of Natural Sciences also at the University of Tirana, for inorganic parameters can be addressed.

#### General Considerations

Regardless of the nature of the chemical analyses, an analysis is required to make an initial demonstration of the ability to generate acceptable precision and accuracy for a given method.

Analysis of a "reagent blank" is performed for each set of samples to demonstrate that interferences from the analytical system are under control. Samples are "spiked" with parameters of interest, at a level 1 to 5 times the background level and analyzed at a rate of not less than 10% of all samples analyzed.

All methods are calibrated via independently prepared calibration samples as well as "check standards" at least every day. This is done mostly for organic analysis. External standard methods (which include most inorganic parameters) require use of "check standards" and/or recalibration every third sample.

Each laboratory maintains performance data, including instrument system response data, "spiked" sample analysis results, laboratory replicate results and "field" replicate results. These are reviewed prior to the initiation of the analysis of any "unknown" samples and are used in determining the need to review analytical results of a particular analysis and repeat the determination, should this be necessary. Additional documentation is maintained on analytical results from the analysis of Certified Reference Materials (CRMs), for those procedures for which samples with a known matrix and composition can be obtained.

Albania has a number of problems with the supply of scientific equipment and reagents which is not normal in this period of time. However, some of the possible solutions to our problems may prove useful in other laboratories. The following steps would greatly assist us in our efforts to produce and maintain quality analytical results:

1. A series of calibration mixtures that are concentrated and stable in sealed ampoules which could be used as either "check standards" to confirm our existing standards or as "calibration standards" against which solutions prepared in our laboratories could be run as "check standards".
2. Robust samples, which could be analyzed with a minimum of sample preparation that would be analyzed by many laboratories on a 6-month cycle. Each laboratory would then analyze a sample of a known and unknown concentration every 6 months and a report would be submitted every 3 months.
3. Preparation of CRMs, characterizing Mediterranean matrices for organic and inorganic parameters for which there is general need.
4. On-site training in formal QC/QA practices at each of the regional laboratories and the maintenance and transmission of QC/QA results together with all analytical results to a central location. This would best be done in a machine readable format.



## CROATIA

In Croatia, the Quality Assurance Programme implemented in monitoring of industrial and urban effluents, coastal and open sea areas and international waters of the Adriatic Sea continues by:

- (a) Calibration and maintenance of equipment.
- (b) Verification of the accuracy of a single analysis with a Reference Method, in which case the content of the measured component is known to the analyst.
- (c) Examination of the reliability of the applied methodology with the RM or SRM (standard reference material produced by US NIST), at two concentration levels of the measured component(s). The content of the measured component(s) is not known to the analyst nor to the participating laboratory. The intercomparison runs were conducted with the available and congruent certified samples, RM or SRM, produced by US NIST, US EPA, IAEA, IAEA-MEL, NRCC and SAGAMI.

The Quality Assurance Programme in three monitoring projects is briefly discussed.

1. The Ministry of Agriculture and Forestry, Water Management, Department of the Republic of Croatia has initiated certification of their laboratories. The laboratories that satisfy defined criteria received the license to measure basic chemical parameters and/or certain harmful and toxic substances in effluents, surface water, ground water and sea water. As part of the network of 45 certified Croatian laboratories, Institutes for Public Health, Medical Center and several industrial laboratories from the coast, as well as two Oceanographic institutes, participated in the intercomparison exercise, which was organized by the Reference Laboratory, Center for Marine Research, Zagreb, Institute Rudjer Boskovic (CIM Zagreb-IRB), to verify the accuracy of applied methodology for measuring basic parameters in waste waters. The following basic parameters of waste water were included in the intercomparison run with US EPA certified samples suspended matter, chemical oxygen demand (COD), five days biological oxygen demand (BOD<sub>5</sub>), pH, nutrient

salts (orthophosphate and total phosphorous, ammonium, nitrates and total nitrogen), Besides validation performed by the Reference Laboratory, all results were evaluated by US EPA experts. A critical evaluation of the results on intercomparison exercises performed in 1991 and 1992 is presented in the Report of the Reference Laboratory CIM Zagreb-IRB. The validation of methodology for measuring the metal and PCB content in waste waters continues during 1993 with US EPA certified samples. Several certified Croatian laboratories participate in the intercomparison exercises organized within the framework of the Programme for the Protection of the Danube and its tributaries.

2. The Analytical Quality Control Services programme of the International Atomic Energy Agency, Marine Environment Laboratory (IAEA-MEL) assists laboratories engaged in the analysis of environmental materials, specifically of marine origin for radionuclides, trace elements and organic micro contaminants. Data bases cover organic and inorganic contaminants and radionuclides in sediments and biota. Since 1973 regular intercomparison exercises were organized on a world-wide and regional scale by the Monaco Laboratory of IAEA. Laboratories which are a part of the MED POL network were supported with the appropriate methodology, reference material, and calibration standards to participate in the intercomparison run.

The report issued by IAEA-MEL in 1993 presents the evaluation of data quality for the MED POL programme over a period of 19 years. Laboratories participating in intercomparison exercises, analyzed traces of metals and organic contaminants in samples of marine origin (fish, mussels, sea plant, sediments) which were prepared by IAEA-MEL. During the period 1976-1992, 7 Croatian laboratories participated in intercomparison exercises on trace metals and trace organic contaminants. This number does not reflect the regularity of participation, while several institutes of Public Health joined the intercomparison exercises not earlier than 1985 (for trace metals) and 1988 (for trace organic contaminants) The Center for Marine Research, Zagreb, Rudjer Boskovic Institute regularly participated in the intercomparison exercises on metal and trace organic contaminants. It should be

pointed out that CIM Zagreb-IRB consistently participates in the intercomparison exercises on radionuclides organized by IAEA on an annual basis.

3. The Quality Assurance Programme for monitoring international waters of the Adriatic Sea was launched in 1986 with the purpose of identifying possible sources of errors in single laboratories and to reduce the discrepancy among the results for the same parameter measured by different laboratories. The coordinating Institute was the Center for Marine Research, Zagreb, Rudjer Boskovic Institute. The QA programme continued in three steps as explained at the beginning of the section: Current Status.

During laboratory intercomparison runs, organized in 1988 and 1989, two Croatian Oceanographic Institutes participated in testing the instrumental response and the accuracy of the analyst of chlorophyll *a* and nutrient salts measurements, using US EPA certified samples. The reliability of the applied analytical method for nutrient salts was evaluated with the SAGAMI reference material and two concentration levels of nutrients in sea water. Methodology of measurements of trace metal content (Pb, Cu, Zn) in the sediment was evaluated with the SRM (US NIST).

A field intercomparison was organized on a bilateral and national level in 1986 and 1987 at one sampling station in international waters of the Middle Adriatic Sea. The performance of measurements of meteorological, oceanographic, hydrographic, chemical, biological and sedimentological parameters was evaluated. The results and obstacles of the intercomparison runs are discussed in the Report on the results achieved in the frame of ASCOP for the period 1979-1992.

#### Future requirements

Quality Assurance is a continuous process, essential for every credible laboratory. Intercomparison exercises alone are not sufficient to ensure data quality. There are still laboratories not prepared to participate in the QA programme, producing inadmissible data for regional and global marine pollution assessments.

*Suggestions for the improvement of data quality:*

- (i) Participating laboratories should be certified, according to the defined criteria. A license should be issued for a limited period of time. Intercalibration exercises should be a mandatory part of the license. If a certain laboratory does not produce acceptable results in several intercomparison runs, the license for measuring certain parameters should be suspended.
- (ii) Sampling, sample storage, sample treatment and the analysis of each parameter have to be well documented. The protocol is mandatory during monitoring and intercalibration activities. Any changes of protocol have to be analytically and statistically verified.
- (iii) Coordinating, Reference Laboratory and the Regional Analytical Center should pay more attention to laboratory records of the analytical data and to the application of internal test procedures, in particular to the control charts.
- (iv) Equipment for in situ sensing, for sampling and analysis, should be renewed with one of improved sensitivity and selectivity. Proper installation and service of such equipment, including calibration, should be organized with technical and financial support from International Foundations or Agencies.
- (v) Preparation of new types of RMs, representative of the Mediterranean and/or Adriatic marine environment.
- (vi) Regular discussions on methodology, possible improvements, joint monitoring exercises, organization of workshops, training of personnel directly involved in the sampling and measurement process.

## CYPRUS

With reference to the quality of analytical data produced in the laboratory of the Fisheries Department for different marine contaminants, the situation is as follows:

a) Trace Organics

The analytical data produced for trace organics (PCBs, DDT's) are of high quality due to a strict quality control system which includes the following:

- (i) Participation in all intercalibration exercises organized by the IAEA-MEL since 1982 with the same analyst. This avoids errors and allows for precise and accurate reporting of results.
- (ii) In each series of analyses, certified reference materials are used.

With the recent implementation of a stronger and precise sampling programme, the quality of our data will be even better.

b) Trace Metals

A number of problems that were encountered in respect to the analysis of metals have been resolved with the purchase of new equipment and training of staff members. These improvements will allow active participation in the future intercomparison exercises organized by IAEA-MEL. With the implementation of good laboratory practice, (including QC charts, analyzing CRMs, etc.) data of high quality will be produced in the future.

## GREECE

### 1. UNEP MED POL

The credibility of methods used in analytical chemistry, particularly when it's the case to determine the elements that are existing in very small quantities (of the order of parts per billion) is most important.

For this reason the MED POL programme has given the opportunity for laboratories to check and improve their analytical methods by taking part in international intercomparison exercises which have been organized by the IAEA-MEL. We have taken part in these exercises from 1975 to 1981, a total of four times. The intercomparisons concerned samples of oyster, sea plant, copepod and fish flesh for the following trace elements, Cu, Zn Fe, Mn, Cd, Pb, Co.

The values for the results of these analyses from all the laboratories taking part in the above exercises have been published in reports from IAEA-MEL. From these intercomparison reports, our laboratory gave results that were in excellent agreement with the middle terms of the values of other laboratories as well as with the values of the tests of Dixon and Chauvenet.

In the progress report No. 18 for Fish Flesh Sample MA-A-2, it clearly states that the measurements from our laboratory (code #61) are of excellent credibility.

### 2. QUASIMEME

This programme is in cooperation with European Institutes who are interested in Marine Research and is financed by the EEC. The participation of the laboratories is very restricted and the selection was made based upon criteria yielding results in nutrient salts, heavy metals and chlorinated hydrocarbons in programmes of marine measurements, i.e. NSTF, MJG (OSPARCOM) and MED POL. The basic goals of the programme (commencing Feb. 1993) are:

- (i) continuous validation of the quality of analyses from laboratories in the form of progress reports.

- (ii) possibility of resolving problems of learning and specialization of the laboratories, and
- (iii) creation and improvement of the quality of administering the results.

Hopefully, this will be achieved during meetings and communication between the laboratories in close cooperation, and also with exchange of information and ideas in the methodology and presentation of their results.

## EGYPT

Egypt has participated in intercomparison exercises since they began in Phase I of MAP. The first report which dealt with trace metals only was done in 1978 and was sent by the Institute of Oceanography and Fisheries (IOF) in Alexandria. Intercomparison exercises were resumed in Phase II, however, during this period Quality Assurance was practiced from time to time (depending mainly upon the analyst) particularly for sediments. This was done using standard rock powder or sediment that had been analyzed and their trace element contents were made known. Outside of the IOF laboratories it was not known whether intercomparison or quality assurance for trace metal analysis were practiced or not. The break-down of instruments and/or lack of standards and intercalibration samples could have been the main obstacles in our country. Also the training that was done for one or just a few individuals, without taking into consideration the high rate of turnover in Egypt surely caused some problems.

In 1982, the University of Alexandria participated in intercomparison exercises on organic contaminants. This was mainly due to the presence of a UNDP project that supplied instruments and funds to the University during this period. Again, the University ceased to participate when this project ended and trained personnel left for other places. It is not known, however, if quality assurance was practiced or not

With the beginning of phase II new pieces of equipment were supplied to the National Institute of Oceanography and Fisheries (NIOF) in Alexandria. A field

mission in 1987 by Dr. Mee and Dr. Jetic discussed the training policy and the supply of funds and technical assistance with the ASRT, the National Coordinator at that time. The results of these two factors were observed later in 1991 and 1992 when Egypt started to participate regularly in the intercomparisons and supplied data to the MED UNIT on the monitoring of coastal waters. During the period 1987-1991 there was a transfer of responsibilities between the ASRT and the EEAA. The latter assisted in different ways, particularly through financial contribution to this activity.

It is evident that Egypt started to participate more actively, and the NIOF participated in the exercise in 1992, but a strategy still has to be set for the delivery of standards, intercomparison samples and regular maintenance of the newly acquired equipment. On the job training in a manner similar to that implemented during 1990 and 1991 should be repeated along with the regular training conducted at the IAEA offices.

## ISRAEL

The Israel Oceanographic & Limnological Research, Ltd. (IOLR) is conducting a number of marine environmental monitoring programmes of various scopes and purposes. The National Monitoring Programme within the framework of MED POL is essentially a "status and trends" programme. The data generated by this programme provide essential background information for the evaluation of results of various components. Quality Assurance (QA) is an essential component of all monitoring programmes. The approach to QA is holistic, covering all stages involved in the acquisition of data, i.e., sampling strategy, sample handling, chemical analyses and data assessment. An example is provided by the monitoring of trace metal levels in fish, benthic organisms and sediments carried out by the IOLR since 1977 as part of the National Monitoring Programme. Analyses of all samples are accompanied by frequent analyses of commercially available Certified Reference Materials (CRMs) of appropriate matrices. Annual and multi-annual Analytical Quality Control Charts (AQCCs) are prepared for each CRM analyzed. In addition, IOLR participated in all relevant intercomparison exercises organized by the IAEA-MEL. The monitoring data are organized in computerized data bases that include tables on the results of CRM



analyses (annual mean values) and AQCCs. Data quality is further checked by various data assessment procedures developed on the basis of scientific studies (e.g. examination of the relationships of mercury levels in fish muscle to body weight and length; use of geochemical normalizers such as Fe and Al for the evaluation of sedimentary trace metal data). It is the view of Israel that a QA programme should be the mandatory component of any monitoring activity within the framework of MED POL.

## LEBANON

The representative from Lebanon said that their participation in the MED POL programme has had its "ups and downs" for obvious reasons. It seems that recently better prospects exist for active participation. He reminded the participants of the latest recommendations of the Eighth Contracting Parties Meeting whereby capacity building and technical assistance should be targeted at countries that are in most need of this assistance.

He also stressed the importance of Quality Control and On-job Training.

## MONACO

There is only one Institute in Monaco participating in the MED POL programme (Service de l'Environnement). The analytical quality control in this institute is organized as follows:

1. In the initial phase, when the analytical capacity for trace metal analysis was built up (1982-83), The IAEA reference materials available at that time were used to check the results given by the AAS-methods which were used for heavy metal determinations (Cd, Pb, Hg, etc.).
2. Since 1985, the Laboratory has participated in the IAEA intercomparison exercises for trace metals on an almost regular basis

3. For nutrient analysis, quality control is done by the regular participation of intercomparisons organized by the French Research National Observation (every 2-3 years).

In our opinion, there are two essential factors for good quality results in environmental pollution studies:

1. The scientific educational level of the persons in charge of the analytical work. In our laboratory, this work is performed entirely by people with an academic level (Ph.D. or M.Sc.). This brings an additional safety level to the quality of results.
2. The quality of the equipment used. The replacement of an old AA-spectrophotometer by a Zeeman-AA-spectrophotometer equipped with a graphite furnace has made obtention of analytical results easier and more accurate.

It should be emphasized that Analytical Quality Control is only a part (but an essential one) of the quality assurance programme. It does not take into consideration problems associated with the sampling procedure and storage of samples, etc. Control charts are useful but their importance should not be over-estimated since an analytical method can work very well for a reference sample but fail for other samples, owing to matrix effects. In our opinion, the ultimate proof of the good quality of results lies in their scientific interpretation. Generally speaking, one can assume that results of analysis are good if:

1. Quality Control is applied during the analytical work.
2. These results can be compared to the determination of other parameters which are independently measured (e.g. nutrients with salinity, heavy metal concentrations with animal weight, etc.) and this comparison should have a logical sense from the scientific point of view (usually by establishing mathematical correlations)

## MOROCCO

Our laboratory is working on water analyses and we consider Quality Assurance as a major priority in analytical protocols, i.e. sampling, analysis and interpretation of results.

Quality Assurance begins from sampling and ends with the interpretation and presentation of results.

Taking into consideration our labour force, the work being done, responsibilities and conditions of work, the maintenance of equipment is also a necessary part of the work as follows:

- Protocols used satisfy C.E.E. or D.I.N. norms.
- Any protocol modification has to be approved by the Head of the Laboratory.
- Log books are kept for laboratory equipment.
- Sampling protocols satisfy I.S.O./D.I.N. norms.
- Results of analyses are written following I.S.O./D.I.N norms.
- The Data Base concerning results is checked by the Head of the Laboratory.
- Laboratory scientists are trained regularly.
- For Standards and Certified Reference Materials, control charts are being kept.

### Future Activities

- Standard addition method charts will be kept.
- Use of certified reference standards.
- Participation in and organization of intercomparison exercises.

## SYRIA

The Marine Research Institute, Tishreen University in Latakia has been involved in the MED POL Monitoring Programme for the last few years, analyzing heavy metals in biota by using flame Atomic Absorption Spectrophotometer (AAS) (Perkin-Elmer).

The Institute has not been involved in any exercises concerning the quality control/quality assurance or intercomparison exercises. Recently, we received two samples (sediment and tuna fish) as reference materials.

They have not used our Graphite Furnace of the AAS for analyses due to some undetermined problems which they hope that the IAEA maintenance engineer will be able to solve in the near future.

They are hoping to have more attention and better collaboration in the future.

## TURKEY

In order to guarantee the quality assurance of future data and eliminate any doubtful issues on the subject, an obligation for the intercomparison and interlaboratory quality control was added to the contract between the laboratories and the Ministry.

Here it seems worth mentioning that the data recovered from the North Levantine, during the Pilot Phase and Phase II, were adequate enough to be published in refereed international journals and this has occurred several times.

### MED POL Programme Assistance

It is essential, especially for those inexperienced laboratories who seek help, that quality assurance and data assistance from the MED POL (Unit) is ensured. For this purpose:

1. The Unit should establish good communications with the participating laboratories in accordance with the National Coordinator.
2. They should check and advise on the quality assurance plans of the participating laboratories.
3. They should monitor the performance of the laboratories.
4. They should continue to provide intercomparison samples.
5. They should continue to provide training.
6. The Unit should publish regional performances by reporting the intercomparison and Data Quality Record (DQR) results to the National Coordinator and publicize the best performing laboratories and/or inform the National Coordinator.

#### Data Quality Assurance

The country profile for data quality assurance is depicted below.

In the N. Levantine report, in addition to intercomparison exercises, data quality records (DQRs) have been kept regularly.

Due to its inhomogeneity, the National Coordinator decided to evaluate the existing MED POL data to see if the data consistency was adequate for further work or whether extensive intercomparison studies would be required. Subsequently the data were screened, pooled and prepared for submission to the related authorities. Since this screening, the data quality was found to be sufficient and a 10-year synthesis was produced in 1990 and distributed to the parties involved.

#### Quality Assurance in Turkey - MED POL Phase II Programme

Several Turkish institutions who participated actively in the MED POL Pilot Phase also participated in the Intercomparison exercises on concentrations of the heavy metals and chlorinated hydrocarbons.

For the Action Plan (Phase II), four institutions are actively participating in the National Programme. In Region VIII (Aegean) and Region IX (Northern Levantine) inputs from land-based sources, coastal stations and reference stations are studied. However, since 1989 airborne pollutants have been studied only in the No. Levantine. These studies have been coordinated and partially sponsored by the Turkish Ministry of the Environment and/or the Undersecretary since 1983. Sponsorship is based on yearly contracts. In the years 1992 and 1993 this support and coordination has not been realized.