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Series of Thematic Workshops on Priority Topics of National Chemicals Management Capacity Building

Strengthening National Capacities for Chemical Analysis and Monitoring for the Sound Management of Chemicals

Observations and Conclusions of an International Expert Meeting

The Hague, The Netherlands

5-8 November 2001

Final Report

UNITAR

OPCW

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD

About the Series of Thematic Workshops on Priority Topics of National Chemicals Management Capacity Building...

The Series of Thematic Workshops on Priority Topics of National Chemicals Management Capacity Building provides a forum to facilitate an exchange of experience and to identify practical steps which interested countries can take to systematically address certain chemicals management priority topics. The series addresses priorities which have been identified by countries through National Profiles and in the context of National Programmes for the Sound Management of Chemicals and which have also been highlighted through the Intergovernmental Forum on Chemical Safety (IFCS). Many of these topics (e.g. chemicals legislation) are inter-sectoral in nature and cut across the activities of various ministries and interested parties at the national level. For this reason, integrated and co-ordinated approaches, which take into consideration the perspective of all interested parties and build upon existing international experience, are considered of great importance.

The workshops are co-ordinated by UNITAR and involve interested countries, IOMC Participating Organizations, industry, public interest groups, and other interested parties. Thematic workshops on the following topics have been held:

* Strengthening National Information Systems and Information Exchange for the Sound Management of Chemicals, September 1998

* Strengthening National Awareness Raising and Education for Chemicals Management, October 1998

* Developing and Strengthening National Legislation and Policies for the Sound Management of Chemicals, June 1999

* Strengthening National Capacities for Risk Management Decision-Making for Priority Chemicals, October 1999

The reports of the workshops are meant to serve as practical inputs to country-based initiatives in the respective areas and may also highlight certain issues which may require further attention at the international level.

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For additional information please contact:

Training and Capacity Building Programmes
in Chemicals and Waste Management
UNITAR
Palais des Nations
CH-1211 GENEVE 10
Switzerland

TEL +41 22 917 85 25
FAX +41 22 917 80 47
E-mail cwm@unitar.org
Website: www.unitar.org/cwm

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Executive Summary

The thematic workshop on *Strengthening National Capacities for Chemical Analysis and Monitoring for the Sound Management of Chemicals* was the fifth in a Series of Thematic Workshops on Priority Topics of National Chemicals Management Capacity Building. It took place in The Hague, The Netherlands, from 5-8 November 2001 and was jointly organised by UNITAR and the Technical Secretariat of the Organization for the Prohibition of Chemical Weapons (OPCW). The event brought together some 41 representatives from more than 20 developing countries, countries with economies in transition, countries with advanced chemicals management capabilities and international organisations.

During the four days, country experiences were exchanged, major issues regarding laboratory capacity were examined and practical recommendations developed. The workshop concluded that important constraints faced by countries with regards to improving laboratory capacity included: lack of training; the reluctance of donors to provide funding; the costs of equipment and maintenance; the loss of trained staff and limits on hiring new staff; the slow process of setting up a self-sufficient, accredited laboratory; and a lack of communication between laboratories.

The recommendations developed at the workshop, in addition to the general workshop proceedings, were designed to highlight the importance of national laboratory capacity for national policy-makers and other interested parties. These general recommendations are grouped in four broad areas: legal and policy, administrative, financial/human resources, and technical. These include, for example:

- ensure that a legal framework (including infrastructure for enforcement) is in place at the national level for chemicals analysis and monitoring; activities under this framework should meaningfully involve interested and affected parties (stakeholders), build upon existing international experiences and take place in an integrated and coordinated fashion;

- consider a "tiered" (or "multi-level") approach to laboratories; some simpler tests can be done locally while other more complicated tests may be referred to centralised laboratory facilities either within the country or externally;

- donors should be encouraged to ensure that equipment donations are suited to the needs of the recipient country and that appropriate training, service and maintenance are ensured; and

- "centres of excellence" for the sound management of chemicals should be established to provide advice and assistance on analytical and monitoring issues.

Recommendations specific to particular themes and issues were also developed, which include, *inter alia*:

- countries should have a national plan for emergency response which should be regularly updated in an integrated way (this should take into account international information, as well as the control of cross-border transport of dangerous goods which makes analytical facilities and procedures for emergency situations necessary);

- scientific institutions in developed countries should be encouraged to cooperate with developing countries and countries with economies in transition in undertaking epidemiological and surveillance studies following a chemical incident; and

- countries should be encouraged to promote cooperative mechanisms and, if appropriate, a legal framework for environmental monitoring programmes.

In addition to considering the recommendations contained herein, the workshop concluded that countries could begin with a self-assessment of needs and analysis of available capacities across all four areas covered by the recommendations. A draft questionnaire was developed for this purpose.

In summary, participants concluded that the workshop provided a valuable opportunity to reflect on experiences, and to discuss key issues in the area of chemical analysis and monitoring. UNITAR and OPCW were encouraged to widely distribute the report of the workshop, both electronically and on paper, to all interested parties.[1]

[1] Electronic copies of this report are available on the UNITAR website at www.unitar.org/cwm and the OPCW website at www.opcw.org.

1. Introduction

The thematic workshop on *Strengthening National Capacities for Chemical Analysis and Monitoring for the Sound Management of Chemicals* was the fifth in a Series of Thematic Workshops on Priority Topics of National Chemicals Management Capacity Building. It took place in The Hague, The Netherlands, from 5-8 November 2001 and was jointly organised by UNITAR and the Technical Secretariat of the Organization for the Prohibition of Chemical Weapons (OPCW). The event brought together some 41 representatives from more than 20 developing countries, countries with economies in transition, countries with advanced chemicals management capabilities and international organisations.

Workshop topics addressed recommendations included in Chapter 19 of Agenda 21[2] which were agreed upon as a basis for action in 1994 at the first session of the Intergovernmental Forum on Chemical Safety (IFCS) and recently confirmed in the priorities adopted by the Forum at its third session in October 2000 in Salvador, Brazil. This workshop also contributed to the implementation of Article XI of the Chemicals Weapons Convention (CWC) dealing with the improvement of the capacity of the States Parties to implement the provisions of the CWC and, more generally, the economic and technological development of States party to the CWC.

1.1 Background

Many countries identified the issue of building capacity for chemicals analysis and monitoring as one of their five most important priorities.

Strengthening national capacities and capabilities to perform chemical analyses is a basic requirement towards achieving the goal of sound chemicals management. Some one-third of all countries that prepared a National Chemicals Management Profile and organised a National Priority Setting Workshop identified the issue of building capacity for chemicals analysis and monitoring as one of their five most important priorities. Requests for external assistance to build and maintain this capacity have also been submitted to various international and donor agencies. Developing and maintaining capacity for chemicals analysis and monitoring is a resource-intensive activity requiring significant investment as well as sustained resources, both financially and in terms of human resources.

Analytical chemical capability is required, for example, to:

- determine concentrations of chemicals in human and animal tissues as well as in environmental media, such as air, water and land;
- determine and monitor concentrations of regulated chemicals in

[2] Adopted by the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992.

work places;

- measure additives and residues of chemicals (including pesticides, veterinary drugs and naturally occurring toxins) in food, drinking water and consumer goods;
- monitor emissions of chemicals from stationary and mobile sources in compliance with national standards;
- monitor chemicals at the point of entry into (or exit out of) the country;
- measure and monitor the environmentally safe disposal of chemicals;
- ensure quality assurance of goods and products in trade, including product registration and labelling;
- identify chemicals subject to bans, restrictions (including drugs, substances of abuse and doping, or chemicals subject to export regulations or prohibitions such as certain chemicals regulated under the CWC); and
- carry out research.

Various international agreements require and/or catalyse the establishment of chemical analytical capacities and capabilities in participating countries.

In addition, various international agreements are now, or will soon be, in place that require and/or catalyse the establishment of chemical analytical capacities and capabilities in participating countries. Examples of such agreements are:

- ILO Chemicals Convention 1990 (No. 170), concerning safety in the use of chemicals at work;
- the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC);
- the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons, and On Their Destruction (Chemical Weapons Convention, or CWC);
- the Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances;
- the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal;
- the Montreal Protocol on Substances that Deplete the Ozone Layer;

- the Stockholm Convention on Persistent Organic Pollutants (POPs); and

- regional agreements related to, *inter alia*, marine pollution and disposal of hazardous waste.

Furthermore, meeting internationally agreed guidance values, such as those for drinking water and residues in food, requires specific analytical capabilities. There has, however, been little coordination among international activities with regard to chemical analysis, and few if any attempts have yet been made to develop the potential benefits of planning, in an integrated and coordinated fashion, for strengthening national capacities for chemicals analysis and monitoring. The reasons for this are largely due to the segmentation of responsibilities for specific aspects of sound chemicals management among a variety of agencies and institutions in countries, with few internal incentives for the sharing of resources.

1.2 Workshop Objectives

The workshop on *Strengthening National Capacities for Chemical Analysis and Monitoring for the Sound Management of Chemicals* served the objectives to:

The workshop examined key issues and problems involved in strengthening capacities.

- provide guidance to countries in developing sustainable strategies for strengthening capacities for chemical analysis and monitoring for sound chemicals management, while recognising national as well as regional circumstances and priorities;

- examine the key issues and problems involved in strengthening capacities, such as improved ways of using existing facilities for multiple purposes, integrating capacities into an overall national/regional plan for the sound management of chemicals, and ensuring the cooperation of all concerned parties; and

- identify synergies and potential links, as well as provide practical suggestions for promoting enhanced cooperation among relevant international and bi-lateral support activities for capacity building.

Key questions addressed through the workshop included, *inter alia*:

- Which national (regulatory and other) requirements need to be considered when addressing chemical analysis capacities?

- Which international agreements dealing with chemicals require analytical capacities in countries; are there any conceptual linkages/overlaps among them?

- What are the key issues that countries may want to address in conducting a systematic assessment of their technical/laboratory infrastructure?

- Which factors need to be considered when systematically analysing requirements and assistance needs (such as competence and skill levels, equipment and availability of reagents and reference materials, comparability of approaches and standardisation of analytical methods, and information including databases and software)?

- Is it possible to identify minimum and maximum capabilities in specific areas of chemical analysis that countries would require under an integrated approach to the sound management of chemicals? Is synergism possible between the capacities required for different agreements/regulations and other requirements (such as private industry standards)?

- What are the hindrances to integrated use of laboratory and monitoring capacities for multiple purposes?

- How can specific chemicals that are regulated by different agreements and regulations be identified? What implications do these agreements and regulations have for capacities in the area of chemical analysis and monitoring?

- How can a high standard of quality assurance at the national level be developed and maintained, including the need for accreditation?

- For what type of chemical analysis or monitoring requirements would cooperation at a regional level (e.g. through a regional laboratory, regional networking) be an effective way of providing the necessary capacity?

- What are the innovative financing and other assistance mechanisms which could contribute to ensuring sustained high quality laboratory capacities (e.g. role of training, exchange of information and sharing experience, exchange of staff through internships, role of research and teaching at laboratories involved)?

1.3 Introductory Presentations

Mr. Bijoy Chatterjee, Head of the International Cooperation Branch, OPCW, welcomed participants to OPCW and The Hague and introduced ***Dr. John Makhubalo***, Director of the International Cooperation and Assistance Division. Dr. Makhubalo highlighted the international participation at the workshop and stressed the importance attached to strengthening national capacities for chemical analysis and monitoring under the Chemical Weapons Convention (CWC). He noted

Capacity is important not only for verification of compliance with the CWC, but also for peaceful applications of chemistry in member states.

monitoring under the Chemical Weapons Convention (CWC). He noted that such capacity was important not only for verification of compliance with the CWC, but also for peaceful applications of chemistry in member states, such as in the context of international cooperation and increasing national capacities as promoted by Chapter 19 of Agenda 21. Emphasising the difficulties in detecting and systematically tracking toxic chemicals, Dr. Makhubalo observed that many developing countries lack the capacity to monitor toxic chemicals, a result confirmed by the worldwide preparation of UNITAR/IOMC National Profiles which also identify two core areas for providing assistance: simplifying and harmonising legislation and improving the technical capacities of laboratories. Recalling OPCW's cooperation with UNITAR during previous thematic workshops, he concluded by suggesting that the events of September 11 required to rethink national and international security as the threat of chemical terrorism emphasises the importance of the full implementation of the CWC.

Mr. Craig Boljkovac, Deputy Programme Coordinator, Chemicals and Waste Management Programme, UNITAR, thanked OPCW and IOMC Participating Organizations for their efforts in preparing the workshop. He highlighted that this was the fifth in a series of thematic workshops, which may include future topics such as financial resource mobilisation and inter-ministerial coordination. Noting that National Profiles reveal improving laboratory capacity as a priority issue for many countries, Mr. Boljkovac stressed that the outcomes of the workshop should be practical suggestions and recommendations. He concluded by highlighting the open spirit of the workshop and by thanking the Swiss government for their financial support.

Under UNEP conventions, analytical requirements/ capacity may often be needed both within countries and internationally.

Dr. Heidi Fiedler, Scientific Affairs Officer, UNEP Chemicals, transmitted the best wishes of the Executive Director of UNEP for the workshop. Emphasising that the many challenges and limited resources available with respect to chemicals analytical capacity and monitoring require international collaboration, she noted that under UNEP conventions such as the Basel Convention on transboundary movements of hazardous wastes, the Rotterdam Convention on the trade in hazardous chemicals and the Stockholm Convention on persistent organic pollutants (POPs), analytical requirements/capacity may often be needed both within countries and internationally.[3] Dr. Fiedler concluded by highlighting the importance of worldwide acceptance for data to monitor convention implementation and of analytical work for risk assessment.

Dr. Jenny Pronczuk, Medical Officer, Management of Chemical Exposures, WHO/IPCS, noted that analytical facilities are essential in the area of toxicology where toxic substances need to be identified and quantified. The guidance developed by WHO on analytical methods for

[3] **N.B.** Terms such as "POPs" and others are defined in the List of Acronyms of this report as found in Annex D.

the detection and measurement of chemicals in air, food, water and biological media were outlined, such as provided in the Environmental Health Criteria documents, the Handbook on Basic Analytical Toxicology and the IPCS INTOX Databank. It was stated that WHO looked forward to the outcome of the workshop, in particular the preparation of clear guidance and further coordination of international efforts.

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Following the opening and introductory presentations, Sessions 1-3 featured a series of panel presentations and discussions which provided an opportunity for participants to better understand the situations and challenges in developing countries and countries with economies in transition, and to hear a range of views about chemicals analysis and monitoring from the perspective of international organisations, convention secretariats and countries with advanced chemicals management capabilities (see Annex 2 for the Workshop Agenda).[4]

During Session 1, entitled *Situations and Challenges in Developing Countries and Countries with Economies in Transition*, representatives from South Africa and Poland gave brief presentations which highlighted the current situation in their countries with regard to national capacities for chemical analysis and monitoring. Emphasis was placed on examples of successful approaches, practical problems faced, and issues which are particularly challenging.

During Session 2, *Perspectives and Experiences of Countries with Advanced Chemicals Management Capabilities*, representatives from Germany and Finland made presentations sharing the experience gained over the past years with chemicals analysis and monitoring. Emphasis was given to approaches that have worked well and/or which have been difficult to implement. Lessons learned, which may be of particular relevance to developing countries and countries with economies in transition, were also highlighted.

In Session 3, entitled *The Perspectives of International Convention Secretariats and International Organisations*, representatives of the OPCW laboratory, OPCW Scientific Advisory Board (SAB) and UNEP Chemicals provided brief overviews from the perspective of their respective organisations on how various programmes or initiatives at the international level shape or contribute to the development and strengthening of national capacities for chemical analysis and monitoring.

1.4 Thematic Discussions and Working Groups

In the second part of the workshop, important themes and challenges that emerged during the presentations were further addressed through

[4] These presentations are outlined in more detail in Section 2 of this report. Copies of presentations can be obtained from UNITAR upon request.

that emerged during the presentations were further addressed through working groups. The first group session enabled participants to exchange experiences regarding their countries' analytical laboratory and monitoring capacity needs, covering five main areas:

- public and occupational health surveillance and the medical needs for chemical emergency response;
- environmental quality monitoring and surveillance of environmental impact of chemical emergencies;
- monitoring for chemical quality assurance of food, drinking water, consumer goods and products of trade, including meeting labelling regulations;
- monitoring of pharmaceuticals, drugs and doping; and
- emission and effluent control (i.e. monitoring of chemical wastes).

Based on the various capacity requirements identified in these thematic discussions, the second group session considered how to develop an integrated approach to capacity building to address specific potential needs in a country.

Based on the various capacity requirements identified in these thematic discussions, the second group session considered how to develop an integrated approach to capacity building to address specific potential needs in a country. Recommendations and practical solutions were developed to address the identified problems and challenges. Five scenarios were considered:

- development of a monitoring programme for a specific chemical or group of chemicals;
- establishing analytical facilities for dealing with chemical emergencies (including industrial, transport, consumer goods, food and water incidents);
- monitoring requirements for trade (internal and external markets) in consumer goods or food products;
- setting up a surveillance programme for exposure (from all routes) of the public or a specific population group (e.g. workers, women, children) to specific chemicals; and
- analytical requirements for regulating an industrial activity (life cycle approach) in order to protect human health and the environment.

2. Summary of the Existing Situations in Selected Developing Countries and Countries with Economies in Transition

This section of the report provides more detail regarding the existing situations in developing countries and countries with economies in transition with regards to national capacity for chemical analysis and monitoring, based on the presentations and discussion at the workshop.

South Africa highlighted their unique background and challenges, particularly after the change in government in 1993.

Dr. Philip Coleman, of Protechnik in **South Africa** highlighted the unique background and challenges in South Africa, particularly after the change in government in 1993. He outlined three phases in the South African chemical industry: (1) commodity based: mining and agriculture; (2) self-sufficiency: petrochemicals (coal based) and strategic chemicals; and (3) globalisation: declining chemicals industry, repositioning (local raw materials) and new initiatives (e.g. "Chem City", to try and support small chemical industry).

He emphasised the current problems as being related to:

- *personnel:* scarcity of skilled analytical chemists, few post graduate students (partly due to unpopularity of chemicals), poor quality of lecturing staff;
- *training:* lowering of standards, high cost of overseas study, decreasing number of top quality research and development facilities (research is a luxury, government priorities have changed, laboratories must be cost effective);
- *analytical equipment:* no local suppliers (resulting in need to import), lack of funding (no funds available for state of the art equipment), existence of outdated equipment, staff not sufficiently skilled in using certain equipment; and
- *maintenance of analytical equipment:* high running costs, high costs of spares, limited stock of spares, few qualified technicians, poor after-sales service, poor infrastructure and utilities.

He suggested that possible solutions to these problems included: grouping of analytical facilities (optimum infrastructure and utilisation); developing in-house training programmes (mentoring); identification of a reliable supplier(s) (ease of maintenance, spares, training, support from country of manufacture); cooperation among SADC countries (pooling of resources); and foreign investment in technology development (not handouts).

Prof. Marek Jakubowski of the Nofer Institute of Occupational Medicine in **Poland** noted that unlike South Africa, Poland is centralised. There are sixteen districts and all institutions involved in environmental monitoring have headquarters in the capital cities of these districts. He highlighted the existence of heavy industry in the

Poland highlighted the existence of heavy industry in the south of the country and copper mining in the west, as well as a legacy of contamination.

these districts. He highlighted the existence of heavy industry in the south of the country and copper mining in the west, as well as a legacy of contamination. In the past, poor analytical facilities had led to mistakes but for the last ten years there has been a body – renamed the Polish Centre for Accreditation in 2001 – which is a member of the International Organisation Forum (IAF), International Laboratory Accreditation Cooperation (ILAC) and expected to become a member of European Cooperation for Accreditation.

The first testing lab was accredited in 1992 and numerous others are becoming accredited. In Poland, monitoring of toxic substances is carried out by the State Environmental Inspection; this body monitors the current state of the environment, trends in quality of the environment, and the effectiveness of corrective actions. All district inspectorates have accredited laboratories, subsidised by money paid by polluting industries. These inspectorates make yearly reports, which are then aggregated by the central office. Other toxicological analyses are carried out by, or in connection with, the Ministry of Health (e.g. the State Institute of Hygiene, the Institute of Occupational Medicine, and the Institute of Food and Nutrition). He concluded by noting Poland's imminent accession to the EU, which would result in changes in law and transposing EU regulations into Polish Law with a new act in 2002 (Act on Chemical Substances and Preparations).

Ghana highlighted the challenges of maintaining equipment, a lack of human resources and the need for training.

Mr. Richard Johnson of **Ghana**'s Environmental Protection Agency noted that Ghana had completed a National Chemicals Management Profile in 1996. He reported that there are twenty laboratories which can analyse for pesticides, pharmaceuticals, food, quality control of soil, water, and effluent discharges from industry. He highlighted the challenges of maintaining equipment, a lack of human resources and the need for training.

Sri Lanka stressed the importance of accreditation and the need for an accreditation body within the country.

Dr. Azeez Mubarak, Ministry of Science and Technology, **Sri Lanka**, outlined their mainly agricultural economy with little chemical manufacturing. He said that laboratories in Sri Lanka were designed for export related commodities control (e.g. tea) due to demands of developed countries for certified testing. This cannot always be done in Sri Lanka and therefore some testing is done abroad at high cost. He noted that there are government laboratories, semi-private laboratories and private laboratories (although few in this latter category). Government labs have been supported by external donors, whereas the semi-government labs charge money for their work. It is in the semi-private labs where export related analyses are undertaken. He stressed the importance of accreditation and the need for an accreditation body within Sri Lanka. He concluded by highlighting the problem of maintenance and service of laboratory equipment and the long process required to develop a good lab, obtain accreditation, and train staff.

Dr. Jane Okado, from **Kenya**'s Ministry of Health, described their National Chemical Management Act, which is not yet fully operational.

Kenya noted the problem of replacing and updating lab equipment, the reluctance of donors, and the high cost of training in other countries.

National Chemical Management Act, which is not yet fully operational. Regarding laboratory capacity, she noted that two national labs were set up in the 1950s and 1960s. These labs have been upgraded, and others created, but trained staff often leave and there is currently a hiring freeze. She noted the problem of replacing and updating lab equipment, the reluctance of donors, and the high cost of training in other countries.

Ms. Wiyada Sontichai, Ministry of Public Health, **Thailand**, outlined the problems faced by laboratories in that country. She said that: not all labs use the same methods; reference materials are not always available; labs sometimes give different results; different equipment is used; and that there is a lack of information exchange between labs. She concluded by discussing the importance and challenges of training.

3. Challenges and Bottlenecks Identified by Countries

Following are some of the most commonly cited challenges and bottlenecks related to the further development and strengthening of national capacities for chemical analysis and monitoring in developing countries and countries with economies in transition.

3.1 Lack of Training

Laboratory staff sent abroad for extra training can be a significant expense.

Many countries reported difficulties with respect to the hiring and training of staff when trying to improve laboratory capacity for chemical analysis and monitoring. Not only is staff training expensive in terms of financial resources (see also 3.2 below), but there are often limits on hiring new staff and those staff with previous training and qualifications may seek employment elsewhere. In some cases, laboratory staff must be sent abroad for extra training, which can be a significant expense.

3.2 Donor Reluctance

Allocating funds to improve laboratories may not always be seen as a priority.

In addition to the restrictive financial situations found in many developing and transition countries, reluctance among donors was also highlighted as a challenge for improving laboratory capacity. Many countries reported a decrease in funds available from donors in recent years. In one case, funds were provided for the purchase of new laboratory equipment, but no further resources were provided to get that equipment up and running. When viewed against the other daily pressing requirements faced, particularly in the poorest countries, allocating funds to improve laboratories may not always be seen as a priority. Many participants stressed the need to find new and creative ways of attracting donor resources for improving monitoring and analysis capacity.

3.3 Costs of Equipment and Maintenance

Virtually all countries reported that the costs of laboratory and testing equipment can prove a significant hurdle to improving capacity. While many participants noted that basic laboratory infrastructure exists in most developing and transition countries, the cost of additional testing or measuring equipment is often prohibitive, particularly for the poorest countries and in light of decreased donor interest. The maintenance of equipment that is available is also costly. Replacement parts are sometimes unavailable or the expertise to repair highly technical testing equipment may not be easily accessible.

3.4 Challenges to Setting up a Self-sufficient, Accredited Laboratory

In addition to the problems outlined above, many countries reported

that setting up a self-sufficient and accredited laboratory is inherently a slow process. There may be legal hindrances to establishing such a facility and not all countries have proper accreditation procedures in place. Moreover, the requirements of different regional and international agreements may differ, thereby placing a strain on the laboratory capacity in poorer countries.

3.5 Lack of Communication

Different laboratories may use different equipment or methods, resulting in differences in the results of similar tests.

Some participants also reported communication difficulties between laboratories as a challenge for improving monitoring and analysis capacity. Different laboratories may use different equipment or methods, resulting in differences in the results of similar tests. Procedures for sharing of information and pooling of knowledge may not be in place, thereby missing opportunities to create synergies among laboratories within a country.

4. Summary of Discussions on Key Issues and Scenarios

A number of specific issues and scenarios were discussed by participants and further elaborated on by working groups.

4.1 Public and Occupational Health Surveillance and Medical Needs for Chemical Emergency Response

There are a number of international agreements dealing with chemicals which influence public and occupational health services.

It was highlighted that there are a number of international agreements dealing with chemicals which influence public and occupational health services, such as the Stockholm POPs Convention, the Rotterdam PIC Convention, ILO Chemicals Convention 170, and the Montreal Protocol. General requirements for laboratories are that they must be able to perform quantitative determinations to the levels below occupational exposure limits (such as ACGIH or SCOEL) or environmental exposure limits (WHO guidelines). To fulfil these requirements, laboratories should have proper facilities, qualified personnel and methods of instrumental analysis. At a minimum, internal quality control with the use of proper reference materials should be applied. When possible, external quality control at the occupational or environmental exposure levels should be implemented. Problems relate to the availability and costs of reference material, accreditation, training, maintenance, access to validated databases of analytical data, as well as the aggregation and interpretation of data.

4.2 Environmental Quality Monitoring and Surveillance of Environmental Impact of Chemical Emergencies

It was proposed that countries have a national plan for emergency response and facilities to do exposure assess-ment.

Regarding chemical emergencies, it was proposed that countries have a national plan for emergency response and facilities to do exposure assessment (sampling, preservation and transport, sample preparation and analysis), available 24 hours a day if possible. Some participants thought it helpful to incorporate all available and useful facilities (governmental and private) and train in "peacetime". Additionally, the CWC and the control of cross-border transport of dangerous-goods – including pesticides and chemical wastes – makes analytical facilities necessary. At the moment, however, there is no international regulation or standard on the minimum level of analytical requirements on a national scale for response to chemical emergencies.

The following issues were also considered important:

- There should be an international training centre for the exchange of experiences, aims, needs and technical and analytical training to support the national organisations.

- There is room for regionalised international support and resource centres (rapid deployment centres). Air transportation is a must in

many cases.

- Immediate response to chemical emergencies minimises public stress.

- Use cost effective techniques, such as screening-methods. These are of great value in monitoring after environmental emergencies. For example, there are cheap and easy-to-use methods for monitoring drinking water.

- Rapid access of response teams (e.g. by fax or Internet) to competent analytical centres to receive advice on adequate field sample preparation and analytical procedures, and assistance with data interpretation

- Emergency drills and training: undertake exercises on a national level in order to train people to cooperate and to define weaknesses in the procedures.

- Most of the methods and apparatus that are necessary for emergency response can be used for other purposes as well, such as the enforcement of legislation or monitoring of quality control for food.

4.3 Monitoring for Chemical Quality Assurance of Food, Drinking Water, Consumer Goods and Products of Trade, including Meeting Labelling Regulations

It was felt that monitoring has to support proactive, rather than reactive, policies.

The working group highlighted that different systems and different levels of development in monitoring systems and capacities were identified across countries, including between pre-accession European counties and countries from Asia, Africa and Latin America. It was suggested that the overall goals of monitoring and sustainable capacity building remain the same for all: monitoring has to go beyond providing data to fulfil legal obligations. It has to be cost-effective and provide information for early identification of emerging problems and real time response to potential hazards. It was felt that monitoring has to support proactive, rather than reactive, policies.

With increasing globalisation, many legal obligations are more or less similar to all countries. These include national and EU legislation, WHO, WTO, FAO, and Codex standards, ISO Standard 17025 for accreditation, as well as international conventions and agreements. Expertise is needed for the development of new, integrated and more cost effective monitoring approaches (e.g. expertise can be transferred from countries with well-developed food safety systems). The following specific areas need to be addressed: overcoming the syndrome of “monitoring being rich in data but poor in information”;

integrating chemical with biological methods – like microbiotests in the field of water – in order to address in a cost effective way the "unknown cocktail of chemicals" and provide early response to emergencies; and the need to establish an effective mechanism for integration across related areas of food safety and the entire chain of production – from the farm to the consumer (the case of pesticides residues is a good example for this approach). Coordination among all actors is therefore essential.

Food safety is strongly connected with the environment, economy and health. This interaction should be reflected in the way monitoring systems are planned and built up. Integration, synergism and communication across sectors are key tools to develop and maintain cost effective monitoring schemes and sustainable capacities.

4.4 Monitoring of Pharmaceuticals, Drugs and Doping

There should be an incentive for laboratories **to achieve and maintain accreditation.**

The working group addressing monitoring for pharmaceuticals, drugs and doping noted that regulatory requirements call for quality control in terms of appropriate content and testing for toxic contaminants (e.g. for heavy metals). For dope testing in sport there are international criteria for laboratory accreditation laid down by the International Olympic Committee. In order to carry out a systematic assessment of laboratory facilities, it was recommended that a questionnaire be sent to all appropriate laboratories, and after analysis of the results, there should be visits to selected laboratories.[5]

Participants suggested that for equipment needs, laboratories should negotiate with equipment companies regarding the following: (i) provision of training in the use and maintenance of the equipment; (ii) provision of teaching manuals; and (iii) guarantee of a regular supply of adequate spare parts. One or more staff could be trained in equipment maintenance to cover, for example, GC, HPLC, GCMS and LCMS and these personnel could then be responsible for maintaining these items for a group of laboratories, funded collectively by the labs involved. It must be borne in mind that the training would have to be limited to instruments from one particular manufacturer.

The minimum requirements for chemical analysis should be designed to meet the main types of substances encountered in quality control issues and overdoses and drug abuse. The recommended minimum equipment would be TLC, UV, GC, LC, and AAS. In a legal situation there is a need for state of the art technology, which would involve GCMS or LCMS. There should also be an incentive for laboratories to achieve and maintain accreditation. This could be achieved by means of additional funding being provided on the basis of continual accreditation, which would be removed should the laboratory fail to

[5] See Annex A for a draft questionnaire.

meet the accreditation criteria. As part of the accreditation process, the laboratories would be expected to take part in external quality assurance (EQA) schemes organised either by the reference laboratory and/or by international bodies. Part of the accreditation scheme should involve

regular inspection of the health and safety measures undertaken by the laboratories to protect staff and to ensure the safe disposal of laboratory wastes.

In some developing countries where there is a statutory requirement for all cases of drug overdoses to be notified to the police, there is reluctance amongst forensic laboratories for biological samples to be analysed in another laboratory. In some laboratories that deal solely with non-biological materials there can be resistance to handling samples of body fluids for fear of staff infection. In addition, this type of laboratory may not have developed the expertise to analyse biological materials. For emergency analyses, where a 24-hour a day service is needed, this may not be available in laboratories other than those attached to a hospital.

Detection of doping agents requires highly sophisticated equipment and a continual programme of research and analytical development. It was felt that this type of investigation should be left with international federations such as the IAAF and the World Anti-doping Agency for the time being and that the establishment of national doping control laboratories should be low priority.

4.5 Emission and Effluent Control and the Monitoring of Chemical Wastes

Participants in this working group suggested that policies for emission/effluent control and the monitoring of wastes should have clear objectives, such as: identifying industrial and domestic sources of pollution; ensuring that each industry make available data on the sort of pollution it emits and its amount; and preventing competition between countries with regard to polluting industries.

To prevent overlap with regard to methods and instruments in different laboratories working in the same field, it is recommended to stimulate synergies and coordination.

Participants also discussed how the level of laboratory structure, equipment and analyses must match the skills and resources available and methods should be related to the availability of expertise and capacity of other laboratories in the region. It was also felt that in order to prevent overlap with regard to methods and instruments in different laboratories working in the same field, it is recommended to stimulate synergies and coordination (e.g. by exchange of data and information, including on analytical procedures and protocols, quality assurance systems and reference data and materials). And if complicated or expensive methods are not optimally available, more simple biological (toxicological) methods might be used for first screening.

4.6 Development of a Monitoring Programme for a Specific Chemical or Group of Chemicals

Under this topic, participants considered the possible starting points for an environmental monitoring programme, which could be external (e.g. requirements of international conventions or recommendations) or

internal (e.g. following a chemical accident or as the result of a national state-of-the-environment report). The launch of any programme should be accompanied by multi-stakeholder awareness raising and agreement about the programme's goals and objectives. It was suggested that a pilot phase of the monitoring programme could be helpful in the identification of chemicals, determination of costs, etc. Following a pilot phase, a full monitoring programme could be established. It was also suggested that external assistance may be needed by some countries to initiate a pilot chemicals monitoring programme, but that the results would help identify needs for analytical capacities.

4.7 Establishing Analytical Facilities for Dealing with Chemical Emergencies (including Industrial, Transport, Consumer Goods, Food and Water Incidents)

This working group considered that simple field tests would be a helpful and low-cost way to improve analytical capacity for monitoring for emergencies. Emergency services could have field kits available (e.g. gas detector tubes for chlorine, phosgene, cyanide, hydrogen sulphide) and simple on-site tests devices. It was also considered advisable to have trained personnel from laboratories or police who can perform these tests on-site.

Regarding laboratory facilities for monitoring chemical emergencies, participants discussed the role of government laboratories, regional laboratories, hospital laboratories and commercial laboratories. It was suggested to send a questionnaire to these laboratories to determine if field test kits are available, if these labs are able and willing to perform the appropriate kinds of tests and if their staff is ready to go the field for taking samples.

Participants also discussed what assistance would be required to establish and maintain these facilities, including staff training, provision of protective equipment, laboratory equipment, and methods and training manuals (e.g. for basic analytical toxicology). It was considered that minimum capabilities would include provision of sample collection kits, proper storage facilities (at 4 °C and -20°C) and simple analytical test kits. Participation in national and international proficiency testing programmes with a view to achieving accreditation with existing international bodies was also encouraged, as was regional cooperation in order to obtain reference materials, reagents and other

consumables, access to reference data and to share information/ experience.

4.8 Monitoring Requirements for Trade (Internal and External Markets) in Consumer Goods or Food Products

Under this topic, participants discussed the importance of investing in equipment and laboratory facilities, including adequate maintenance regimes, supply of consumables and adequate infrastructure such as uninterrupted power supply, clean environment, etc. It was also suggested that, due to the high costs of analysis for consumer and food products, new facilities should not be created, but rather existing ones should be upgraded and their scope of activities widened. This could help reduce costs since it makes optimum use of equipment. For developing countries, it was considered important that regular training programmes, like those conducted by VERIFIN, should be arranged and that labs could be "twinned" with centres of excellence. It was again suggested that accreditation should be required and that financial assistance should be provided for developing countries to acquire certified reference materials (CRMs) since it is difficult and expensive for countries to develop them on their own. Increased use of the Internet to access data and information was also discussed.

4.9 Setting up a Surveillance Programme for Exposure (from all routes) of the Public or a Specific Population Group (e.g. workers, women, children) to Specific Chemicals

Many countries survey occupational exposures to a limited number of chemicals; but few have surveillance systems for exposure of the general public or specific sensitive groups of the population.

In discussing surveillance programmes, it was observed that while many countries have Departments of Epidemiology dealing with the problems of bacteriological and viral diseases, few countries undertake studies of diseases of chemical aetiology. Further, many countries survey occupational exposures to a limited number of chemicals (e.g. heavy metals, pesticides, asbestos); but few countries have surveillance systems for exposure of the general public or specific sensitive groups of the population (e.g. women and children) to chemicals. One suggestion was to establish national strategic units for providing advice on the undertaking of health surveillance and epidemiological studies of diseases of chemical aetiology. Such a unit would call upon the appropriate expertise from the necessary fields of competence, including laboratory services. The unit would advise on when epidemiological studies or surveillance should be undertaken; particularly in relation to a specific chemical incident where public health may be affected. However, it was also commented that countries may need to give consideration to establishing the necessary legislation or regulations to put into place the strategic unit, and which would allow epidemiological studies to be undertaken in a timely manner following a chemical incident. Some international guidance, such as through the WHO Environmental Health Criteria (EHC) Document

214, "Human Exposure Assessment", is available.

Participants also discussed a number of international agreements that may call for surveillance, such as ILO conventions for protection of the workplace in relation to chemical exposures and the bilateral and multilateral agreements involving trans-boundary pollution including the international waterway commissions (e.g. Rhine, Danube and Great Lakes) in relation to water pollution, where both riparian populations and environments can be affected. There may also be the need for surveillance in relation to the Regional Seas Conventions.

It was considered important to have a reference laboratory involved in the design of any surveillance or epidemiological studies, and all laboratories undertaking analyses should be accredited for the purpose of the measurements being undertaken. Minimum requirements for sampling, storage and transport of samples should be established. Simple guidelines need to be prepared (e.g. international guidelines). For the emergency phase of an incident, the minimum of simple field test must be available for surveillance at the site of the incident. For follow-up surveillance and epidemiological studies, the top of the range of analytical techniques may be required, particularly where there is possibility of litigation.

4.10 Analytical Requirements for Regulating an Industrial Activity (Life Cycle Approach) in order to Protect Human Health and the Environment

To enable industries to produce LCAs for industrial production processes, it was considered important that a legal basis exist.

Participants discussed this topic by considering the examples of a life cycle approach (LCA) with regards to banana production and shrimp farming. To enable industries to produce LCAs for industrial production processes, it was considered important that a legal basis exist. One participant suggested that Environmental Impact Assessment (EIA) legislation can sometimes be used in this context. Once a LCA is accepted as a means for proper identification of crucial steps in the industrial processes in regard to protecting human health and the environment, a specific monitoring system can be developed.

It was suggested that the availability of such information (LCAs as well as data from monitoring systems) should be coordinated and interpreted by some form of inspectorate/institute with enough legal power to allow for measures to be taken in cases of problems. A controlling and/or coordinating organisation should possess or have access to expertise in the field of LCAs and information systems – nationally as well as internationally.

For new developments, LCAs can be requested in the framework of EIA. For existing plants and production processes, the situation is quite different. A screening can be made looking especially at those activities

that pose the highest risks for humans and the environment. Following prioritisation of the activities, LCAs can be drawn/developed to allow for identification of crucial steps that allow for control. Important technical considerations that were discussed included: the availability of expertise; the availability of laboratory facilities; and proper monitoring strategies and execution.

5. Practical Suggestions and Recommendations

A number of practical suggestions and recommendations emerged from the workshop, which may be of value for countries which are seeking to strengthen their national capacities for analysis and monitoring for the sound management of chemicals.

The general recommendations, as found in section 5.1, are grouped in four broad areas: legal and policy, administrative, financial/human resources, and technical. Recommendations specific to particular themes and issues are found in section 5.2.

In addition to considering the recommendations contained herein, countries could also begin with a self-assessment of needs and analysis of available capacities across all four areas. A draft questionnaire has been developed for this purpose (see Annex A).

5.1 General Recommendations

Legal and Policy Issues

It was recommended that a legal framework be put in place at the national level for analysis and monitoring.

- It was recommended that a legal framework (including infrastructure for enforcement) be put in place at the national level for analysis and monitoring for the sound management of chemicals. Activities under this framework should meaningfully involve interested and affected parties (stakeholders), build upon existing international experiences and take place in an integrated and coordinated fashion.

- Where there are conflicting mandates or legal barriers to the use of facilities for multiple-purposes (regarding, for example, police/criminal issues, defence, confidential business information), it was recommended that action be taken to overcome them, particularly in emergency situations when public health and/or environmental protection is at risk.

- Within the context of inter-departmental coordination mechanisms for chemical safety, countries should develop a national plan for strengthening analytical and monitoring capacities in the framework of sound chemicals management.

- Analytical and monitoring capacity should be available as part of necessary mechanisms to prevent/control the entry of banned or restricted chemicals into the country and to ensure that residue levels in exported and imported commodities are within permitted levels. For exported commodities, adequate analytical and monitoring capacity – as part of a systematic monitoring programme – is increasingly needed to meet the compulsory

requirements of importing countries or the import/export regulations of the CWC.

- National emergency planning should include planning for *chemical* emergencies, including analytical and monitoring services with an on-site analytical component (if possible).

Countries should strive for laboratory testing and calibration accreditation.

- It was recommended that countries strive for laboratory testing and calibration accreditation. While this can be a time-consuming and expensive process, it can be initiated using the entry point of economic interest (such as for export commodities) and, where synergies exist, with environmental and health protection benefits.

- Secretariats of different international conventions should be encouraged to consult amongst themselves to identify common assistance needs regarding implementation of those conventions (including requirements that are implicit as well as those that are explicit). As a starting point, the different analytical requirements of various conventions should be examined in detail, with a view to identifying potential synergies, overlaps, as well as gaps. It was also recommended that donor organisations establish concerted action for strengthening analytical and monitoring capacity in developing countries and those in transition. Assistance provided should match national priorities and preferably be integrated into on-going activities, thereby helping to ensure sustainability beyond external funding.

- Countries should recognise the importance of incorporating training into multilateral agreements to ensure their effective implementation, particularly in developing countries and countries with economies in transition.

Administrative Issues

"Twinning" between laboratories at the international level should be encouraged.

- "Twinning" between laboratories at the international level should be encouraged to promote training, exchange of personnel and experience, access to reference materials and information, etc.

- Laboratories within countries should establish a network amongst themselves to facilitate sharing of information, pooling of resources and analytical facilities, etc.

- Consideration should be given to regional cooperation and networking to promote capacity building and access to reference materials (e.g. reference materials in different matrices, calibration standard gases), as well as general support such as in accreditation matters.

- To increase cost effectiveness of monitoring programmes, all relevant sectors (e.g. agriculture, industry) should be involved from the outset to ensure integrated planning and coordination for monitoring design.

- Consideration should be given to a "tiered" (or "multi-level") approach to laboratories; some simpler tests (using simple instruments such as spectrophotometers and pH meters, and other activities such as sampling) can be done locally while other more complicated tests may be referred to centralised laboratory facilities either within the country or externally.

Financial / Human Resource Issues

- It was recommended that donors be encouraged to coordinate assistance for capacity building activities for analysis and monitoring for the sound management of chemicals.

- Donors should also be encouraged to ensure that equipment donations are suited to the needs of the recipient country and that appropriate training, service and maintenance are ensured.

Appropriate analytical capabilities should be established to meet internationally recommended quality standards.

- The use of economic instruments, such as national taxation policies, should be considered as a means of establishing sustainable financing sources for analytical and monitoring facilities.

- In order to create a favourable investment climate, appropriate analytical capabilities should be established to meet internationally recommended quality standards for food, drinking water, air and recreational waters.

- Incentives should be developed to ensure ongoing professional/ career development in order to attract and retain staff.

- There should be incentives for laboratories to achieve and maintain accreditation. This could be by means of additional funding provided on the basis of continual accreditation, which would be discontinued should the laboratory fail to meet the accreditation criteria.

- In view of the difficulties for small and medium enterprises (SMEs) to undertake analyses requiring sophisticated equipment, shared cost projects between SMEs and government laboratories should be promoted to support control of exported products in areas demanding highly sophisticated infrastructure and expertise (e.g. pesticide residues).

Technical Issues

Participants proposed that "centres of excellence" for the sound management of chemicals be established.

- Participants proposed that "centres of excellence" for the sound management of chemicals be established. With regard to laboratory capacity, these centres would provide advice and assistance on analytical and monitoring issues, including:
  (a) accreditation assistance (e.g. GLP, ISO/IEC Standard 17025), including workplace health and safety, safe disposal of laboratory waste, and other measures;
  (b) technical advice on equipment (e.g. samplers and analytical instruments) that may be purchased based on the technical specifications, reliability and the willingness of the manufacturers to offer training (including maintenance training), spare parts, manuals and other support;
  (c) good quality reagents and reference materials;
  (d) available resources for databases and appropriate software for proper interpretation of analytical data as well as access to literature on databases and monitoring procedures (this could be provided in the form of a readily accessible and regularly updated website);
  (e) procedures for sampling, conservation, transportation and storage of samples, and sample processing (including, where required, in relation to chain of custody procedures);
  (f) internal quality control and assurance procedures and Standard Operating Procedures (SOPs), and their development, if required;
  (g) how to deal with analytical requests in cases involving less common agents where more sophisticated techniques may be required (e.g. through a national laboratory or laboratory network) and for non-urgent tests as may be required;
  (h) organisation of practical training courses for local laboratory personnel; and
  (i) assessment, analysis, interpretation and dissemination of data.

- The need is recognised for Reference Laboratories for specific fields or chemicals, which would provide:
  (a) advice on sampling, conservation, transportation and storage of samples, and sample processing (including, where required, in relation to chain of custody procedures);
  (b) advice on and development of, if required, Standard Operating Procedures (SOPs) for specific chemicals;
  (c) coordination of proficiency testing and evaluation of results;
  (d) practical training courses for local laboratory personnel; and
  (e) advice on building up a multilevel national or regional laboratory network.

- Laboratories should have internal quality control (QC) procedures developed gradually to an internal quality management system as the basis of accreditation. To this effect, participation in an external

the basis of accreditation. To this effect, participation in an external quality control scheme, which can include proficiency testing and inter-laboratory interactions, should be promoted. Contacts and exchanges between laboratories developing their internal quality management system, and laboratories already maintaining such a system, should be encouraged and donors should consider supporting such exchanges.

Countries should establish a focal point to compile and update databases on national, regional and international regulatory and other requirements.

- Subject to a self-needs assessment and priority setting process, it may not be necessary for all developing countries to establish analytical facilities for all multilateral agreements that would require top-of-the-range, resource intensive techniques (e.g. for monitoring dioxins, testing for doping in sport). However, it is essential that all countries, in order to comply with these international agreements, ensure optimal capacity for sampling, transportation and storage, and have access to a network of analytical facilities. There is sufficient existing analytical capacity globally available for analysis required in relation to compliance with and monitoring of these agreements.

- Countries should establish a focal point to compile and update databases on national, regional and international regulatory and other requirements (such as for trade of food and consumer goods) and provide ready access to this information.

- Laboratories within a country and regionally should seek to use harmonised or suitable complementary methods and equipment – where appropriate – both for comparability of analyses and for effective management of spares, human resources, reagents and databases.

- Laboratories should be involved in emergency response drills and other simulation exercises.

Countries should ensure high quality Internet access for all staff.

- In relation to equipment provision, laboratories, including networks of laboratories that undertake similar work, should be encouraged to negotiate with equipment companies regarding the following: (a) provision of training in the use, maintenance and repair of the equipment; (b) provision of detailed instruction manuals; and (c) guarantee of a regular supply of adequate spare parts and continued maintenance for a ten year period.

- Countries should ensure high quality Internet access for all staff. A centralised database in the form a website with all relevant information regarding availability of training courses, developments in the field of analytical monitoring, and offers of technical and financial assistance would also be desirable.

5.2 Specific Recommendations

Chemical Emergencies and Surveillance

Countries should establish, as appropriate, a strategic unit for providing advice on the undertaking of health surveillance and epidemiological studies of diseases of chemical aetiology.

- It was recommended that all countries should establish, as appropriate, a strategic unit for providing advice on the undertaking of health surveillance and epidemiological studies of diseases of chemical aetiology. This unit would survey the appropriate facilities available in the country and establish the strategic plan to enable studies to be commissioned rapidly when required. Such a unit would call upon the appropriate expertise from the necessary fields of competence, including laboratory services and occupational hygienists. The unit would advise on when epidemiological studies or surveillance should be undertaken, particularly in relation to a specific chemical incident where public health may be affected. The unit would call upon expertise in the design of studies, which must involve the required sampling and analytical techniques. Countries may need to give consideration to establishing the necessary legislation or regulations to be put into place the strategic unit, and which would allow epidemiological studies to be undertaken in a timely manner following a chemical incident. Some international guidance is already available (e.g. WHO EHC 214).

- Countries should have a national plan for emergency response which should be regularly updated in an integrated way. This should take into account international information, as well as the control of cross-border transport of dangerous goods. Any national plan should provide for a unit responsible for central coordination in cases of emergencies and the collection of data on chemical incidents and simulation exercises. Such exercises should include all relevant laboratory services.

- Laboratories must, as a minimum requirement, be able to perform quantitative determinations to the levels below occupational exposure limits (such as ACGIH, SCOEL and other regional OEL (e.g. EU Directives)) or environmental exposure limits (such as WHO and EU guidelines and others).[6]

- Scientific institutions in developed countries should be encouraged to cooperate with developing countries and countries with economies in transition in undertaking epidemiological and surveillance studies following a chemical incident.

- Storage facilities for samples are essential so as to be able to analyse samples at a later time if required. Simple international guidelines need to be prepared (and published) for minimum

[6] The first three recommendations in this subsection represent a "tiered" approach to laboratory capacity for analysis and monitoring for emergency response.

requirements for sampling, storage and transport of samples.

Emergency services should have field kits available and user-friendly on-site test devices.

- Emergency services should have field kits available and user-friendly on-site test devices, both chemical (e.g. gas detector tubes, passive badges and direct reading instruments for, *inter alia*, chlorine, phosgene, cyanide, and hydrogen sulfide, and, as appropriate, air quality monitors for entering enclosed spaces with suspected lack of oxygen or presence of explosive gases) and biological (e.g. micro-bio tests).

- It is advisable to have regularly trained personnel from laboratories or emergency personnel, who can perform these tests on-site. In addition, these personnel need to maintain an adequate standard of training in taking samples in the field, stabilising and processing samples, and transporting them.

- Countries and international organisations are encouraged to undertake surveys that monitor exposure of vulnerable groups (such as women, children and the elderly) in order to, *inter alia*, improve the scientific basis for standard-setting.

Environmental Monitoring including Environmental Impact Assessment and Life Cycle Analysis Requirements

Countries should promote cooperative mechanisms and, if appropriate, a legal framework for environmental monitoring programmes.

- It was recommended that countries promote cooperative mechanisms and, if appropriate, a legal framework for environmental monitoring programmes as well as develop cost-effective integrated monitoring systems capable of providing not only data for compliance but also information for early identification of emerging problems**,** real time response to potential hazards and for support of proactive policies and decision-making.

- In developing integrated monitoring the following key elements need to be considered: a) intersectoral planning, coordination and synergism amongst all sectors involved from the onset of monitoring design; b) clear definition of monitoring objectives and evaluation criteria including data analysis protocols, generation of information and reporting in order to fulfil legal, health, environmental and other needs; c) an integrated, flexible and tier-investigational approach, based on both chemical and biological methods, including the use of cost effective microbiotests for toxicity testing – this will enhance cost effectiveness and identification of new emerging problems; d) sustainable capacity building based on expertise and infrastructure, supported by target-oriented research; and e) harmonisation: a monitoring framework with minimum technical and management requirements can be developed regionally or internationally. This will be the basis of tailor made country specific monitoring programmes.

Adequate monitoring programmes should be established on a broad basis with all stakeholders involved.

- From the beginning, adequate monitoring programmes should be established on a broad basis with all stakeholders involved and sufficient funding and (technical) support (including access to samples or sampling sites) to allow for a timespan on the order of decades. Any monitoring programme should be tailored to answer the question of concern. When designing a monitoring programme, integrative matrices may be chosen to allow for risk assessment even with small numbers of samples; such matrices are for example breast milk, bivalves, etc. It is recommended to utilise matrices where databases with results from other countries exist in order to compare results and benefit from experience in the interpretation of results. The structure of any monitoring programme should be flexible enough to allow for changes in the course of the programme to adjust to new situations if these should arise. If possible, samples should be used for multiple analytical purposes, e.g. POPs and heavy metals.

- It is recognised that LCA is a useful tool, when used appropriately, as part of an effective environmental monitoring programme and related activities such as environmental impact assessments (EIA). Programmes can benefit from a coordinating mechanism – such as an inspectorate – which possesses, or has access to, expertise in the field of LCAs for ensuring the sound management of chemicals in the industrial and agricultural sectors.

- Environmental monitoring could be evaluated as part of sustainable development indicators (SDI) for countries.

Annex A: Proposed National Reporting Format for a Survey of Analytical Laboratory Facilities for the Sound Management of Chemicals

The need for national capacities for chemical analysis and monitoring has been recognised both by UNCED and the Intergovernmental Forum on Chemical Safety (IFCS) as an important element in implementing sound management of chemicals in a country. Further, some one third of all countries that have prepared a National Chemicals Management Profile and organised a national priority setting workshop addressed the issue of building capacity for chemicals analysis and monitoring as one of their five most important priorities in the area of chemicals management. As part of the National Profile preparation process and its regular updating it is necessary to make a "situation analysis" of facilities for chemical analysis and monitoring. Provision of chemical analysis and monitoring may be through a variety of services, such as: government chemists; forensics; Ministries of defence, public health, environment, food and drugs, and agricultural laboratories; industry, commercial, and municipal laboratories; standards organisations; and private laboratories, as well as hospital laboratories and university science and medical departments. For the purpose of assessing the current capacity for chemical analysis and monitoring in the country, all relevant services should be surveyed. This document provides a proposed reporting format for surveying analytical laboratory facilities in a country.[7]

Laboratory and its Functions

Name of Laboratory: ……

Postal address of Laboratory: ……..

Location of Laboratory: Is the laboratory operated independently? **YES**... **NO**…
Is the laboratory part of another service (e.g. Food Quality, Clinical Chemistry)?**YES**..**NO**..
If YES please give details…….

Size of Laboratory in square metres: ……

Formal function or mandate of the Laboratory: ……
……
……
……

[7] This format was originally developed for the WHO South East Asia Regional Office and its survey of analytical toxicological facilities in countries of the SEA region. It was adapted for use in surveying all types of Analytical Laboratory Facilities during the IOMC Thematic Workshop on Strengthening National Capacities for Chemical Analysis and Monitoring for the Sound Management of Chemicals in The Hague, The Netherlands, 5-8 November 2001.

Administrative structure and whether part of another administration (e.g. Ministry, Hospital, University, Industrial company). If so which: ……..
……
……
……

Source of Financing of Laboratory:……
Annual Budget of Laboratory in local currency:
Capital: ……..…….
Recurrent: ..…….

Staff

Total number: ……

Supervisory level (e.g. Director): ……... qualifications: …….

Trained Analyst level: ……... qualifications: …….

Technician/laboratory assistant level: ……... qualifications: ……..

Other support level: ……... qualifications: …….

Administrative/secretary level: ……... qualifications: …….

Sampling, Analyses and Related Logistic Infrastructure

Sampling

For what types of analyses are samples taken (forensic, clinical, occupational, environmental, other): ……
……
……
……

Types of samples (blood, urine, other biological, food, water, air, soil, sediments, flora, fauna, commercial and industrial products, other): ……..
……
……
……

Number of cases/samples per month (by type if appropriate): …….
……
……

Sampling containers and sampling media or additions to samples (by type as appropriate):
……
……

Any special equipment required for sampling (e.g. hi vol. samplers, mobile or fixed vehicle, boat, aircraft) (by type as appropriate), including equipment maintenance: …….
……
……

In situ sampling and analysis: list types of sampling and analytical methods, automated or manual, and how the results are transmitted to the laboratory or user of the data: ……..
……
……
……

Storage of samples before transportation to the laboratory (by type as appropriate): ……..
……
……

Transport of samples to the laboratory (by type as appropriate):

Transport storage facilities (e.g. dry ice, cool-boxes, refrigerated containers) (by type as appropriate): ..…….
……
……

Type of transport (e.g. laboratory vehicle, public transport, DHL, express or ordinary mail) (by type as appropriate): ……..
……
……..……..

Registration of samples on arrival at the laboratory (by type as appropriate), including any automated or computerised system, and any additional manipulation: ……
……
……

Storage facilities at the laboratory (by type as appropriate):

Short-term storage before analysis: ……...
……
……
Long-term storage of samples, or sub-samples: ……
……
……

Types of Substances Analysed:

Pesticides:
- Chlorinated compounds: ……..
- Organo-phosphorus compounds (including cholinesterase assays): ……
- Carbamates: …….
- Pyrethroids: ……..
- Paraquat: ……..
- Others: ……..……

Drugs and pharmaceuticals, listing specifics: …….
……..
……..
Solvents (list): ……..
……
……

Petrochemicals (list): ..……..
……
……

Chemical weapons and their precursors (list): …….
……
……

Heavy Metals (including Arsenic) (list): ……..
……
……

Toxic Gases (list): …….
……
……

Fumes (list): ……..
……
……

Poly-aromatic hydrocarbons/TCDDs/PCBs: ……
……
……

Alcohols (methyl, ethyl and others) and glycols (list): …….
……
……

Natural toxins, including mycotoxins (list): ……
……
……

Other poisons or contaminants (list): ..……..
……
……

Food Additives (list): ……
……
……

Others (list): ……..
……
……

Equipment*

* *Tick equipment used and give technique and substance(s) for which it is used*.

Methods

Direct chemical tests (e.g. flames tests for metals, silver nitrate test for phosphides): …….
……
……

Colorimetric methods: ……..
……
……

UV spectrophotometry: ……..
……
……

IR spectrophotometry: ……. …….
……
……

Other spectrophotometric methods (e.g. fluorescence): ..……..
……
……

Thin Layer Chromatography: ……..
……
……

Gas Liquid Chromatography: ….……..
……
……

High Performance Liquid Chromatography: ….……...
……
……

Mass spectrometry, including combinations of techniques (e.g. CC-MS, LC-MS, ICP-MS, HPLC-MS, FTIR-MS): …….
……
……

Atomic Absorption Spectrophotometry: …….…….
……
……

Immuno-assays: ……
……
Others (e.g. X-Ray Fluorescence, XRD, ESM,CE, ICP, NMR) (list) : ……
……
……

Equipment Maintenance and Supply

Are there any formal relationships or agreements with equipment suppliers for maintenance and training? **YES** … **NO** …

If YES, give details (such as guarantee periods for maintenance, training of staff, provision of maintenance as well as operating manuals): …….
……
……

Reagents and Reference Materials

Source of reagents:…….…….
Any problems in availability: **YES** … **NO** …

Source of reference materials:…..……
Any problems in availability: **YES** … **NO** …

Comments:……
……..
……..
……..

Quality Assurance Programmes

Does the laboratory have a formal quality assurance system? **YES** … **NO** …

Does the laboratory have an internal quality assurance programme? **YES** … **NO** …

Does the laboratory take part in an external quality assurance programme? **YES** … **NO** …

Comments……..
……
……

Accreditation

Is the laboratory formally accredited? **YES** … **NO** …

If YES, by whom: ……..…….
For what purpose or which specific tests: ……..……
……..
……

Relations with other Laboratories and Services

Does the laboratory have cooperation with other laboratories? Formal … Informal …

Give details:……
……
……

Is there regular contact between laboratory analytical staff and professionals requiring analytical data (e.g. physicians treating poisoned patients; chemical emergency responders, inspectors)? **YES** … **NO** …

If Yes, give details: ……
……
……

Do staff of the laboratory belong to professional bodies? **YES** … **NO** …
Do staff take part in scientific meetings? **YES** … **NO** …
Do staff publish in the scientific literature? **YES** … **NO** …
If Yes, give details: ……
……
……
……

Hindrances and Problems

Describe any problems or hindrances that are experienced in providing the laboratory service to the relevant sector (e.g. financing of the service, staff training and retaining staff, equipment maintenance, availability of equipment spare parts and reagents): …….
……

……
……

Name and contacts of person completing the questionnaire

Name:……..
Title or function:…….
Contact address:……..
Telephone number:…….
Fax:…..……
E-mail:……

Annex B: Workshop Agenda

Monday, 5 November 2001

10:00 Opening Ceremony

Statements by:

- John Makhubalo, Director, International Cooperation and Assistance Division, OPCW
- Craig Boljkovac, Deputy Programme Coordinator, UNITAR
- Heidi Fiedler, Scientific Affairs Officer, UNEP
- Jenny Pronczuk, Management of Chemical Exposures, IPCS

10:30 Coffee Break

10:45 Introductory Presentation on Workshop Topic, Objectives and Methodology
John Haines, UNITAR

11:00 Session 1: Situations and Challenges in Developing Countries and Countries with Economies in Transition, Moderator: Craig Boljkovac, UNITAR

Representatives of developing countries and countries with economies in transition will give brief presentations (around 20 minutes) which highlight the current situation in their countries with regard to national capacities for chemical analysis and monitoring. Emphasis will be placed on examples of successful approaches, practical problems faced, and issues which are particularly challenging. There will be 10 minutes at the end of each presentation for questions and answers.

- Philip Coleman, Protechnik, South Africa
- Marek Jakubowski, Nofer Institute of Occupational Medicine, Poland

12:00 Session 2: Perspectives and Experiences of Countries with Advanced Chemicals Management Capabilities, Moderator: Bijoy Chatterjee, OPCW

Representatives from countries with advanced chemicals management capabilities will give brief presentations (around 20 minutes) which share the experience gained over the past years with chemicals analysis and monitoring. Emphasis will be given to approaches that have worked well and/or which have been difficult to implement. Lessons learned which may be of particular relevance to developing countries and countries with economies in transition will also be highlighted. There will be 10 minutes at the end of each presentation for questions and answers.

- Jamshid Hosseinpour, Oekometric, Germany

12:30 Lunch Break

14:00 Session 2 continued

- Marjatta Rautio, VERIFIN, Finland

14:30 Session 3: The Perspective of International Convention Secretariats and International Organisations, Moderator: John Haines, UNITAR

Representatives from international organisations will provide brief overviews (around 20 minutes), from the perspective of their respective organisations, on how various programmes or initiatives at the international level may shape or contribute to the development and strengthening of national capacities for chemical analysis and monitoring. There will be 10 minutes at the end of each presentation for questions and answers.

- Mieczyslaw Sokolowski, Analytical Chemist, OPCW laboratory
- Heidi Fiedler, Scientific Affairs Officer, UNEP Chemicals

15:30 Tea Break

15:45 Session 3 continued

- Ralf Trapp, Office of the Deputy Director General and Secretary, Scientific Advisory Board (SAB), OPCW

16:15 General Discussion of Presentations and Experiences of Stakeholders, Moderator: Sukanya Devarajan, OPCW (16.15 - 17.30)

Tuesday, 6 November 2001

9:30 Session 4: Thematic Working Groups: Exchange of experience in five groups on analytical laboratory capacity requirements, Moderator: John Haines, UNITAR

Introduction to Working Groups for Sessions 4 and 5, John Haines, UNITAR

Session 4 consists of five thematic working groups exchanging experience of requirements for which analytical laboratory and monitoring capacity is needed in countries, covering five main areas. Each group will examine the various issues involved and prepare a summary report for examination in plenary in the second part of the afternoon.[8]

[8] Background paper authors/presenters will also Chair the relevant Working Group. Rapporteurs should be chosen within each Working Group and will report back orally to Plenary and in writing to the Drafting Group (Wed. p.m.).

9:45 Brief Presentations on Themes for Working Groups:

1. Public and occupational health surveillance and the medical needs for chemical emergency response, Nida Besbelli, WHO
   (9.45 to 9.55)
2. Environmental quality monitoring and surveillance of environmental impact of chemical emergencies, Jan Kliest, National Institute of Public Health and the Environment, Netherlands
   (9.55 – 10.05)
3. Monitoring for chemical quality assurance of food, drinking water, consumer goods and products of trade, including meeting labelling regulations, Stella Canna Michaelidou, State General Laboratory, Cyprus
   (10.05 – 10.15)
4. Monitoring of pharmaceuticals, drugs and doping, Brian Widdop, Medical Toxicology Unit, UK
   (10.15 –10.25)
5. Emission and effluent control: monitoring of chemical wastes, John Meulemans, AquaSense, Netherlands
   (10.25 – 10.35)

10:35 Coffee Break

10:50 Meetings of Working Groups according to the five Themes[9]

12:30 Lunch Break

14:00 Working Groups continue

15:30 Tea Break

15:45 Presentation of Working Group results and discussion in Plenary
(15.45 to 17.30)

Wednesday, 7 November 2001

9:30 Session 5: Potential Country Scenarios. Discussion in Five Working Groups, Moderator: Hans de Kruijf, UNITAR

Session 5 consists of discussion in five working groups of potential country scenarios. Based on the various capacities identified in the thematic discussions during Session 4, each group will consider how to develop an integrated approach to capacity building for specific potential needs in a country. Five scenarios will be considered. Recommendations and practical solutions will be developed to address the identified

[9] Working Groups will meet as follows: WG 1 - Room 003; WG 2 Room – 005; WG 3 – 007; WG 4 – 009; WG 5 - Room 011.

problems and challenges and the Groups will report back to plenary early in the afternoon.[10]

9:30 Brief Presentations on Scenarios for Working Groups:

1. Development of a monitoring programme for a specific chemical or group of chemicals, Heidi Fiedler, UNEP Chemicals
   (9.30 - 9.40)
2. Establishing analytical facilities for dealing with chemical emergencies (include industrial, transport, consumer goods, food and water incidents), John Haines, UNITAR and Brian Widdop, Medical Toxicology Unit, UK
   (9.40 - 9.50)
3. Monitoring requirements for trade (internal and external markets) consumer goods or food products, Azeez Mubarak, Chemical and Environmental Technology Division, Sri Lanka
   (9.50 – 10.00)
4. Setting up a surveillance programme for exposure (from all routes) of the public or a specific population group (e.g. workers, women, children) to specific chemicals, Gary Coleman, WHO Collaborating Centre, UK
   (10.00 – 10.10)
5. Analytical requirements for regulating an industrial activity (life cycle approach) in order to protect human health and the environment, Hans de Kruijf, UNITAR
   (10.10 – 10.20)

10:20 Coffee Break

10:35 Meetings of Working Groups according to the five Scenarios[11]

12 :30 Lunch Break

14:00 Working Groups continue

15:30 Tea Break

15:45 Presentation of Working Group results and discussion in Plenary
(15.45 – 17.30) (Drafting Group meets from 17.30)

Thursday, 8 November 2001

9:30 Session 6 Discussion of a Draft a Checklist to Assist Countries in Designing an Integrated Programme for Strengthening National Analytical Laboratories, Moderator: Bijoy Chatterjee, OPCW

[10] Background paper authors/presenters will also Chair the relevant Working Group. Rapporteurs should be chosen within each Working Group and will report back orally to Plenary and in writing to the Drafting Group (Wed. p.m.).

[11] Working Groups will meet as follows: WG 1 – Room 003; WG 2 Room – 005; WG 3 – 007; WG 4 – 009; WG 5 – Room 011.

10:30 Coffee Break

10:45 Session 7: Review of Workshop Conclusions and Recommendations,
Moderator: Craig Boljkovac, UNITAR

The Secretariat will table the main observations and conclusions of the workshop for discussion and possible adoption by participants.

12:30 Closing Ceremony

12:40 Reception hosted by John Makhubalo, Director, International Cooperation and Assistance Division, OPCW
(12:40 - 13:30, location: outside Room 007/009)

Annex C: List of Participants

1. Countries	
Argentina Mrs. Maria Elena **Carnino** Dept. of Chemical Implementation Instituto de Investigaciones Cientificas y Tecnicas de las Fuerzas Armadas (CITEFA) San Juan de Lasalle 4397 1603 Villa Martelli Buenos Aires, Argentina TEL: +54 11 4709 8100 ext. 1305 FAX: +54 11 4709 3210 or 8228 mcarnino@citefa.gov.ar	***Algeria*** Mr. Brahim Youcef **Meklati** Director Centre de Recherche CRAPC BP 248 Alger RP 16004 Alger Algeria TEL: +213212474 06/ 21321248793 FAX: +21 321247406 bmeklati@wissal.dz
Cyprus Dr. Stella **Canna Michaelidou** Senior Chemist Head of Environmental Chemistry I, Ecotoxicology, Pesticides and Radioactivity State General Laboratory Kimonos 44 Nicosia 1451, Cyprus TEL: +357 2 301 440 FAX: +357 2 316 434 stellacm@spidernet.com.cy	***Ecuador*** Mr. Eduardo **Espin** Chemical Engineer Director de Calidad Ambiental Secretaría Técnica de Productos Químicos Peligrosos Ministry of Environment Edificio MAG Piso 7 Av. Eloy Alfaro y Amazonas Quito, Ecuador TEL: +593 2 256 3492/ 593 22 523 269 FAX: +593 2 256 5809 eespin@ambiente.gov.ec
Finland Prof. Marjatta **Rautio** VERIFIN University of Helsinki A.I. Virtaselackie 1 PO Box 55 FIN-00014 Helsinki, Finland TEL: +358 9 191 50474 FAX: +358 9 191 50437 marjatta.rautic@helsinki.fi	***Germany*** Dr. Jamshid **Hosseinpour** Managing Director Oekometric GmbH Bernecker Str. 17-21 D-95448 Bayreuth Germany TEL: +49 921 726 330 FAX: +49 921 726 3399 hoseinpour@oekometric.de

Ghana Mr. Richard Kwesi **Johnson** Assistant Programme Officer Environmental Protection Agency PO Box M326 Accra, Ghana TEL: +233 21 664 697/8 FAX: +233 21 667 374/ 622690 rjohnson@epaghana.org	***Greece*** Dr. Ioannis **Gardikis** General Chemical State Laboratory 16 An. Tsoha GR-115 21 Athens Greece TEL: +30 1 64 79 427 FAX: +30 1 64 65 123 gxk-environment@ath.forthnet.gr
Hungary Mr. Miklos **Náray** Central Lab. for Chemical Analysis Jozsef Fodor National Center for Public Health Nagyvarad Ter 2 PO Box 22 H-1450 Budapest Hungary TEL: +36 1 215 54 91/361 476 1147 FAX: +36 1 476 1374 miklos_naray@e34.kibernet.hu	***Kenya*** Dr. Jane **Okado** Deputy Government Chemist Government Chemist's Department Ministry of Health PO Box 20753 Nairobi, Kenya TEL: +254 2 72 58 06 FAX: +254 2 71 75 67 a_dhiambo2000@yahoo.com
Iran Dr. Mohammad **Teymouri** National Iranian Oil Company NIOC-RIPI PO Box 18745-4163 Teheran, Iran TEL: +98 21 5901 092 FAX: +98 21 615 33 97 teymourim@nioc.ripi.org	***Latvia*** Mr. Eriks **Strazds** Deputy Head of Laboratory National Environmental Health Centre NEHC 7, Klijanu str. LV-1012 Riga Latvia TEL: +371 7 374 715 FAX: +371 7 375 940 strazds@nvvc.org.lv

Morocco Mr. Mostafa **Tarhy** Chef du Service Pesticides Laboratoire officiel dánalyses et de recherches chimiques (LOARC) Ministère de l'agriculture, du développement rural et des eaux et forêts 25 rue Nichakra Rahal (ex Rue de Tour) Casablanca, Morocco TEL: +212 22 30 21 96/98 FAX: +212 22 30 19 72/ 22 31 24 65 loarca@casanet.net.ma	***The Netherlands*** Mr. Jan **Kliest** Rijksinstituut voor Volksgezondheid en Milieu (RIVM) Postbus 1 NL-3720 BA Bilthoven The Netherlands TEL: +31 30 274 3120 FAX: +31 30 229 09 19 jan.kliest@rivm.nl
The Netherlands Dr. Johannes **Meulemans** Netherlands Aquasense Postbus 95125 NL-1090 HC Amsterdam The Netherlands TEL: +31 20 592 2249 FAX: +31 20 592 2249 jmeulemans@aquasense.com	***Poland*** Prof. Marek **Jakubowski** Nofer Institute of Occupational Medicine 8 Teresy Street 90-950 Lodz Poland TEL: +48 42 631 4801 FAX: +48 42 656 8331 majakub@imp.lodz.pl
South Africa Prof. Hindrik **Bouwman** School for Environmental Sciences and Development Potchefstroom University Potchefstroom 2520 South Africa TEL: +27 18 299 2377 FAX: +27 18 299 2370 DRKHB@puknet.puk.ac.za	***South Africa*** Dr. Philip Charles **Coleman** Managing Director Protechnik Laboratories PO Box 8854 Pretoria 001 South Africa TEL: +27 12 665 0231 FAX: +27 12 665 0240 philipc@protechnik.ca.za

Sri Lanka Dr. Azeez M. **Mubarak** Head Chemical and Environmental Technology Division Industrial Technology Institute 363 Bauddhaluka Mawatha Colombo 7 Sri Lanka TEL: +94 1 698 622 FAX: +94 1 698 622 muba@iti.lk	***Thailand*** Ms. Chootima **Jamekornkul** IFCS National Focal Point Food and Drug Administration Ministry of Public Health Tiwanon Road Nonthaburi 11000 Thailand TEL: +662 590 7021 FAX: +662 590 7287 chootima@health.moph.go.th
Thailand Ms. Wiyada **Sontichai** Food and Drug Administration Ministry of Public Health Tiwanon Road Nonthaburi 11000 Thailand TEL: +662 590 7265 FAX: +662 591 8457, 590 7266 swiyada@health.moph.go.th	***Ukraine*** Ms. Viktoriya **Nassalska** Chemical Industry Department Ministry of Industrial Policy 3 Surikova Street Kyiv, Ukraine TEL: +380 44 246 3243 FAX: +380 44 212 8189/ 246 3404 foreign@industry.gov.ua
United Arab Emirates Mr. Abdullah **Siddiqui** Environmental Services ERWDA PO Box 45553 Abu Dhabi United Emirates United TEL: +971 2 17 171 ext. 528 /6934x 528 FAX: +971 2 6810 008 asiddiqui@erwda.gov.ae	***United Kingdom*** Prof. Gary **Coleman** WHO Collaborating Centre for Chemical Incidents University of Wales Institute, Cardiff Western Avenue Cardiff CF5 2YB United Kingdom TEL: +44 2920 416852 FAX: +44 2920 416 803 gcoleman@uwic.ac.uk

United Kingdom Dr. Brian **Widdop** Laboratory Director Medical Toxicology Unit Avonley Road London SE14 5ER United Kingdom TEL: +44 207 771 5301 FAX: +44 207 771 5359 brian.widdop@gstt.sthames.nhs.uk	

2. International, Intergovernmental and Regional Organisations/Entities	
OPCW Mr. Bijoy **Chatterjee** Head, International Cooperation Branch ICA Division Organisation for the Prohibition of Chemical Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 33 00 FAX: +31 70 306 3535 bijoy.chatterjee@opcw.org	***OPCW*** Ms. Sukanya **Devarajan** Senior International Cooperation Officer ICA Division Organisation for the Prohibition of Chemical Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 37 75 FAX: +31 70 306 3535 sukanya.devarajan@opcw.org
OPCW Mr. Murali **Karri** Inspector Inspectorate Division Organisation for the Prohibition of Chemicals Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 33 00 FAX: +31 70 306 3535	***OPCW*** Mr. John **Makhubalo** Director International Cooperation and Assistance Division Organisation for the Prohibition of Chemical Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 33 00 FAX: +31 70 306 3535 john.makhubalo@opcw.org

OPCW Mr. Ghirma **Moges** Assistance and Protection Branch ICA Division Organisation for the Prohibition of Chemical Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 38 43 FAX: +31 70 306 3535 emergAssistBr@opcw.org	***OPCW*** Mr. Pankaj **Pujara** Inspector Inspectorate Division Organisation for the Prohibition of Chemical Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 33 00 FAX: +31 70 306 3535
OPCW Mr. Mieczyslaw **Sokolowski** Analytical Chemist OPCW Laboratory Verification Division Organisation for the Prohibition of Chemical Weapons (OPCW) Heulweg 28-30 2288 GN RIjswijk Netherlands TEL: +31 15 215 4608 FAX: +31 15 284 0679 msokolow@euronet.nl	***OPCW*** Mr. Ralf **Trapp** Secretary, Review Conference Steering Committee Office of the Deputy Director General Organisation for the Prohibition of Chemical Weapons (OPCW) Johan de Wittlaan 32 NL 2517 JR The Hague Netherlands TEL: +31 70 416 37 70 FAX: +31 70 306 3535 ralf.trapp@opcw.org
UNEP Chemicals Dr. Heidelore **Fiedler** Scientific Affairs Officer UNEP Chemicals Maison internationale de l'environnement 11-13 chemin des Anémones CH-1219 Chatelaine Switzerland TEL: +41 22 917 81 87 FAX: +41 22 797 34 60 hfiedler@unep.ch	***UNITAR*** Mr. Craig **Boljkovac** Deputy Programme Coordinator Chemicals and Waste Management United Nations Institute for Training and Research UNITAR Palais des Nations CH-1211 Geneva 10 Switzerland TEL: +41 22 917 84 71 FAX: +41 22 917 80 47 craig.boljkovac@unitar.org

UNITAR Prof. H.A.M. **de Kruijf** Senior Special Fellow Chemicals and Waste Management United Nations Institute for Training and Research UNITAR Ecoassistance Den Dam 10 7084 BH Breedenbroek Netherlands TEL: +31 315 330852 FAX: +31 315 330 852 kruijf@ecoassistance.nl	***UNITAR*** Dr. John **Haines** Senior Special Fellow Chemicals and Waste Management United Nations Institute for Training and Research UNITAR Palais des Nations CH-1211 Geneva 10 Switzerland TEL: +41 22 917 84 70 FAX: +41 22 917 80 47 hainesj@eurospan.com
UNITAR Dr. Jonathan **Krueger** Chemicals and Waste Management United Nations Institute for Training and Research UNITAR Palais des Nations CH-1211 Geneva 10 Switzerland TEL: +41 22 917 81 66 FAX: +41 22 917 80 47 jonathan.krueger@unitar.org	***WHO*** Dr. Emine Nida **Besbelli** World Health Organisation 20 Avenue Appia 1211 Geneva 27 Switzerland TEL: +41 22 791 4287 FAX: +41 22 791 4848 besbellin@who.ch
WHO Dr. Jenny **Pronczuk** World Health Organisation 20 Avenue Appia 1211 Geneva 27 Switzerland TEL: +41 22 791 3602 FAX: +41 22 791 4848 pronczukj@who.ch	

Annex D: List of Acronyms

AAS	Atomic Absorption Spectroscopy
ACGIH	American Conference of Governmental Industrial Hygienists
Codex	FAO/WHO Codex Alimentarius
CRMs	Certified Reference Materials
CWC	Chemical Weapons Convention
EIA	Environmental Impact Assessment
EQA	External Quality Assurance
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GC	Gas Chromatography
GCMS	Gas Chromatography Mass Spectrometry
GLP	Good Laboratory Practices
HACCP	Pathogen Reduction and Hazard Analysis Critical Control Point
HPLC	High-Performance Liquid Chromatography
IAF	International Organisation Forum
IFCS	Intergovernmental Forum on Chemical Safety
ILAC	International Laboratory Accreditation Cooperation
ILO	International Labour Organization
IOMC	Inter-Organization Programme for the Sound Management of Chemicals
IPCS	International Programme on Chemical Safety
ISO	International Organization for Standardization
LC	Liquid Chromatography
LCMS	Liquid Chromatography Mass Spectrometry
OEL	Occupational Exposure Levels
OPCW	Organization for the Prohibition of Chemical Weapons
PIC	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
POPs	Persistent Organic Pollutants
QC	Quality Control
SAB	Scientific Advisory Board
SADC	Southern African Development Community
SCOEL	Scientific Committee on Occupational Exposure Levels
SDI	Sustainable Development Indicators
SMEs	Small and Medium Enterprises
SOPs	Standard Operating Procedures
TLC	Thin-Layer Chromatography
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNITAR	United Nations Institute for Training and Research
UV	Ultraviolet
VERIFIN	Finnish Institute for Verification of the Chemical Weapons Convention
WHO	World Health Organization
WTO	World Trade Organization

UNITAR

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  b. Environmental and Natural Resource Management Training Programmes;

  c. Training Programme on Debt and Financial Management with special emphasis on the Legal Aspects;

  d. Training Programme on Disaster Control;

  e. Training Programme on Peace-Keeping, Peace-Making, and Peace-Building.

Street Address:
11-13 chemin des Anémones
1219 Châtelaine
Geneva
SWITZERLAND

Postal Address:
UNITAR
Palais des Nations
CH-1211 GENEVA 10
SWITZERLAND

Tel.: +41 22 917 1234

Fax: +41 22 917 8047

Website: www.unitar.org