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*PROTECTION AND
CONTROL OF
WATER QUALITY
FOR THE
UPDATING OF THE
WHO GUIDELINES
FOR DRINKING-
WATER QUALITY*

Report on a WHO Working Group

Bad Elster, Germany
17-19 June 1996

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WATER QUALITY

By the year 2000, all people should have access to adequate supplies of safe drinking-water, and the pollution of groundwater sources, rivers, lakes and seas should no longer pose a threat to health.

ABSTRACT

The WHO guidelines for drinking-water quality are an important resource for the maintenance of the supply and quality of drinking-water worldwide. Since the publication of the second edition, a process of continuous updating has begun, and will extend coverage to aspects of risk management, as well as risk assessment. A WHO working group of 14 experts met in Bad Elster, Germany, at the Research Department of the Institute for Water, Soil and Air Hygiene, the WHO collaborating centre for research on drinking-water hygiene, to discuss aspects of risk management, including resource and source protection, water treatment, materials and chemicals used in the production and distribution of drinking-water, and the monitoring and assessment of drinking-water supply and quality. The group made detailed recommendations on the content and format of priority guidance and developed a programme of work for its preparation, aiming for publication of the first set of guidelines by the end of 1997.

Keywords

DRINKING WATER
WATER QUALITY
WATER POLLUTION – prevention and control

CONTENTS

1. Background	1
2. Objectives.....	2
3. Opening	2
4. General	3
5. Identification of priority products	4
5.1 Resource and source protection	4
5.2 Water treatment.....	5
5.3 Materials and chemicals used in the production and distribution of drinking-water	5
5.4 Monitoring and assessment of drinking-water supply and quality	6
6. Programme of work.....	7
7. Provisional agenda for second working group meeting.....	8
Annex 1. List of participants.....	10
Annex 2. Agenda.....	13
Annex 3. List of working papers.....	14
Annex 4. Terms of reference for the working group on protection and control of water quality.....	15
Annex 5. Procedure for the preparation and review of background documentation	16
Annex 6. Priority products by coordination institution and year of production	18
Annex 7. Cyanobacteria monograph.....	21
Annex 8. Nitrate monograph.....	26
Annex 9. Fluoride monograph	28
Annex 10. Provision and monitoring of drinking-water supply and quality in emergencies	29
Annex 11. Testing and control of materials and chemicals used in the production and distribution of drinking-water	30
Annex 12. Monitoring and surveillance of drinking-water in urban areas	32
Annex 13. Health-related monitoring of water quality in international river basins, including early warning monitoring systems	35

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1. BACKGROUND

The first WHO publication dealing specifically with drinking-water quality was published in 1958 as *International Standards for Drinking-water*. It was subsequently revised in 1963 and in 1971 under the same title. In 1984–85, the first edition of the *WHO Guidelines for Drinking-water Quality* was published. The philosophy and content of the Guidelines constituted a drastic departure from the previous International Standards. The basic premise of the Guidelines was that they are not international standards, but should be used as a basis for setting national or regional standards to ensure the safety of drinking-water.

In 1989, work was started on a second edition of the *Guidelines for Drinking-water Quality* (GDWQ). The new GDWQ are being published in three volumes: Vol. 1 – *Recommendations*, (1993), Vol. 2 – *Health criteria and other supporting information* (1996) and Vol. 3 – *Surveillance and control of community supplies* (in press).

The primary aim of the *Guidelines for Drinking-water Quality* is the protection of public health. The GDWQ provide an assessment of the health risk presented by microorganisms and chemicals present in drinking-water. This assessment can then be applied to the development and implementation of national standards for drinking-water quality. In addition, in response to demands from Member States, the Guidelines have always included guidance material concerning specific problems related to small community supplies.

There will be a continuing process of updating of the GDWQ with a number of microbiological agents and chemical substances subject to periodic evaluation. Addenda will be issued, containing evaluations of new or already-evaluated substances/agents for which new scientific information has become available. Chemical substances for which provisional guideline values have been established will receive high priority for re-evaluation.

A Coordinating Committee meeting for the updating of the *WHO Guidelines for Drinking-water Quality* was held in Geneva 13–15 December 1995 to set the framework for the updating process, including the development of the outline of an expanded scope of work to address the protection and control of water quality. The Report of the Coordinating Committee Meeting has been released (WHO/EOS/ECEH/96.1). The meeting recommended that the coverage of the GDWQ be expanded to include provision of guidance addressing both risk assessment and risk management. In order to achieve this aim, additional guidance material should be progressively developed and integrated into the Guidelines. Such material should include monitoring and assessment of urban water supply and quality in addition to the existing coverage of the rural sector. It should also consider resource and source protection; water treatment; and chemicals, materials and other issues related to the production and distribution of drinking-water.

The Meeting also recommended the establishment of a Working Group on Protection and Control of Water Quality to support this activity and proposed its initial membership and Terms of Reference as well as the priority products to be concluded during 1996/97.

2. OBJECTIVES

This meeting of the Working Group on Protection and Control of Water Quality, its first, had the following objectives:

- to identify priority products (i.e. WHO guidance materials which should be developed) in each of the four principal theme areas and of products which cross these areas;
- to make recommendations regarding the content and format of the Protection and Control elements of the third edition of the Guidelines including the proposed 'Volume 4' on Protection and Control of Water Quality and the relationship between interim products and the preparation of the third edition;
- to classify priority products into biennial groups for preparation in the periods 1996–1997, 1998–1999 and 2000–2001, preparatory to the third edition of the Guidelines for publication in 2003;
- to reach agreement regarding the scope, content and approximate size of products to be prepared during the present biennium;
- to identify lead and support organizations for each product or other means for its development, ensuring an appropriate global participation in the process;
- to recommend the publishing format of the intermediate products in the period up to the preparation of the third edition of the Guidelines for publication in 2003.

3. OPENING

The Meeting was opened by Professor Dr Eckart Meyer, who welcomed the participants to the Institute for Water, Soil and Air Hygiene, Bad Elster. He outlined the history of WaBoLu which was established in 1901 in Berlin. In 1990, the Institute for Hygiene and Microbiology in Bad Elster was merged with WaBoLu in Berlin, which as a whole became part of the German Federal Protection Agency in 1994.

Dr Jamie Bartram welcomed the participants on behalf of WHO. He thanked WaBoLu, the WHO Collaborating Centre for Research on Drinking-water Hygiene, for hosting the meeting and gratefully acknowledged the support of the Umweltbundesamt in supporting the meeting.

Dr Arie Havelaar was designated as Chairman and Dr Eckart Meyer as Vice-Chairman, Dr Jamie Bartram and Dr Hend Galal-Gorchev acted as Rapporteurs.

The list of participants, adopted Agenda and list of working papers for the meeting are included as annexes 1, 2 and 3 to this report.

4. GENERAL

The members of the Working Group discussed and adopted the terms of reference proposed for it by the Coordinating Committee for the updating of WHO Guidelines for Drinking-water Quality. The terms of reference are presented as Annex 4 to this report. The representatives of the Institutions confirmed their willingness to adopt the role of Coordinator as described in the report of the meeting of the Coordinating Committee for the updating of WHO Guidelines for Drinking-water Quality and included as Annex 5 to this report. The coordinating institutions and their representatives on the Working Group are summarized in Table 1, below.

Table 1. Coordinating institutions and their representatives on the Working Group

THEMATIC AREA	COORDINATING INSTITUTION	REPRESENTATIVE ON WORKING GROUP
Resource and source protection	Research Department, Bad Elster of the Institute for Water, Soil and Air Hygiene, DEU (WHO Collaborating Centre for Research on Drinking-water Hygiene)	Dr Ingrid Chorus
Materials and Chemicals used in the production and distribution of Drinking-water	NSF International (WHO Collaborating Centre for drinking-water safety and treatment)	Mr Gordon Bellen
Water Treatment	WRc, UK (WHO Collaborating Centre for drinking-water and water pollution control)	Mr Peter Jackson
Monitoring and Assessment of Drinking-water Supply and Quality	Robens Institute, UK (WHO Collaborating Centre for Protection of Drinking-water Quality and Human Health) jointly with Water Quality Institute (VKI), DNK (WHO Collaborating Centre for Water Quality Assessment and Control)	Mr Guy Howard and Mr Arne Jensen

The Working Group discussed the various potential formats for publication of its products. Concern was expressed regarding the need to ensure a flexible and responsive format and one which would enable updating within a realistic timeframe in light of developments and emerging priorities. It recommended that a WHO series be associated with the Guidelines and suggested the title *WHO Guidelines for Drinking-water Quality: Monograph Series on protection and control of water quality*. The series should have a standard visible format to the extent possible. Publication arrangements should be such as to allow rapid deployment of the products.

It was suggested that WHO investigate the possibility of co-publication with a publisher with wide distribution systems in order to maximize dissemination.

Given the diversity of products that were required the group discussed at some length how it would ensure the quality of individual products. The group agreed to ensure suitable contributions from individuals and institutions known to be competent in the topic of concern, ensure that suitable review institutions/individuals were identified for each product, seek and actively pursue the review of each product by such institutions and individuals, and satisfy themselves on the basis of addressing the comments of such persons that the products were of acceptable quality.

The target audience for the outputs of the Working Group on Protection and Control of Water Quality was agreed to be broad and included all those concerned with drinking-water supplies: water engineers, planners and those in the health and water supply sector who have managerial responsibility for the protection and improvement of water supplies.

5. IDENTIFICATION OF PRIORITY PRODUCTS

The Working Group discussed the working papers available to it (Annex 3) and defined priority products within the area of responsibility of each Coordinating Institution and proposed target dates for their completion. These are detailed below and summarized in Annex 6. In assessing the priority to be assigned to individual products the following criteria were taken into consideration:

- Recommended by the December 1995 Coordinating Committee Meeting
- Demand from Member States
- Working Group considered it an emerging/increasingly important issue (for health)
- Absence of alternative information sources/overlap with existing documentation
- Coherence with Working Group Terms of Reference
- Complementary with other elements of GDWQ
- Time-delays because of need to pre-coordinate with other interested agencies
- Available resourcing.

5.1 Resource and source protection

The working paper prepared and presented by Dr Ingrid Chorus (WaBoLu) on this subject area was discussed.

The Working Group agreed that the immediate requirements were for monographs addressing the issues of cyanobacteria and nitrates in drinking-water as proposed by the Coordinating Committee in December 1995. The Working Group meeting noted the feasibility of preparing the monograph on cyanobacteria in the proposed timeframe but for the monograph on nitrate recommended the preparation of a first draft for 1997 to be revised and

finalized for 1999. Descriptions of these documents were prepared and are included as Annexes 7 and 8 to this report, respectively. Close coordination will be established with the Working Group on Chemicals and/or IPCS, with regard to health risk assessment.

The Working Group discussed potential targets to the year 2003 and agreed that the principal focus should be to have a number of documents entitled 'Control of health hazards in drinking-water arising from ...', with individual documents addressing 'domestic sewage and excreta', 'agriculture', 'industry and traffic' and 'solid wastes'. Descriptions of the four documents would be prepared by the coordinator for review at the next Working Group Meeting. The document concerning 'agriculture' would be prepared in stages based upon shorter monographs regarding pathogens, nitrate and cyanobacteria.

Other potential products were discussed (see Annex 6) and should be reviewed at the next meeting of the Working Group.

5.2 Water Treatment

The working paper prepared and presented by Mr Peter Jackson (WRc) on this subject area was discussed.

The Working Group endorsed the recommendation of the Coordinating Committee for the updating of WHO Guidelines for Drinking-water Quality that there was an urgent need for a monograph on fluoride in drinking-water and recommended that this be the only priority product for preparation in this area for the year 1997. Its scope and content was discussed and agreed and is included in Annex 9 to this report.

The meeting discussed at length the preferred format for guidance material on drinking-water treatment for preparation prior to the year 2003. It noted certain gaps in the available literature and also the current availability of considerable literature on unit processes in drinking-water treatment. It recommended that a single document or cluster of monographs be treated as the priority product. The Coordinating Institution would prepare a detailed description of these for discussion at the next Working Group Meeting.

5.3 Materials and chemicals used in the production and distribution of drinking-water

The working paper prepared by NSF-International and presented by Mr Gordon Bellen on this subject area was discussed.

The Working Group noted the recommendation of the Coordinating Committee meeting in December 1995 that guidance concerning point of use treatment and efficiency of disinfectants be prepared for 1997. The diverse target audience of such a product (including for example disaster relief agencies and travellers) was discussed and it was recommended that a single product entitled *Provision and monitoring of drinking-water supply and quality in emergencies* be produced to address information needs for both water supply in emergencies and monitoring and assessment of water supply and quality in emergencies. The former area should be co-ordinated by NSF-International and the latter by the Robens

Institute. The document should focus upon conditions where microbiological quality is poor or at risk. Close coordination should be established with the Microbiology Working Group, especially with regard to disinfectants efficiency. The Working Group further noted that a number of agencies were active in this and related areas and recommended that coordination be established with these. A description of the proposed document was prepared and is included in Annex 10. It was recommended that a first draft be developed for 1997 and revised and finalized for 1999.

The Working Group also discussed potential targets to the year 2001 and agreed that activity should focus upon the development of a document entitled *Testing and control of materials and chemicals used in the production and distribution of drinking-water*. Close coordination will be established with the IPCS concerning health risk assessment of chemicals. A description of the document is included in Annex 11.

5.4 Monitoring and assessment of drinking-water supply and quality

The working paper prepared by the Robens Institute and VKI and presented by Mr Guy Howard on this subject area was discussed.

The Working Group noted that the Coordinating Committee meeting in December 1995 had recommended the preparation of a booklet concerning water in bottles sold for consumption. The Codex Alimentarius Commission (CAC) has established a European Regional Standard for Natural Mineral Waters (Codex STAN 108-1981) and a code of Hygienic Practice for the Collecting, Processing and Marketing of Natural Minerals Waters (CAC/RCP 33-1985). The conversion of the Codex European Regional Standard for Natural Mineral Waters to a world-wide Codex standard was initiated in 1993. In addition, the Codex Committee on Food Hygiene is in the process of elaborating a Code of Hygienic Practice for Bottled Water (other than natural mineral water). The Working Group decided not to initiate work on bottled water and to await the work of CAC on bottled mineral and other waters.

The availability of guidance concerning monitoring and assessment of drinking-water supply and quality in urban areas was considered a very high priority and had been highlighted by the Coordinating Committee in December 1995. Its development would require a process including consolidation of available experience and expertise; preparation of draft guidance; testing in pilot areas; review of experience gained; revision and finalization. This process should be started as soon as possible and concluded by 2003. The outline of the document is given in Annex 12.

The Working Group also discussed other potential products and made the following recommendations.

- It noted that guidance on health-related monitoring of water quality in trans-boundary river systems was a high priority and recommended preparation of a first draft on this theme for 1997, to be finalized for 1999. The outline of this document is given in Annex 14.

- Guidance on the monitoring of phage was in increasing demand and should be treated as a high priority for preparation for 1999, in time to meet the second addendum on microbiological aspects. The Working Group requested that the Microbiology Working Group discuss and comment on this proposal.
- For many areas of monitoring and assessment the concept of 'minimum safe distances' was important and was an area of significant current research and development. The Meeting recommended that at an appropriate time (2001) a review meeting be called on this theme and the meeting report treated as an output of the Working Group.
- Guidance on monitoring and assessment of water supply and quality in emergency situations of all types was considered a priority and it was recommended that a single guidance document covering this theme and that of provision of water in emergencies be developed (see section 5.3).

The meeting also discussed the monitoring and assessment component of the microbiology review documents (MRDs) and requested the microbiology coordinator to agree with the Microbiology Working Group that the protection and control Working Group prepare for each a short section on monitoring and assessment and review the section on sampling and analysis. The preparation of the sections on monitoring and assessment by the Robens Institute is to be synchronized with that of the MRDs. These sections will be reviewed by the Microbiology Working Group and incorporated as appropriate into the MRDs early/mid 1997.

6. PROGRAMME OF WORK

Working group members agreed to proceed with development of the priority products to be concluded in 1997 as outlined in Annex 6 and within available resources. The target date for publication of the monograph on cyanobacteria and fluoride is December 1997. WHO and the relevant coordinators should contact support Institutions during July and August 1996 to confirm their participation.

WHO with the relevant area coordinators as appropriate should work together to secure resourcing for the development of those products which require substantial commitments, meetings or field work in their development with initial emphasis on those products to be initiated or completed in 1997 and which require such activity.

WHO will seek resourcing for future Working Group meetings.

Based upon the above a provisional schedule of meetings was prepared as given in Table 2.

Table 2. Provisional schedule of meetings

DATES	MEETING	COORDINATION
Early 1997	Technical consultation on monitoring and assessment of urban water supply and quality	Robens
Late 1996/early 1997	Preparatory/writers meeting on materials and chemicals (3 days)	NSF-International
Late 1997 or mid 1998	Technical consultation on domestic sewage and excreta (4–5 days)	WaBoLu
October 1997	Second Working Group meeting to include finalization of 1997 products and planning for 1999 products (6 days, possibly in Budapest)	EURO/HQ
Early 1999	Third Working Group meeting	EURO/HQ

7. PROVISIONAL AGENDA FOR SECOND WORKING GROUP MEETING

(name in parenthesis indicates person/institution expected to introduce the theme and provide a background paper where appropriate).

1. Adoption of documents for finalization in 1997:
 - monograph on cyanobacteria in drinking-water (WaBoLu);
 - monograph on fluoride in drinking-water (WRc).
2. Review of draft documents prepared in 1997:
 - monitoring of drinking-water supply and quality in urban areas (Robens);
 - monograph on nitrate in drinking-water (WaBoLu and WRc);
 - health-related monitoring of water quality in trans-boundary river systems (VKI/VITUKI); and
 - provision and monitoring of drinking-water supply and quality in emergencies (Robens/NSF-International).
3. Review of progress with longer-term development activities:
 - monitoring of drinking-water supply and quality in urban areas (Robens);

- monitoring and control of materials and chemicals used in the production and distribution of drinking-water (NSF-International); and
 - water treatment (WRc).
4. Papers on issues requiring further identification:
- resource and source management (WaBoLu/VITUKI);
 - unit processes in water treatment (WRc);
 - information management systems (VKI/Robens);
 - bankside filtration (VITUKI);
 - technology reviews (Robens); and
 - source monitoring and risk assessment (VKI/WaBoLu).
5. Review of meeting reports and other recommendations regarding priority products:
- (list according to meetings held).
6. Review of proposed 1999 products:
- control of health-hazards in drinking-water arising from domestic sewage (WaBoLu);
 - control of health-hazards in drinking-water arising from pathogens from agriculture (WaBoLu);
 - drinking-water treatment (WRc);
 - phage monitoring (Robens Institute); and
 - testing and control of materials and chemicals used in the production and distribution of drinking-water (draft for 1999) (NSF-International).
7. Other activities:
- possible conference or conference stream on economic aspects of balance between protection and treatment.

NB: Review of section on monitoring and assessment of MRDs will be through direct submission on to the Microbiology Working Group Meeting in May 1997.

Annex 1

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Annex 2

AGENDA

1. Opening 09:30 am.
2. Designation of Chair, Vice-chair and Rapporteurs.
3. Discussion of background paper on source and resource protection.
 - Identification of short-term products, summary descriptions and contributors.
 - Identification of medium- and long-term products and approaches to their development.
4. Discussion of background paper on water treatment.
 - Identification of short-term products, summary descriptions and contributors.
 - Identification of medium- and long-term products and approaches to their development.
5. Discussion of background paper on materials and chemicals use in the production and distribution of drinking-water.
 - Identification of short-term products, summary descriptions and contributors.
 - Identification of medium- and long-term products and approaches to their development.
6. Discussion of background paper on monitoring and assessment of drinking-water supply and quality.
 - Identification of short-term products, summary descriptions and contributors.
 - Identification of medium- and long-term products and approaches to their development.
7. Issues which cross the above divisions.
 - Identification of short-term products, summary descriptions and contributors to them.
 - Identification of medium- and long-term products and approaches to their development.
8. Publishing format for products in short- and long-term.
9. Timetable of work.
10. Financing aspects.
11. Closure.

Annex 3

LIST OF WORKING PAPERS

ICPEUD021VD96/2	Scope and purpose
ICPEUD021VD96/3	Provisional agenda
ICPEUD021VD96/4	Provisional programme
ICPEUD021VD96/5	Provisional list of participants
ICPEUD021VD96/6	Monitoring and assessment of water supply and quality by Guy Howard on behalf of Robens Institute and Water Quality Institute
ICPEUD021VD96/7	Protection and control of water quality by resource and source protection by Ingrid Chorus
ICPEUD021VD96/8	Materials and chemicals used in the production and distribution of drinking-water by N. Culotta and B. Tanner, NSF International
ICPEUD021VD96/9	Drinking-water treatment by Peter Jackson, WRc

Annex 4

TERMS OF REFERENCE FOR THE WORKING GROUP ON PROTECTION AND CONTROL OF WATER QUALITY

The Working Group is established in order to facilitate the preparation of guidance in the fields of risk management and monitoring and assessment of drinking-water supply and quality in relation to the *Guidelines for Drinking-water Quality* and in order to contribute to the overall aim of the protection of public health. As with other aspects of the Guidelines it is expected that the guidance will represent scientific consensus and best available evidence.

Four principal areas of work will be addressed and for each a Coordinator was identified:

- resource and source protection (WaBoLu, DEU);
- drinking-water treatment (WRc, UNK);
- materials and chemicals related to the production and distribution of drinking-water (NSF, BEL);
- monitoring and assessment of drinking-water supply and quality (Robens Institute, UNK, jointly with VKI, DEN).

In each of these areas the Working Group in general and Coordinator in particular will, in coordination with the Coordinating Committee:

- develop and implement a general programme of work in order to ensure that balanced, integrated guidance is available by the time of preparation of the third edition of the Guidelines in 2003;
- within a biennial workplan, identify urgent information needs and ensure that guidance for these is developed where not already available;
- ensure dissemination of guidance and its incorporation into the Guidelines in the most appropriate format.

In addition to the above it is envisaged that the Working Group will review recommendations arising from country and regional meetings related to drinking-water in general and to the *Guidelines for Drinking-water Quality* in particular. It is anticipated that these reviews will lead to incorporations into the programme of work of the Working Group and to redirecting certain recommendations to other appropriate institutions or committees.

Annex 5

PROCEDURE FOR THE PREPARATION AND REVIEW OF BACKGROUND DOCUMENTATION

The procedure for the preparation and review of draft documents, the respective roles of Lead Institutions, Support Institutions and Coordinators are described below, and are based on those adopted in the preparation of the second edition of the *Guidelines for Drinking-water Quality* (Reports No. WHO/PEP/89.4 and WHO/PEP/90.2)

(a) LEAD INSTITUTION

A Lead Institution (LI) prepares a first draft of a review document on microbiological or chemical contaminants, or on protection and control of water quality.

In cooperation with the respective Coordinator, the draft document prepared by the LI is sent to Support Institutions (SI) and other national institutions for review and comment. Comments are integrated by the LI and Coordinator into the draft document or made available directly to the Working Group Meeting.

HC documents for chemicals prepared by a LI should take into full consideration international assessments, published or in progress, carried out by the IPCS in its EHC monographs, or through the JMPR, and JECFA. Evaluations of carcinogenic risks of chemicals to humans conducted by IARC must also be taken into consideration. The WHO Headquarters Coordinator is to provide to the Lead Institution all IPCS and IARC documents relevant to the preparation of the HC document.

(b) SUPPORT INSTITUTIONS

The Support Institutions (SIs), identified for each agent, substance or topic at the Coordinating Committee Meeting of December 1995 or subsequently should provide any relevant data or information to the designated LI. The SIs should also be prepared to receive requests for assistance with specific areas of the review by the LI.

The SIs should critically review the draft document paying particular attention to the quality of the studies mentioned. Comments and supplementary text should be sent to the LI or Coordinator, as appropriate, within 6 weeks of receipt of the document. Any new information should be supported by appropriate documentation.

(c) OTHER REVIEW INSTITUTIONS

Other review institutions should critically examine the draft documents. Comments should be sent to the relevant Coordinator with copies of appropriate support documentation within 6 weeks of receiving the draft document.

(d) COORDINATORS

The Coordinators will handle relevant correspondence regarding the updating of the GDWQ and check that the draft documents fall within the established format.

The Coordinator will distribute the draft documents to SIs and other review institutions. The Coordinators will then work with LIs to incorporate the comments received or prepare summaries setting out the points of dispute or controversy requiring resolution at the Working Group Meetings.

The Coordinators will also summarize and focus the comments and scientific issues for each substance/agent or topic prior to the Working Group Meeting. Coordinators will also attend meetings of the relevant Working Groups and review groups and other meetings in order to assist the experts in their deliberations, and thereafter, finalize the draft document for inclusion in addenda to the GDWQ or other publications as appropriate.

Annex 6

**PRIORITY PRODUCTS BY COORDINATING INSTITUTION
AND YEAR OF PRODUCTION**

IDENTIFIED PRODUCTS	COORDINATOR *	LEAD INSTITUTION(S)	NOTES
1997			
Monograph on cyanobacteria and drinking-water quality	Resource and source protection	WaBoLu	To be reviewed by Microbiology Working Group/Coordinator. Health risk assessment based on that developed by Working Group on Chemicals.
Monograph on fluoride in drinking-water	Water treatment	WRc	Health risk assessment to be reviewed by IPCS.
Contribution on monitoring to MRD's	Monitoring and assessment of drinking-water supply and quality	Robens Institute/RIVM	To be reviewed by Microbiology Working Group
Monitoring drinking-water supply and quality in urban areas	Monitoring and assessment of drinking-water supply and quality	Robens Institute	Draft 1997, then pilot testing for review in 2000; revision in 2002
1999			
Monograph on nitrate in drinking-water	Resource and source protection	WaBoLu/WRc (for removal techniques)	Draft to be available in 1997. Health risk assessment based on that developed by Working Group on Chemicals.
Health-related monitoring of water quality in trans-boundary river systems	Monitoring and assessment of drinking-water supply and quality	VKI/VITUKI	Draft to be available 1997
Provision and monitoring of drinking-water supply and quality in emergencies	Materials and chemicals ... with Monitoring and assessment of drinking-water supply and quality	NSF International, Robens Institute and others (Oxfam, RED-R, UNHCR subject to response)	Formal draft to be available 1997 Close coordination with Microbiology Working Group
Control of health-hazards in drinking-water arising from domestic sewage and excreta	Resource and source protection	WaBoLu	
Control of health-hazards in drinking-water arising from pathogens from agriculture	Resource and source protection	WaBoLu/RIVM	
Drinking-water treatment: water treatment process application, monitoring and control; water quality in distribution	Water treatment	WRc	
Phage monitoring	Monitoring and assessment of drinking-water supply and quality	Robens Institute	To be reviewed by Microbiology Working Group

IDENTIFIED PRODUCTS	COORDINATOR *	LEAD INSTITUTION(S)	NOTES
2001			
Control of health-hazards in drinking-water arising from solid wastes	Resource and source protection	WaBoLu/VKI	
Testing and control of materials and chemicals used in the production and distribution of drinking-water	Materials and chemicals ...	NSF International	Draft to be available 1999. Health risk assessment of chemicals to be reviewed by IPCS.
Expert review on minimum safe distances	Monitoring and assessment of drinking-water supply and quality	Robens	
2003			
Control of health-hazards in drinking-water arising from agriculture	Resource and source protection	WaBoLu	From monographs on nitrate, cyanobacteria and pathogens from agriculture
Control of health-hazards in drinking-water arising from industry and traffic	Resource and source protection	WaBoLu	
Requiring Further Definition			
Resource and source management	Resource and source protection	N/A	WaBoLu/ VITUKI to present a revised paper/proposal to next WG meeting
Information management systems	Monitoring and assessment ...	N/A	VKI, Robens to present a revised paper/proposal to next WG meeting
Bankside filtration	Resource and source protection	N/A	VITUKI to present a paper/proposal to next WG meeting
Technology reviews	various	N/A	Robens to present a paper/proposal to next WG meeting
Source monitoring and risk assessment	Monitoring and assessment ...	N/A	VKI/WaBoLu to present a paper/proposal to next WG meeting
Areas requiring promotional activity, not guidance development			
Economic aspects of balance between protection and treatment	Resource and source protection jointly with Water treatment		approaches to be made to major professional associations regarding possibility of a conference or conference stream

IDENTIFIED PRODUCTS	COORDINATOR *	LEAD INSTITUTION(S)	NOTES
Themes covered through linkage to other products			
Monitoring of microorganisms included in MRDs	Microbiology Working Group	Robens Institute	P&CWQ WG to develop monitoring and assessment section for MRDs early/mid 1997

* Coordinators are:

- Resource and source protection: WaBoLu (represented by Dr Ingrid Chorus).
- Water treatment: WRc (represented by Mr Peter Jackson).
- Materials and chemicals used in the production and distribution of drinking-water: NSF International (represented by Mr Gordon Bellen).
- Monitoring and assessment of drinking-water supply and quality: jointly Robens Institute and VKI (represented by Mr Guy Howard and Mr Arne Jensen respectively).

Annex 7

CYANOBACTERIA MONOGRAPH

Title:

WHO Guidelines for Drinking-water Quality, Series on Protection and control of Water Quality: Cyanobacteria, their Toxins and Impact on Healthy Drinking-water.

Objective:

To present the information necessary for protecting drinking-water, sources and water resources from the health hazards caused by cyanobacteria and their toxins in an easy-to-access methodological format covering the impact of Cyanobacteria on health, their management and control.

Scope

All types of surface waters used for drinking-water abstraction, with an emphasis on maintaining a global balance and taking into consideration climatic and regional differences. The volume will refer to use of sources and resources for bathing water, as far as this usage is relevant for understanding the rationale of approaches in dealing with drinking water risks.

Target audience:

Environmental health officers; professional in the fields of water supply, public health, freshwater ecology and teaching; NGOs and special interest groups; post-graduate students, farmers (small-holders) with an own drinking-water supply

Potential contributors:

Professor Wayne W. Carmichael, Wright State University, Dayton, USA; Professor Geoffrey A. Codd, University of Dundee, Scotland; Professor Ian R. Falconer, University of Adelaide, Australia; Dr Kaarina Sivonen, University of Helsinki, Finland; Dr Hans Utkilen, National Institute of Public Health, Oslo, Norway; Professor. Yu Shun-Zhang, Shanghai Medical University, Republic of China; Dr Ken-Ichi Harada, Meijo University, Nagoya, Japan; Professor Steve Hrudey, University of Alberta, Canada; Dr Tine Kuiper-Goodman, Health Canada Food Directorate, Canada; Dr Gary Jones, CSIRO Division of Water Resources, Griffith, Australia; Mr. Mike Burch, Australian Centre for Water Quality Research, Salisbury, Australia; Dr Blahoslav Marsalek, Inst. of Botany, Brno, Czech Republic; Professor Robert Hoehn, Virginia Polytechnic and State University, USA; Dr Jim Fitzgerald, South Australian Health Commission, Adelaide, Australia; Professor Luuc Mur, University Amsterdam, Netherlands.

Microbiology Working Group/Coordinator will contribute to the review of the monograph. Health risk assessment of cyanobacterial toxins is to be reviewed by the Working Group on Chemicals and/or IPCS.

	CHAPTER TITLE	CONTENTS	APPROX. PAGES	AUTHORS	SUPPORT FROM
0	Foreword	Purpose of guidelines, WHO context, wider drinking water and health context, international activities	5	Bartram	
1	Introduction: Toxic Cyanobacteria – a recent issue of concern?	<ul style="list-style-type: none"> • historical perspective, • current relevance of this issue and overall scale and severity of the problem, trends, • present state of knowledge and critical gaps, • substantial interregional variations, • ongoing initiatives 	12	Carmichael	
2	Risk assessment:	2.0 Summary on the current status of knowledge on hazards caused by toxic cyanobacteria – what do we know and what knowledge do we lack?	5	<u>Jones / Burch</u>	Carmichael IPCS/Chemicals Working Group for entire Chapter 2
		2.1 What are cyanobacteria?	5	<u>Skulberg?</u> / <u>Mur?</u>	Jones
		2.2 What toxins do cyanobacteria contain? (and can we trust that we know the most important ones?)	8	<u>Sivonen</u> / Jones	Codd
		2.3 How hazardous are cyanotoxins? – toxicological evidence	7	<u>Kuiper-Goodman / Falconer / Fawell</u>	Burch
		2.4 Have people been harmed by cyanotoxins? – epidemiological evidence	10	Falconer / <u>Yu Shun-Zhang</u>	Kuiper-Goodman / Burch anyone else with info?

	CHAPTER TITLE	CONTENTS	APPROX. PAGES	AUTHORS	SUPPORT FROM
		2.5 Exposure to cyanotoxins: in which water resources must cyanotoxins be expected? Quantitative estimates via drinking water	25 7	<u>Hrudey</u> /Kuiper-Goodman	Codd/Falconer
		2.5.1 Data on occurrence world-wide, and as far as available on toxin concentrations and seasonal patterns	7	Jones/Yu Shun-Zhang/ Marsalek/Sivonen/ <i>South-Africa?</i> /Chorus	!
		2.5.2 Factors affecting bloom formation and enhancing toxin production	7	<u>Utkilen</u> / Sivonen / <i>Mur</i>	
		2.5.3 Persistence and degradation of cyanotoxins	4	Jones / Sivonen	
3	Risk avoidance	3.1 Management actions to prevent cyanobacterial proliferation – general principles	11 2	<i>Mur ?</i>	Marsalek /Chorus
		3.1.1 Nutrients from sewage	3	Chorus	
		3.1.2 Nutrients from agriculture	3	Chorus	
		3.1.3 Other factors	3	<i>Mur ?</i>	
		3.2 Management actions to prevent toxin liberation and formation	5 2	<u>Utkilen</u> / <i>Mur?</i>	
		3.2.1 Toxin liberation	2	<u>Utkilen</u> / <i>Mur?</i>	
		3.2.2 Toxin formation	1	Sivonen	

	CHAPTER TITLE	CONTENTS	APPROX. PAGES	AUTHORS	SUPPORT FROM
4	Risk management	4.1 Basic principles: avoidance preferable to management, monitoring of cyanobacteria is preferable to toxin monitoring	5	Hrudey / Falconer	Burch
		4.2 Approaches to risk management: derivation of guideline values, legislation and implementation	34 10	<i>Hrudey / Falconer / Yo Shun-Zhang</i>	
		4.2.1 Guidelines for safe operating practice of drinking water supplies	10	<u>Hrudey/Burch/Falconer</u>	Jones
		4.2.2 Guideline values for cyanotoxins in drinking water and their derivation	7	<u>Falconer/Kuiper-Goodm. /Burch/Fitzgerald</u>	Hrudey / Yo Shun-Zhang
		4.2.3 Guideline values for cyanotoxins in bathing waters and their derivation (subject to publication format)	7	<u>Falconer/Kuiper-Goodm. /Jones/Fitzgerald</u>	<i>Pearson/Chorus</i>
		4.3 Monitoring and surveillance in water resources, drinking water and recreational waters	35 3	<u>Codd</u>	Hrudey
		4.3.1 Approach and design of programs	7	Burch/Yu Shun-Zhang	
		4.3.2 Methods for monitoring cyanobacteria	5	<u>Marsalek / Burch</u>	
		4.3.3 Relation or non-relation to odor problems	5	<u>Hrudey/Utkilen</u>	
		4.3.4 Detection methods for cyanotoxins	15	<u>Harada/Kondo/Lawton</u>	<i>Holmes/Fawell</i>
		4.4 Remedial measures	25 5	co-ordination and chapeau: <u>Burch</u>	Hrudey
		4.4.1 Management of abstraction	3	Hrudey/ <u>Burch/Brikas</u>	

	CHAPTER TITLE	CONTENTS	APPROX. PAGES	AUTHORS	SUPPORT FROM
		4.4.2 Drinking water treatment (including small private supplies!)	7	<i>Hrudey/Burch/Brikas/Pearson</i>	<i>Pearson ?</i>
		4.4.3 Bathing sites	5	Codd	
		4.4.4 Public awareness	5	Codd	
	5. Case studies	Retrieval of case studies, e.g. from Australia, the United Kingdom and South Africa (decision on whether to integrate them into other chapters or to use them as a separate chapter will depend upon the material compiled)	15-25	all authors, particularly Yu Shun-Zhang, Burch, Jones, Marsalek, <i>Vasconcelos ?</i>	

Annex 8

NITRATE MONOGRAPH

Title:

Nitrate and Nitrite, Drinking-water and health.

Objective:

To present information necessary for protecting human health from hazards caused by nitrate and nitrite in drinking-water, sources and water resources; their management and control.

Scope

Drinking-water; water used for drinking-water, abstraction and sources of contamination.

Target audience:

Environmental health officers; professionals in the field of water supply, public health, water ecology, and teaching; NGOs and special interest groups; post-graduate students, farmers (small-holders) with an own drinking-water supply.

	CHAPTER TITLE	CONTENTS	PAGES	AUTHORS	SUPPORT FROM
0	Foreword		2	Bartram?	
1	Introduction	General descriptions; current relevance of this issue trends	2	?	
2	Risk assessment	Environmental levels and human exposure; toxicological and health aspects evaluation; guideline values.	10	Speijers ¹	
3	Sources of pollution	Origin of nitrate in drinking-water; # natural sources # sewage, wastes, # agricultural production (plants, animals) # other sources (e.g. ambient air)	10		Höring
4	Risk avoidance	Prevention of contamination: # sewage # wastes # agriculture # pasture farming # stock breeding	5		
5	Risk management	Environmental transport, distribution and transformation; surveillance; # factors other than above influencing the nitrate concentrations in water (seasonal variation and trends, variation caused by depth of ground water extraction, natural groundwater recharge and nitrate concentrations, anoxic conditions in the aquifer, monitoring and surveillance of nitrate in ground and surface water); practice of sewage and waste deposition; practice of agriculture, pasture farming and stock breeding.	15	H.- W: Möller, UBA?	?
6	Treatment	Methods: physical, chemical, biological and combinations Advantages and limitations of treatment: health and environmental aspects, technological and economic limits.	10	Peter Jakson. WRc	H. Frimmel Engler-Bunte- I. Karlsruhe F.U. Schlosser, WaBoLu
7	Monitoring and assessment	Study design Monitoring programme design Sampling methods Analytical methods			
8	Recommendations	Recommendations for protection of human health: public health measures, screening and monitoring	1		

¹ The content of this chapter will be used on the draft Health Criteria monograph on nitrate and nitrite in drinking-water prepared by Dr Speijers which will be finalized by the Working group on Chemicals.

Annex 9

FLUORIDE MONOGRAPH

Title:

Fluoride in Drinking-water.

Objective:

To make it useful to health workers and sanitary engineers who might not have major resources to call on. Monograph should be brief, about 70 pages long.

Potential contributors:

Mr F.J. Gumbo, Ministry of Water, Tanzania; Mr R. Sarin, National Environmental Engineering Research Institute (NEERI), Nagpur, India; and expert from Mexico, WHO Oral Health Unit, and IPCS.

	CHAPTER TITLE	CONTENTS	APPROX PAGES
1	Introduction	<ul style="list-style-type: none">• Explanation of the document's purpose.	2
2	Fluoride occurrence and chemistry	<ul style="list-style-type: none">• Where it occurs, what forms;• Need to cover developing countries extensively.	6
3	Assessment of human health risks of fluoride	<ul style="list-style-type: none">• Toxicological and epidemiological evaluations;• Derivation of WHO Guideline Value.	20
4	Beneficial use	<ul style="list-style-type: none">• Discussion of its use to prevent caries, WHO policy, etc.	6
5	Guidelines and standards	<ul style="list-style-type: none">• Including basis	3
6	Removal	<ul style="list-style-type: none">• Methods of removal particularly for small supplies and developing countries;• What different approaches can achieve.	20
7	Artificial Fluoridation	<ul style="list-style-type: none">• Methods and controls;• Summary of info from UK and USA manuals, and WHO Oral Health Unit.	10
8	Decision Tree	<ul style="list-style-type: none">• What approach to take.	4

Annex 10

PROVISION AND MONITORING OF DRINKING-WATER SUPPLY AND QUALITY IN EMERGENCIES

Title: Provision and monitoring of drinking-water supply and quality in emergencies.

Objective:

To describe and provide authoritative guidance, based upon scientific consensus and best available evidence and experience, on issues and techniques necessary to provide safe drinking-water to displaced populations and in areas affected by disasters where conventional water distribution is not available or has been severely disrupted.

Scope

This guideline will describe minimum criteria and procedures necessary for the assessment and provision of water for domestic uses for communities affected by disasters or displaced from their home or permanent water supplies.

Target audience:

Emergency relief professionals and local authorities in affected areas.

Potential contributors:

NSF International to lead "provision"; Robens Institute to lead "monitoring".
Contributors: OXFAM, RED-R, UNHCR etc.

	SECTION	CONTENTS	APPROX PAGES
1	Introduction	Risks to human health from exposure to inadequately treated water: compounding a crisis situation.	10
2	Assessing status and alternative sources and means of provision	Conducting a sanitary survey; assessing the quality of available water; identifying water sources; identifying water volume needs; protecting the source.	50
3	Selecting appropriate technology	Treatment fundamentals; estimating treatment needs and capability; assessment of operation needs – supplies, expertise, waste disposal.	50
4	Operation and maintenance	Frequency of service; minimum expertise required; infrastructure support; monitoring water quality and population health.	30

Annex 11

TESTING AND CONTROL OF MATERIALS AND CHEMICALS USED IN THE PRODUCTION AND DISTRIBUTION OF DRINKING-WATER

Title:

Testing and control of materials and chemicals used in the production and distribution of Drinking-water.

Objective:

To describe and provide authoritative guidance based upon scientific consensus and best available evidence on how to evaluate and predict the impact on drinking-water quality of the use of materials and chemicals in contact with drinking-water during its treatment, storage and distribution.

To describe the use of chemicals and materials, methods for measuring their potential to impact water quality, methods for assessing that impact and selecting materials and chemicals, and methods for establishing systems for their review and acceptance.

Scope

All materials and chemicals which contact water that is intended for human consumption from the point of collection (e.g. from ground or surface water sources) to the point of use have the potential to have a detrimental impact on human health. That impact may be caused by the presence of impurities or because at elevated use levels, residual concentrations may exceed acceptable limits.

Target audience:

Regulatory authorities, water treatment professionals concerned with design and operation of treatment and distribution systems, manufacturers of chemicals and materials, NGOs and special interest groups.

	CHAPTER TITLE	CONTENTS	APPROX PAGES
1	Introduction	The public health risks associated with the intentional and unintentional addition of chemicals to drinking-water, health and economic aspects.	10
2	Rationale for the selection of materials and chemicals	<ul style="list-style-type: none">• Review all categories of chemicals and materials;• purpose of all categories of chemicals and materials, contaminants common to each, and examples of health effects;• importance to water quality improvement through its intended use versus health effects.	50

	CHAPTER TITLE	CONTENTS	APPROX PAGES
3	Methods for measuring contaminants	<ul style="list-style-type: none"> • Test conditions and methods of laboratory exposure for all categories of chemicals and materials; • rationale for exposure conditions: time, surface to volume ratios, water quality. 	30
4	Assessing the impacts of contaminants	<ul style="list-style-type: none"> • Overview of chemicals and materials use in the treatment and distribution systems and the potential for at the tap concentrations; • numerical rationales for relating contaminant measurement to human exposure. 	30
5	Risk assessment ² and management	<ul style="list-style-type: none"> • Relating the human exposure estimate with health effects data; • types of health effects, toxicological studies used as predictors, impacts of data quality and assumptions on decisions and establishing "acceptable" levels of risk. 	50
6	Establishing a system for selection of materials and chemicals suitable for contact with drinking-water	<ul style="list-style-type: none"> • Review of systems and procedures currently in existence • establishing an evaluation system; • review of existing sources of data; • data quality objectives and evaluation. 	30

² Risk assessment of chemicals to be reviewed by IPCS

Annex 12

**MONITORING AND SURVEILLANCE OF DRINKING-WATER
IN URBAN AREAS**

Title:

Monitoring and Surveillance of Drinking-water Supply and Quality in Urban Areas

Objective:

To describe and provide guidance upon the monitoring and assessment of water supplies in urban areas with particular emphasis on countries less industrial.

Target audience:

Regulatory bodies, water supplies, NGOs and Donor agencies involved in the provision of water supplies in urban areas of monitoring and control of environmental health.

Potential contributors:

Robens Institute (Guy Howard), Jamie Bartram, MRCS, Comunità di S. Egidio, Rojas (Perù), IRC, WEDC, LSHTM (Cairncross), Healthy Cities Programme, Dubè

	CHAPTER TITLE	CONTENTS	APPROX PAGES
1	Introduction to monitoring and surveillance of drinking-water supplies	<ul style="list-style-type: none">• Introduction to monitoring and surveillance of drinking-water supplies;• water quality and health;• The nature, growth and complexity of urban areas in developing countries;• addressing the broader issues of water supply and their impacts on human health.	10
2	Water quality in urban areas and the unique conditions of urban areas in developing countries	<ul style="list-style-type: none">• Water quality in urban areas and the unique conditions of urban areas in developing countries;• the need for routine water quality monitoring by suppliers and surveillance agencies;• differences between monitoring and assessment;• management needs for monitoring;• planning for water supply and water quality in urban areas;• developing urban water master plans; management of water supplies in urban areas.	10

	CHAPTER TITLE	CONTENTS	APPROX PAGES
3	Design of monitoring networks	<ul style="list-style-type: none"> • Design of monitoring networks for surveillance and quality control, sample site selection, sampling inspections of urban water supplies; • the need for water source and resource monitoring; • treatment efficiency assessment. 	20
4	Analytical ranges for urban monitoring and assessments	<ul style="list-style-type: none"> • Analytical ranges for urban monitoring and assessments; • the critical parameters concept; expanding analytical ranges; • on-site versus laboratory-based testing; • equipment selection for laboratory and on-site testing; • differing analytical needs for suppliers and surveillance agencies. 	10
5	Institutional aspects of drinking-water in urban areas	<ul style="list-style-type: none"> • Institutional aspects of drinking-water in urban areas: • supply and surveillance functions; • defining roles and responsibilities; • servicing low-income areas; • particular problems with informal settlements; • human resource requirements for quality control and surveillance; • human resource development strategies. 	10
6	Information management for urban monitoring	<ul style="list-style-type: none"> • Information management for urban monitoring; • the needs of surveillance and supply agencies; • information sharing; • public access issues; • reporting of water quality data and information. 	10
7	Preventive and remedial actions	<ul style="list-style-type: none"> • Preventive and remedial actions for improving water quality in urban areas of developing countries; • technology selection; • water treatment versus source protection; • particular problems with leakage and illegal connections; • leakage detection and reduction; • particular problems of point source development in urban and peri-urban areas. 	20

	CHAPTER TITLE	CONTENTS	APPROX PAGES
8	Water supply and quality in low-income urban and peri-urban areas	<ul style="list-style-type: none"> • Water supply and quality in low-income urban and peri-urban areas; • the problems of water supply development in low-income areas; • low-cost approaches for low-income urban and peri-urban areas; • monitoring water quality in low-income areas; • the role of NGOs and community organizations in developing monitoring of water quality in urban areas. 	20
9	Legislation and regulation of water quality in urban areas	<ul style="list-style-type: none"> • Legislation and regulation of water quality in urban areas; • dialogue and enforcement; • dealing with community based programmes; • ensuring basic needs are met. 	20

The meeting noted the offer of the Comunità di S. Egidio/University of Tor Vergata to facilitate the role of the project in which they are involved in Albania as a pilot project and recommended that this be pursued.

Annex 13

HEALTH-RELATED MONITORING OF WATER QUALITY IN INTERNATIONAL RIVER BASINS, INCLUDING EARLY WARNING MONITORING SYSTEMS

Title:

Health-related monitoring of water quality in international river basins, including early warning monitoring systems

Objective:

To describe and provide authoritative guidance to the target audience based upon experience from existing transboundary river monitoring systems and early warning systems.

Scope

To be used as framework for setting up such systems for transboundary rivers in other areas.

Target audience:

Regulatory authorities, international commissions, staff concerned with river monitoring and warning systems, designers and operators of water works, water treatment plants using surface waters, bankside filtration wells for drinking-water supplies.

Potential contributors:

VITUKI, VKI

	CHAPTER TITLE	CONTENTS	APPROX PAGES
Part I			
1	Introduction		5
2	Description of present monitoring systems	<ul style="list-style-type: none"> • Danube River • Rhine River • Others 	20
3	Health related pollutants	<ul style="list-style-type: none"> • Nutrients • Heavy metals • Organic micropollutants – polar and hydrophobic • Bacteria 	6
4	Sampling and field measurements	<ul style="list-style-type: none"> • Short description of methods with reference 	6
5	Laboratory analysis	<ul style="list-style-type: none"> • Short description of methods with reference 	10
6	Quality assurance, Quality control	<ul style="list-style-type: none"> • Sampling • Laboratory 	8
7	Data reporting	<ul style="list-style-type: none"> • Data handling • Interpretation 	10

	CHAPTER TITLE	CONTENTS	APPROX PAGES
8	Information utilization	<ul style="list-style-type: none"> • National • International 	5
9	Conclusions	<ul style="list-style-type: none"> • Summary • Recommendations 	4
Part II			
1	Introduction		3
2	Description of present warning systems	<ul style="list-style-type: none"> • Ohio river (ORSANCO) • Danube river • Rhine river • Others 	12
3	Transportation accidents	<ul style="list-style-type: none"> • Description of possible accidents • Examples 	5
4	Industrial accidents	<ul style="list-style-type: none"> • Description of possible accidents • Examples 	5
5	Hazard identification	<ul style="list-style-type: none"> • Description of risks 	5
6	Predictive modelling	<ul style="list-style-type: none"> • Short description of alarm models • Examples 	10
7	Field observations, automatic water quality monitoring	<ul style="list-style-type: none"> • Description of approaches in situ and on-line instruments, stations 	10
8	Signalling, communication	<ul style="list-style-type: none"> • Description of approaches • Examples 	4
9	Proposal for a warning system	<ul style="list-style-type: none"> • Description of an early warning system 	4
10	Emergency measures	<ul style="list-style-type: none"> • Actions to be taken at water treatment plants 	3
11	Conclusions	<ul style="list-style-type: none"> • Summary • Recommendations 	2