DEVELOPMENT OF WHO GUIDELINES FOR SAFE RECREATIONAL WATER ENVIRONMENTS

Report on a WHO Expert Consultation

St Helier, Jersey, United Kingdom
23–30 May 1997

SCHERFIGSVEJ 8
DK-2100 COPENHAGEN Ø
DENMARK
TEL.: +45 39 17 17 17
TELEFAX: +45 39 17 18 18
TELEX: 12000
E-MAIL: POSTMASTER@WHO.DK
WEB SITE: HTTP://WWW.WHO.DK
TARGET 20

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 recreational use of fresh and coastal waters, as well as swimming pools and spas, is widespread around the world. Concern has been expressed about adverse health effects associated with such use, which can arise from accidents, poor water quality, toxic organisms and exposure to sun and heat, for example. WHO has therefore initiated the preparation of guidelines for safe recreational water environments, which included convening a four-part Consultation, hosted by the Public Services Department, Jersey, United Kingdom. At the Consultation, 32 experts discussed the further development of the guidelines, and made a series of detailed recommendations on their finalization. Immediate action was to be taken following the Consultation to complete the various volumes of the guidelines by the end of 1999.

Keywords

WATER QUALITY
SWIMMING POOLS
HEALTH RESORTS
TRAVEL
GUIDELINES
# CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Background .......................................................................................................................... 1</td>
</tr>
<tr>
<td>2. Opening ................................................................................................................................. 1</td>
</tr>
<tr>
<td>3. Organization of the work ...................................................................................................... 2</td>
</tr>
<tr>
<td>4. General recommendations regarding guidelines for safe recreational water environments ... 2</td>
</tr>
<tr>
<td>5. Working Group 1. Health risks arising from recreational use of marine and freshwater environments ................................................................. 3</td>
</tr>
<tr>
<td>8. Working Group 4. Planning for dissemination and Implementation ........................................ 19</td>
</tr>
<tr>
<td>9. Working Group 5. Swimming pools, spas and similar recreational water environments .......... 19</td>
</tr>
<tr>
<td>Chapter</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>10.1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>11.1</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>
1. Background

WHO has been active in the field of tourist health and health aspects of recreational use of the environment for many years. Concern for environmental health aspects in this regard has been reflected in various meetings on this theme over recent years.

In response to the mounting evidence of significant health impact and public concern regarding recreational water and bathing beach quality, the World Health Organization through collaboration between its headquarters and the Regional Office for Europe, has initiated development of a document with the provisional title of *WHO guidelines for safe recreational water environments*.

A meeting of experts was called in St Helier, Jersey, Channel Islands, on 23–30 May 1997 with the following objectives:

- to review the content of the technical draft of Volume 2 alongside comments received from peer review and make recommendation regarding actions necessary for technical finalization;
- to review and make recommendations regarding the risk assessment – risk management linkage and on the derivation of Guideline values; to recommend for which parameters Guideline values should be derived and to propose Guideline values for these;
- to review the overall structure and content of Volume 4, (including overall structure and content of Code of Good Practice for Monitoring) and of the recently initiated initiative concerning local management for healthy tourism;
- to review progress with the development of Guidelines concerning swimming pools, spas and similar recreational water environment;
- to review and update the recommendations of the Expert Consultation on Health Impacts of Recreational Water and Bathing Beach Quality, Bad Elster, June 1996 regarding areas in which research is necessary in order that guidelines may be developed based upon adequate scientific information and in order that monitoring, standard setting and enforcement may be upon sound scientific criteria.

2. Opening

The meeting was opened by Mr Brian Stuttard, Public Services Department, States of Jersey, who welcomed participants to the Island of Jersey.

Dr Jamie Bartram welcomed participants on behalf of WHO. He thanked the States of Jersey for co-sponsoring and hosting the meeting and noted the other authorities sponsoring the process, including the European Commission, German Umweltbundesamt and Government of Italy.

Dr Al Dufour, Dr Gareth Rees, Dr Mihaly Kadar and Dr Joseph Cotruvo acted as Chairpersons for different parts of the meeting and Mr William Robertson, Dr Juan Lopez-Pila, Dr Kathy Pond and Dr John Ridgway as rapporteurs. The list of participants is included as Annex 1 to this report, the agenda as Annex 2 and the list of working papers as Annex 3.
3. Organization of the work

In light of the diversity of topics addressed at the consultation, it was organized as a series of working groups as follows:

- Working Group 1 (23, 24, 26 May): Health risk assessment for coastal and freshwaters
- Working Group 2 (27, 28 May): Microbiology review documents
- Working Group 3 (27, 28 May): Monitoring and assessment of coastal and freshwaters
- Working Group 4 (28 May): Development of an initiative to support Guidelines implementation
- Working Group 5 (29, 30 May): Swimming pools, spas and similar recreational water environments.

4. General recommendations regarding guidelines for safe recreational water environments (GSRWE)

The meeting noted the recommendations of the previous meetings at Bad Elster and Ann Arbor and endorsed them in general. It also noted the extent of material related to specific microbiological hazards and the extensive overlap between two of the volumes in this area. It therefore recommended minor amendments to the structure of the Guidelines for safe recreational water environments as follows.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Subtitle</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume 1</td>
<td>Recommendations</td>
<td>Should be prepared following finalization of drafts of the other documents and should provide a clear and succinct summary of their contents, conclusions and recommendations; and their application.</td>
</tr>
<tr>
<td>Volume 2</td>
<td>Health Risks arising from recreational use of marine and fresh waters</td>
<td>Should act as an authoritative referenced review and assessment of the available information concerning health impacts arising from recreational use of marine and fresh waters and bathing beaches; and include the derivation of guideline values or conditions and other measures for health protection.</td>
</tr>
<tr>
<td>Volume 3</td>
<td>Swimming pools, spas and similar recreational water environments</td>
<td>Should act as an authoritative referenced review and assessment of the available information concerning health hazards in swimming pools, spas and similar recreational waters and include the derivation of guideline values or conditions or other measures for health protection and their control.</td>
</tr>
<tr>
<td>Volume 4</td>
<td>Monitoring and assessment of marine and freshwater recreational areas</td>
<td>Should provide comprehensive guidance for the design, planning and implementation of monitoring programmes, studies and assessments of recreational water and bathing beach quality.</td>
</tr>
<tr>
<td>Volume 5</td>
<td>Microbiological review documents</td>
<td>Should describe the principal characteristics of the microbes actually or potentially representing a hazard in the recreational water environments.</td>
</tr>
</tbody>
</table>
The meeting endorsed the overall content and approach adopted in preparation of the *Guidelines for safe recreational water environments* (GSRWE) and in particular the coverage of diverse hazards and diverse water uses in a single package.

The meeting emphasized the importance of drowning and injury and the chapters concerning associated hazards in Volumes 2, 3 and 4. Surveillance procedures for accidents and injuries both in pools and in the natural environment including drowning, near drowning and diving-related injuries were generally poor. As a result critical analysis of the importance of hazards and of contributory factors was hindered. It recommended that a small group of experts in this field be identified to assist in the further development/finalization of these sections.

The meeting noted the emphasis that had occurred in recent years upon direct measurement of faecal indicator organisms to assess water quality and the limitation of this approach in isolation of other sources of information, especially if regulatory compliance were applied as the sole management strategy. Greater emphasis upon predictive potential, on the full diversity of information sources and on the full diversity of management uses of the information was required throughout the guidelines. This theme would merit an expert consultation were resources to become available.

5. Working Group 1: Health risks arising from recreational use of marine and freshwater environments

**General**

It was recommended that, as far as possible, each chapter of the health risk assessment should proceed through the following sections:

- Public health basis
- Epidemiological basis
- Management actions
- Guideline derivation
- Monitoring and assessment.

The meeting reviewed the materials submitted alongside recommendations of the earlier meeting at Bad Elster and made the following recommendations regarding finalization.

**Chapter 1: Introduction**

The meeting reviewed the draft chapter, endorsed its conclusions and general approach and recommended its finalization taking account of reviewers comments and the following:

- exclusion of motion sickness, decompression sickness and other phenomena restricted to sub-aqua and deep sea diving;
- therapeutic uses of water (thalassotherapy, spas) and benefit for wellbeing should be noted; and
- comment that recreational use of even a “clean” environment may have an adverse health impact should be included and that several causes of minor discomfort (such as irritation) were recognized.

Section 1.3: Application of the Guidelines should be added and cover:
1.3.1. General principles – social, economic and environmental context as well as health.

1.3.2. Participants and players – material from the background paper on “Safe Recreational Waters: Context” concerning stakeholders etc. should be expanded and included here.

1.3.3. Management actions – This section should also introduce types of management action which would then be built upon in later chapters. These should include policy frameworks; public awareness and improved personal choice; monitoring and enforcement; actions by public health authorities; and remedial actions. In preparing this some material might be transferred from Chapter 2. These should be “revisited” in Chapter 14.

It was agreed that the chapter should balance the hazards related to recreational water activities with the positive mental health aspects associated with bathing and beach aesthetic issues.

Chapter 2: Hazards and risks associated with specific recreational activities

The meeting reviewed the chapter and endorsed its finalization and inclusion, taking into account reviewers comments and harmonizing earlier sections with Chapter 1. Material on exposure assessment presently in Chapter 9 (chemical and physical agents) should be moved here. The meeting recommended detailed changes to the tables and agreed upon the modified tables in plenary discussion.

The contributors responsible for this chapter should liaise closely with those for Chapter 5 of Volume 3 and Chapter 10 (new Chapter 9) of Volume 2 to ensure consistency in approach and content.

Chapter 3: Microbiological hazards and risks

The meeting reviewed the draft chapter, noting recommendations of the previous meeting at Bad Elster and the process of its development since then. After considerable discussion participants agreed that the structure and substance of the chapter should be as follows:

3.1 Public health basis for guidelines should include introduction to causal relation and theoretical context.

3.2 Epidemiological Evidence should incorporate section 3.1 as revised by participants and Section 3.2, less Table 6, which should either be removed or be revised since it does not include all relevant pathogens.

It should be noted that the studies reviewed could not demonstrate “specificity of association”, according to Bradford Hill. It would be preferable to modify the statement to indicate that “studies suggest that there is a causal relationship between gastrointestinal symptoms and recreational water quality, as measured by indicator bacteria concentrations.

A summary of various relevant disease outbreak reports (which will be described in more detail in Volume 5) and an explanation of why these reports are not useful for the evaluation of evidence should be included.

The terms “relative risk” and “analysis of bias” should be explained, either in this section or in a glossary. The possible effects of bias should be discussed in more detail.

Additional public-available epidemiological studies should be considered for evaluation: Dewailly, E. et al., 1986; Kuch, C.S.W., 1995; Fleisher, J.M., 1996; and van Asperen, et al., 1996. All studies should be subjected to the same exclusion criteria as previously applied.
The section should also include a discussion of staphylococci and non-faecally contaminated waters.

3.3 Strategies and Activities in Risk Management should address informed personal choice, public health advisories, pollution abatement and regulatory compliance (as introduced in Chapter 1) and as an introduction to guidelines derivation.

3.4 Derivation of Guideline Value with a discussion of the limitations of the approach to allow users of the chapter to account for, for example, regional variations in analytical methods, bathing season and acceptable risk and providing sufficient information to enable others to derive values for specific circumstances which may require consideration of economic aspects, of the cost-effectiveness of different intervention and the public health importance of different hazards (as discussed in Chapter 1). This subsection should also indicate that as additional information becomes available the selection of indicator and derivation of Guide Values (GLVs) will require review and possibly revision.

3.5 Monitoring and assessment with a discussion of possible compliance systems, i.e. geometric mean, 95 percentile, 95%, maximum admissible concentration, etc. and their selection and sampling regimes. This section will require cross-referencing and harmonization with 6.6).

With regard to Guideline derivation, the meeting reached unanimous agreement upon the approach to be taken for guideline value derivation (with one observer registering dissent) and regarding a structured series of reference values related to alternative management interventions (with two observers suggesting the values were too risk-averse). The values and their relationship to management actions are summarized in Annex 4.

It was recommended that the term “threshold” should be replaced with “lowest-observed-adverse-effect-level” (LOAEL).

The meeting recommended that the revised chapter, having taken into account comments of reviewers, be circulated for comment to a small expert group, amended accordingly and then be considered concluded.

Chapter 4: Microbiological aspects of beach sand quality (old Chapter 5)

Chapter 4 was to have included microbiological reviews for the organisms of actual or potential importance in coastal and freshwaters. The group recommended that this be merged with similar material for swimming pools, spas and similar recreational water environments to form Volume 5 (see section 6).

The meeting reviewed the draft of this chapter, endorsed its inclusion and recommended its finalization taking account of reviewers comments and the following:

- The introductory section should introduce the public health basis for concern.
- There is to date no evidence for significant microbiological health risk from casual contact with beach sand and therefore no evidence to support a guideline value for indicator organisms on beach sand.
- Routine monitoring of beach sand for indicator organisms is not justified.
- Available beach management strategies for dealing with beach pollution including faecal contamination by animals should be briefly described and their impact summarized.
• It should be noted that “beaches” include riverside areas which may be affected by flooding and that these present special characteristics of contamination, health risk and remediation.

• Densely-used areas provide possibilities for person-to-person transmission which may therefore occur at beaches (e.g. dermatophytes) although this hazard was not specifically related to beach materials such as sand.

On completion of these changes and addressing peer review comment the chapter should be considered concluded. The section concerning information in “Bacteria indicators of faecal pollution” and “pathogenic micro-organisms isolated in wet beach sand” (sic) should be incorporated in volume 5.

Chapter 5: Algae and cyanobacteria in coastal and estuarine waters (old Chapter 6)

The participants reviewed the draft of this chapter and recommended that it be revised to address the following comments:

• The chapter should focus on ingestion and inhalation of water. Consumption of cyanobacteria-containing shellfish should be briefly mentioned in the introduction, but not further discussed.

• Cyanobacteria sections in Chapter 5 should be harmonized with Chapter 6; the use of a procedural guideline and practical monitoring schemes similar to that developed for fresh water cyanobacteria should be investigated.

• Title of chapter should reflect the fact that it also deals with marine cyanobacteria (“Algae and Cyanobacteria in Coastal and Estuarine Waters”).

• The importance/relevance of scums should be discussed.

• References to established programmes/standards should be omitted.

• This chapter should be restructured to conform to the general structure described in “general recommendations”.

• In discussing management options three principal areas should be discussed: (i) eutrophication may increase bloom formation and therefore nutrient enrichment was relevant, whilst recognizing that blooms were natural phenomena; (ii) in areas/countries where problems may occur general awareness-raising would be merited; and (iii) wherever bloom formation potential existed, public health/competent authorities should be mindful of this and prepared to make advisory action wherever appropriate.

The meeting further recommended that the revised chapter, having addressed further peer review comment, be circulated to a small expert group and be considered finalized following incorporation of their comments.

Chapter 6: Freshwater algae and cyanobacteria (old Chapter 7)

The participants reviewed the draft of this chapter, endorsed its general conclusion and recommended that the following points be considered alongside reviewers comments in finalization:

• Total phosphate concentrations in Table 5 should read below 0.01–0.02 mg/L; chlorophyll-\(a\) concentrations should read below 0.01 mg/L for all lakes.

• The title of the chapter should be “Freshwater algae and Cyanobacteria”.

• There was no need to present and describe prevailing approaches in specific countries.
• Tables 5 and 6 should be combined to make it easier to link control measures with the presence of cyanobacteria. A reference to “visual inspection” should be provided.
• It should be clearly expressed that a procedural guideline rather than a guideline value is presented. This procedural guideline consists of Table 5 and 6 and where desirable step 3 on page 22. The introduction should reflect this distinction.
• The first sentence on page 3 is incorrect.
• Replace “National Rivers Authority” on page 13 with “Turner, et al.”.
• In the conclusions on page 14 “one case” of human illness should be replaced with “one outbreak”.
• Reference should be included to any published “negative” studies.
• The chapter requires editing. For example many of the “boxes” could be deleted as could much of the historic development.

The meeting recommended that the revised chapter be circulated to a small expert group and be considered finalized following incorporation of their comments.

Chapter 7: Poisonous and venomous organisms (old Chapter 8)
It was agreed that this chapter was important and should be included, but required restructuring for clarity and completeness.
• The introduction requires a brief explanation of the contents of the chapter and public health importance of the theme.
• Information on avoidance of poisonous and venomous organisms should be included.
• Diagnosis and therapy discussions for jellyfish and other organisms should be removed, but general framework for risk management (role of awareness, warning, hospitals, etc.) included.
• Attacks by marine animals should also include seals and sharks. This will require a change to the title of the chapter. Issues related to conger, moray and electric eels should be included as should corals.

Upon completion of the restructuring and addressing the above points and any review comment received, it should be separately circulated for peer review.

Chapter 8: Chemical and physical agents (old Chapter 9)
The review of the draft of this chapter highlighted its importance, noting that it would most commonly serve to allay fears regarding recreational exposures to chemical pollutants. The recommendations of the previous meeting in Bad Elster had been similar and were endorsed by the meeting.

The chapter should be finalized, taking into account peer review comment and the following:
• The introductory section should clearly indicate that problems of this type do occur but are rare.
• No guideline values per se should be recommended, since hazards are likely to be highly local in character.

• In assessing local problems, initial screening for risks associated with ingestion may be undertaken by use of the WHO Guidelines for Drinking-water Quality (GDWQ), applying a correction factor. Whilst the GDWQ are not, generally, based upon short term exposures, in assessing the risk associated with occasional use of recreational waters, public health authorities could normally use a reference value of 100 times the WHO GDWQ Guideline value for initial screening assessment of recreational water pollution with chemicals with health effects arising from long term exposure. It should be emphasized that the exceedence of such a reference value does not necessarily imply a risk, but rather that public health authorities should evaluate the situation.

• Reference should be made to dermal exposures (e.g. Moody and Chu, 1995).

• A short introduction and a table of WHO GDWQ Guidelines values for substances of potential interest in recreational water with the (100x) reference value should replace narrative on inorganic and organic contaminants unless specifically justifiable.

• Material on exposure assessment should be moved to Chapter 2.

• There was no need to include material presenting and discussing prevailing standards in individual countries.

• Material concerning aesthetic aspects should be transferred to the appropriate chapter, i.e. dissolved oxygen should be addressed in Chapter 7.

• In light of public concern a short section addressing pollution with radio isotopes and organotins should be added and specifically radon in caves for divers.

Upon completion of the above the chapter should be considered concluded.

Chapter 9: Beach Safety: accidents and physical hazards (old Chapter 10)

It was agreed that this chapter should be returned to expert reviewers for more guidance on structure and content. The format of the chapter should be revised to emphasize the significance of drowning and spinal injury. It was suggested that the following format would best illustrate their importance:

1. a brief review of health risks broken-down into: drowning and near drowning, spinal injury; and lesions;

2. a description and review of the effectiveness of the various available risk management options;

3. a rationalization of why guideline values are not required for this section;

4. a section on monitoring and assessment of available risk management options.

Discussion on hypothermia should be transferred to Chapter 10 (old Chapter 11). Some material on clarity and colour should be integrated from Chapter 11 (old Chapter 12). Turbidity as a drowning/diving injury-related hazard should be addressed (presently in Chapter 11) while noting that it is common and may be naturally-occurring. Discussion of legal aspects should be moved to Chapter 12.

The title of the chapter omitted significant physical hazards associated with freshwater bathing sites as well as coastal beaches such as river bores, underwater entanglement, canal locks and
weirs; collision with piers; sudden weather changes. Issues which increase the severity of health outcomes (cardiac arrest, cramps) should be mentioned.

There was considerable discussion on the section dealing with medical wastes. It was agreed that this information should be presented, but recognized that the problem was of less significance than drowning and spinal injury and this should be reflected in the presentation of the chapter.

The contributors responsible for this chapter should liaise closely with those for Chapter 2 of Volume 2 and Chapter 5 of Volume 3 to ensure consistency in approach and content.

**Chapter 10: Sun, heat and cold (old Chapter 11)**

The participants accepted the general structure of the chapter and recommended its inclusion and the following actions:

- editing to reduce length and restructuring for clarity;
- diagnosis and treatment actions should be removed;
- discussion of hypothermia should be transferred from Chapter 10 (new Chapter 9) to here;
- check for any additional points in the WHO/UNEP book on climate change and incorporate them as appropriate. This book should be referenced in the chapter;
- to reconfirm harmonization with the Environmental Health Criteria Document on UV radiation;
- Seek expert review from appropriate individuals.

**Chapter 11: Wellbeing and aesthetic aspects (old Chapter 12)**

Participants generally agreed on the content of the chapter. The following recommendations were made:

- Country specific approaches with respect to aesthetic criteria should be removed.
- Turbidity should be discussed only as it relates to sensual revulsion. Turbidity and health hazards should be addressed in Chapter 9 (old Chapter 10).
- The chapter should emphasize and outline the positive mental health aspects associated with bathing and beach aesthetic issues and their management.
- No guidelines should be derived since there is no health basis for their derivation.
- Material related to accidents (such as transparency of water) should be moved to Chapter 9 (old Chapter 10).
- Material concerning monitoring and assessment should be moved to the corresponding volume and careful consideration given to their harmonization.
- Mention should be made of nuisance organisms such as biting insects and aquatic plants.
- Editing down, eliminating for example historical review.

The material should be restructured as follows:
11.1. link between aesthetic parameters and health and wellbeing;
11.2. description of aesthetic parameters;
11.3. management options (to include mechanical cleaning of beaches, education against littering; solid waste management; economic effects of unattractive beaches; beach classification; voluntary activities);

11.4. rationale for no guideline values/conditions;

11.5. cross-reference monitoring to Monitoring and Assessment volume.

**Chapter 12: Management options for healthy recreational water use (old Chapter 14)**

Participants discussed the content of proposed Chapter 14 and background paper. They recommended that the chapter be prepared utilizing the background paper and bringing together the various strands of risk management discussed in individual chapters. The proposed title for the chapter would be “Management Options for Healthy Recreational Water Use” and structured as follows:

12.1. organizational framework, emphasizing intersectorality, Integrated Coastal Zone Management (ICZM) and referring back to Chapter 1;

12.2. policy frameworks with cross-referencing to the monitoring volume;

12.3. public awareness and improved personal choice;

12.4. monitoring, enforcement and standards;

12.5. remedial actions;

12.6. urgent and emergency actions.

The chapter should include award schemes and their problems of international comparability; and emphasize all type of hazard as well as the need for predictive capacity.

**6. Working Group 2: Microbiology review document**

At previous meetings in Bad Elster and Ann Arbor it had been proposed that Microbiology Review Documents (MRDs) be incorporated into Volumes 2 and 4 of the GSRWE. Review of draft materials indicated that this would be voluminous and result in extensive duplication. Participants recommended the inclusion of MRDs covering both aspects (health-risk and monitoring) in a separate volume (Volume 5), the scope of which would cover: coastal waters, fresh waters, swimming pools; beach sand and pool/spa facilities.

A series of source documents concerned with viruses, protozoa and fungi were tabled and discussed. It was agreed that Volume 5 should comprise principally a series of review documents, each addressing a single pathogen or indicator/index organism. Participants discussed the content of the MRDs and agreed that in finalizing the review of each organism should follow the format described in Annex 5.

For each MRD, the lead person would combine the information available from the source documents and from the draft chapter on microbiological aspects of beach quality, keeping each section generally short, if necessary, by effective use of references. It was noted that for some of these organisms, such as *Giardia* and *Cryptosporidium*, analytical methods were developing rapidly and more up-to-date references were required.
The source documents are largely related to epidemiology of swimming pools and in combining the documents, the lead persons were asked to include all recreation-related evidence of exposure and disease.

The group recognized that many of the organisms reviewed, although of potential significance to health, did not meet the group’s “credible evidence” criteria related to reasonable concern. These criteria were:

- organism of known public health relevance
- credible evidence of relevant outbreaks/disease incidence
- expression of interest or concern.

Although all organisms mentioned in the source papers should be listed in the guidelines, only the following require full MRDs in the first instance.

<table>
<thead>
<tr>
<th>Table 2. Microorganisms requiring review for Volume 5 of the Guidelines for safe recreational water environments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organism</strong></td>
</tr>
<tr>
<td>Viruses</td>
</tr>
<tr>
<td>Adenoviruses</td>
</tr>
<tr>
<td>Hepatitis A</td>
</tr>
<tr>
<td>Norwalk</td>
</tr>
<tr>
<td>Polio virus</td>
</tr>
<tr>
<td>Rotavirus</td>
</tr>
<tr>
<td>Papillomavirus</td>
</tr>
<tr>
<td>Molluscum contagiosum</td>
</tr>
<tr>
<td>Parasites</td>
</tr>
<tr>
<td>Giardia</td>
</tr>
<tr>
<td>Cryptosporidium amoebae</td>
</tr>
<tr>
<td>(e.g. Naegleria, Acanthamoeba)</td>
</tr>
<tr>
<td>Trichomonas</td>
</tr>
<tr>
<td>Schistosoma</td>
</tr>
<tr>
<td>Swimmers itch</td>
</tr>
<tr>
<td>Fungi</td>
</tr>
<tr>
<td>Brief mention cover</td>
</tr>
<tr>
<td>Significance of surfaces</td>
</tr>
<tr>
<td>Mention athletes foot</td>
</tr>
<tr>
<td>Bacteria</td>
</tr>
<tr>
<td>E. coli 0157</td>
</tr>
<tr>
<td>Shigella</td>
</tr>
<tr>
<td>Chlamydia</td>
</tr>
<tr>
<td>Staphylococcus</td>
</tr>
<tr>
<td>Legionella</td>
</tr>
<tr>
<td>Mycobacterium</td>
</tr>
<tr>
<td>Leptospira</td>
</tr>
<tr>
<td>Pseudomonas</td>
</tr>
<tr>
<td>Aeromonas/Vibrio</td>
</tr>
<tr>
<td>Indicator organisms</td>
</tr>
<tr>
<td>Total coliform organisms</td>
</tr>
<tr>
<td>Faecal coliform organisms</td>
</tr>
<tr>
<td>E. coli</td>
</tr>
<tr>
<td>Faecal streptococci/enterococci</td>
</tr>
<tr>
<td>Sulphite/reducing bacteria</td>
</tr>
<tr>
<td>Viable counts at 22°C and 37°C</td>
</tr>
<tr>
<td>Staphylococci</td>
</tr>
<tr>
<td>Ps aeruginosa</td>
</tr>
<tr>
<td>Phages</td>
</tr>
</tbody>
</table>
The draft content list for Volume 5 was discussed and agreed as in Annex 5. The combined document should be sent for peer review. Each of the expert authors was asked to identify potential members of the peer review panel.

7. Working Group 3: Monitoring and assessment of coastal and freshwater recreational areas

The structure of Volume 3 as proposed at the Bad Elster meeting was outlined and the first draft contents of each chapter were tabled and discussed.

General

There was extensive discussion regarding the structure and purpose of this Volume of the Guidelines. The following general conclusions were reached:

- The manual should be a “stand alone” document – authorities should be able to undertake monitoring programmes based on this. It was agreed that it was appropriate for protocols to be included. ISO standards should be considered as the most appropriate but others should also be included.
- Codes of good practice should be included in the form of check lists for each chapter.
- The manual should be concluded with a collated code of good practice.
- There should be consistency and continuity between chapters.
- Where possible and appropriate, innovative methods should be included.
- Case studies should be included where possible.

The volume should be clearly based upon the health risk assessment of Volume 2 of the Guidelines. Each chapter addressing a specific type of hazard should include a brief introduction including the conclusion of the health risk assessment in Volume 2 of the Guidelines.

A major factor limiting the applicability of monitoring, especially for microbiological parameters, was poor inter-laboratory comparability. Whilst emphasis in the past had sometimes been placed upon method and media standardization, the meeting recommended that emphasis be given to inter-laboratory comparison and performance testing.

Levels of monitoring

The manual should describe successive levels of monitoring to accommodate areas with low, intermediate and high organizational, technology and human resource capacities. The levels were identified as presented in Table 3. The establishment of monitoring programmes should be discussed in the context of each of the levels described above and each chapter should include scenarios for each level.

It was recommended that monitoring of hazards, such as drowning, should be considered in priority over microbiological monitoring as such methods are low cost and achievable at each level. The baseline parameters and a hierarchy of recommended methods should be identified early in the manual.
Chapter 1: Introduction
Participants recommended that this chapter be prepared based upon the model provided by other volumes of the Guidelines and in particular the introduction to Volume 2, once revised in line with the recommendations of the corresponding working group.

Chapter 2: Public and environmental health considerations
Participants recommended that this chapter be prepared on completion of Volume 2 and should largely comprise a summary of that volume. It should also introduce the importance of monitoring for management and thereby introduce Chapter 13: Beach Management Criteria and 14: Public Information.
Table 3. Example levels of monitoring competence related to resource requirements

<table>
<thead>
<tr>
<th>Level</th>
<th>Basic information/visit rate</th>
<th>Accident hazards</th>
<th>Microbiological parameters</th>
<th>Algae</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>0. No national organization yet</td>
<td>Local action comparable to level 1 in some locations only</td>
<td>Visual inspection of hazards and availability of basic facilities</td>
<td>Visual inspection for “sewage indicators” (Sanitary Inspection) Faecal streptococci/E. coli for most used beaches</td>
<td>Scum scouting, Secchi disk depth</td>
<td>Register of local special problems</td>
</tr>
<tr>
<td>I. No access to equipment or staff resources at national level, limited local resources</td>
<td>1 visit per year for most beaches, few pilot studies</td>
<td>Faecal streptococci (marine) or E. coli (freshwater)</td>
<td>Phosphate analysis (freshwater), Chorophyll a (freshwater)</td>
<td>Check on local information availability, active warning and response capacity</td>
<td></td>
</tr>
</tbody>
</table>

II. (include 0 and I): limited access to resources at both local and national level

<table>
<thead>
<tr>
<th></th>
<th>Categorization of use and strategy for implementation</th>
<th>Visual inspection of abatements (signing, cleaning, equipment, etc.)</th>
<th>Faecal streptococci (marine) or E. coli (freshwater)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>10–20 samples per year Initial “hot spots” survey/basic hydrology Most beaches – inter-lab comparisons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. (include 0, I and II). No significant resource limitations</td>
<td>20 visits/season most beaches Multiple sites most beaches</td>
<td>Faecal streptococci and E. coli 20 per year or more</td>
<td>Toxicity detection and toxin analysis capacity (not routine) Remote sensing methods</td>
<td>Chemical monitoring (initial investigation, routine as necessary)</td>
<td></td>
</tr>
</tbody>
</table>

Chapter 3: Programme design

The draft chapter was based upon the Black Sea Guidelines and required substantial rewriting to adapt it to the criteria agreed for levels of monitoring, for all types of water recreation, and for types of study. The following word changes were also recommended to reflect the broadened scope:

Bathing – to become “water recreation”
Beach – to become “area”
Monitoring programme – to become “study”
Register – to become “assessment”.

A contents framework was agreed, together with key components to be included as follows.

3.1. Definition of recreational waters
“An area where significant water recreation occurs or may be encouraged in the future”. Examples of water recreation should be given in a worldwide context.
3.2. Underlying concepts
   3.2.1 Purpose – why?, terms of reference
   3.2.2 Justification – who needs the information, how it will be used
   3.2.3 Important to establish the time schedule. The need drives the timing
   3.2.4 Nature of the study – such as initial assessment, compliance, beach classification, planning consents, epidemiology, scientific, serial warning of hazards.

3.3. Types of study; monitoring and assessment as a managerial tool
Illustrated by a diagram of responsibilities (initiator-manager/team leader-consulting advisors with local knowledge implementers team reporters to initiator). This structure should generate a strategic and operational plan.

This section should briefly describe the different types of study/assessment in relation to their objectives (one-off study; compliance monitoring; beach classification; for facility planning; epidemiological and other scientific studies; for special warnings such as adverse weather/sharks).

3.4. Design of the study
   3.4.1 Statement of objectives
   3.4.2 Statement of the study programme necessary to achieve the objectives
   3.4.3 Statement of resources (for fieldwork, analytical resources, site surveys)
   3.4.4 Pilot studies and progressive implementation.

3.5. Key point code of good practice
The chapter should bear in mind the following:
   • The prime object is to protect health.
   • Openness of reporting is highly desirable to encourage real interest and cooperation.
   • Studies will evolve from initial assessments, as needs grow.
   • Examples should be placed in an Annex at the end of the volume.

Chapter 4: Programme implementation
This chapter was based upon the Black Sea and, in its present state it was felt to be too specific and in need of broadening in scope to consider the levels of resources, all forms of water recreation and all types of study. Particular points to be covered were:
   • time scale for planning, execution, reporting, negotiation;
   • laboratory: staffing, days and hours of work, needs (materials, equipment);
   • the planning should adopt the principles of Hazard Assessment – Critical Control Path (HACCP), by noting what features at each stage of planning and execution is likely to cause a problem and what is the best way of overcoming it.

The chapter should conclude with a key point code of good practice.

Chapter 5: Visual inspection and investigation of hazards
No draft had been produced of this chapter to date. The contributors responsible for this chapter should liaise closely with those for Chapter 2 of Volume 2 and Chapter 10 (new Chapter 9) of Volume 2 to ensure consistency in approach and content. It was agreed that the chapter content as originally planned required modification and it was suggested that it was split into sections covering the following:

5.1. Identification and monitoring of physical hazards
Cross-referenced to Volume 2

(1) Identification of potential hazards
   (a) Hazards relating to drowning
   (b) Spinal injury hazards
   (c) Cuts and lesions.

(2) Local Action
   (a) Inspection of existing abatement schemes
   (b) Identification of areas where additional schemes could be implemented.

5.2. Pollution/sanitary inspection
This section should emphasize the importance of conducting a desk study to identify priorities followed by field investigation. The chapter should cover the identification of potential polluting points such as inflows, farming/agriculture, aquaculture. Seasonal differences in pollution loadings should also be addressed. It was agreed that a check list and questionnaire which could be adapted to local situations should be developed initially from the Coastwatch Europe questionnaire and Black Sea manual to identify problem areas. A short section on questionnaire design should be included.

The analytical programme was considered to be adequately covered by other chapters in the manual and did not need to be repeated here.

5.3. Implementation of inspection programmes
The section should identify: who does the monitoring, resource demand, training systems, standardization.

5.4. Interpretation of results

5.5. Key point code of good practice

Chapter 6: Water quality sampling and analysis: microbiological aspects
The draft of this chapter had been prepared taking into account previous documentation. It was felt to be largely acceptable but should be amended to include:


6.2. A section on field analysis – data handling and reporting.

6.3. Sampling procedures, including selection of sampling site, at all three resource levels; procedures (at any level); size of sample; frequency of sampling, including a special reference for cholera; and storage of samples (maximum 8 hours).

6.4. Analytical methods. Should include: a figure summarizing the Most Probable Number (MPN) and membrane filtration (MF) methodologies; protocols for analysis of faecal streptococci and E. coli; and table of different media with advantages and disadvantages, including ISO and APHA standards with comments.

6.5. Quality Control – cross-link to Chapter 10.

6.6. Interpretation of results – MPN method, MF method, the implications of using 95%, geometric means and 95% percentile in reporting of results (this section will require cross-reference and harmonization with 3.5).

6.7. Key point code of good practice.
Chapter 7: Monitoring: aesthetic aspects

This chapter was considered to be largely acceptable in its present form. It was felt however, that it was too restricted by including the term “beach” in the title and this could be changed. Additions to this chapter should include:

- introduction cross-referencing Volume 2;
- a distinction between items which are considered hazardous due to public perception and those which are actual indicators of pollution;
- what triggers visual annoyance in various countries and the level of tolerance;
- descriptions of mechanical beach cleaning methods, including advantages and disadvantages;
- costs of beach cleaning related to GNP;
- litter survey techniques – more emphasis should be put on human health and tourism as reasons for conducting such surveys;
- timing of litter surveys;
- use of data collected by beach surveys;
- the identification of litter problems are often reported by the general public: the chapter should emphasize the encouragement of public citizens in vigilance and public participation schemes;
- key point code of good practice.

Chapter 8: Water quality monitoring: freshwater and marine algae

Meeting participants reviewed the draft material presented to the meeting and in light of the deliberations of Working Group 1. It was agreed that the chapter should be further developed in light of the recommendations of Working Group 1 concerning Chapters 5 and 6 of Volume 2.

This chapter should include:

8.1. A short introduction cross referencing with Volume 2 including:

   (a) A definition of risk locations.
   (b) Emphasis that no routine monitoring is required for risk-free zones unless a problem is predicted or detected.
   (c) In order to recognize the problem, visual inspection should be undertaken.

8.2. Visual Inspection:

   (a) Introduction taking into account the various levels of resource availability.
   (b) Visual inspection criteria with deducing actions at three levels.

8.3. Sampling – should be considered at three levels and the chapter should include the following:

   (a) Objectives of surveillance – 3 levels: Secchi disk; Chlorophyll-\(a\); Phosphorus.
   (b) Analytical methods and protocols.
   (c) Data handling reporting with interpretation.
   (d) Limnological and oceanographic characterization for interpretation.

8.4. Interpretation of results

8.5. Key point code of good practice
Chapter 9: Water quality monitoring: physicochemical aspects

The draft material for this chapter was based upon the Black Sea Manual for Recreational Water and Beach Quality Monitoring and Assessment. Meeting participants reviewed the draft material. It was recommended that the chapter be further developed in light of the recommendations of Working Group 1 concerning Chapter 8 of Volume 2.

Additions to this chapter were identified:
- Introduction to be cross-referenced to Volume 2, Chapter 9.
- The chapter should be linked to the resource levels identified. At levels 0, I and II the parameters should be linked to health and safety which could be identified by sanitary inspection to a direct source of pollution. At level III all parameters should be considered as appropriate.
- Field analyses – applied to levels 1 and 2. To include visual inspection, sampling procedures, field analytical protocols – turbidity, pH.
- Laboratory analysis to be applied to level 3.
- Analytical procedures – largely covered in other chapters but should be referenced.
- Data handling and interpretation.
- Reference to assessment procedure introduced in Volume 2; inclusion of a table of guideline values and reference values.
- Key point code of good practice.

Chapter 10: Analytical quality control

No material on this chapter was submitted to the meeting although a draft was in preparation. Participants endorsed inclusion of coverage of this topic as a separate chapter, emphasizing the importance of microbiological aspects field analysis and quality control of inspections. Material published previously in “Water Quality Monitoring” might provide some guidance.

Chapter 11: Epidemiological surveys

No material on this chapter was submitted to the meeting.

Chapter 12: Programme data processing, management and storage

Meeting participants reviewed the draft material presented to the meeting. It was considered to be well balanced and comprehensive and it was recommended that the chapter be further developed taking into account the following:
(a) Expand to cover recreational waters more generally.
(b) Collection of data should be restricted to that needed to meet the objectives of the study, unless additional data would not alter the total cost significantly.
(c) Discuss rejection of values which cannot be accepted as correct (data quality control checks).
(d) Extend statistical treatment to include analysis of temporal trends and quality control charts.
(e) Describe how a personal computer routine could be used to generate basic statistics and quantiles.
(f) Key point code of good practice.

Chapter 13 and 14: Public information strategies
Meeting participants recommended that careful consideration be given to the harmonization of these chapters with chapter 12 of Volume 1. The overall coverage should include: management framework; resort/beach management; coastal management concerns; role of municipalities; beach registration data; socio-economic issues; public information and education; legislative context; statutory obligations; beach award schemes; official public information schemes; role of voluntary bodies; illustrative awareness schemes.

Chapter 15: Code of good practice for monitoring and assessment
This chapter is to be prepared upon conclusion of preceding sections.

8. Working Group 4: Planning for dissemination and implementation
Dr Maurizio Cavalieri briefly introduced the initiative to be supported by ACEA (the Rome Energy & Environment Authority) and sought feedback on its objectives, output and method.

Participants recommended:

- that an initiative supportive of implementation of the GSRWE at local level be considered a priority;
- that the principal output of the initiative be a book addressing good practice at local level;
- that the above be supported by the continued publication of the newsletter “Current Waves” and equivalents in other languages;
- that the principal means to support the development of guidance on good local practice be the establishment of a network of local actors from diverse environments worldwide;
- that in order for the network to be valid, its functions should include recovery of case study experience for analysis and dissemination; and promotion of “twinning arrangements” and decentralized cooperation.

9. Working Group 5: Swimming pools, spas and similar recreational water environments

General
At the Ann Arbor consultation it had been recommended not to cover therapy pools. Documentation had become available which revealed considerable information on the design and operation of such pools and the differences between therapy and conventional pools. There was a lack of a uniform approach to the design and operation of such pools. Many of the concerns addressed in the guidelines also related to therapy pools, especially regarding microbiological factors and related design and operational issues. However there was concern about embracing therapy pools within this exercise. Despite their being health-related issues relating to these non-recreational uses, it was recommended to exclude therapeutic uses from the scope of the Guidelines but there would be reference to their existence and the relevance of specific parts of the Guidelines to therapy pools.
The group recommended that the Guideline document should be provided with a summary at the front (not as part of Chapter 8 as proposed at the meeting in Ann Arbor), possibly as a free-standing executive summary or integrated into the “introduction”.

Participants recommended that a full draft of the volume be prepared in light of the comments received and be circulated for peer review.

Chapter 1: Introduction
The draft preface and introduction were reviewed and generally endorsed. A table of use types versus hazards should be added as should a description of the actors concerned.

A classification of principal types of pools – which should also note therapy pools – should be included. The characterization should reflect broad ranges related to public health hazard, e.g.: paddling pools; indoor swimming pools, open air swimming pools; sophisticated pools (flumes, adjustable bottoms, amusement parks); unfiltered pools; medical/therapeutic/pools; and spas and hot tubs.

The chapter should also describe different types of organization: fully public, semi-public (such as hotels, clubs, schools and apartment complexes) and domestic/private as well as types of use (non-contact; contact without head immersion, head immersion).

The section on exclusions should exclude heat/cold effects including those in saunas, hot tubs and plunge pools and treatment of injured/rescued persons.

The introduction should include a section on their progressive application as some improvement over current arrangements might yield benefits despite falling short of the full Guideline requirements.

Chapter 2: Accidents
The overall structure of this chapter as proposed at Ann Arbor was endorsed and available background material reviewed. Based upon the resulting discussion the following recommendations were made for finalization.

- The overall purpose of this chapter should be to succinctly describe the known association of specific hazards and contributory factors with adverse health outcome.
- Heat/cold aspects should be noted but not be fully addressed.
- Rather than provide a long list of hazards and abatements, the section should be structured so that the most serious risks were highlighted and the readers attention focused on them. No significant risk was to be excluded in this treatment.
- The background material provided for this section was extensive and considerable scope for editing and “tightening” of the text existed.

Issues noted as important in the further development of Chapter 2 included:

2.1. Introduction
This should introduce the accident chain and include general education, awareness-raising and skill acquisition, especially through schools and clubs.

2.2. Scale and nature of health effects
As discussed at Ann Arbor but omitting brain damage and fetal damage associated with extreme heat.
Should refer to disinfectant gas poisoning and conclude with a table relating health effects with risk factors.

2.3. User Factors
As discussed at Ann Arbor, expanding “effects of alcohol” to “effects of alcohol, drugs and medication”; adding “medical preconditions including epilepsy”. For both of these areas, self awareness (i.e. education of affected groups); specific warnings on arrival at the facility; and awareness of supervisors were considered important. For alcohol, general awareness-raising, facility supervision and exclusion of access were seen as key measures. This section should also address acquisition of swimming and life saving skills as a preventive measure for instance supported by specific policy for school children, need for increased supervision of “learner” sessions.

The issue of signing, including use of pictographs/text, signing on entry, near hazard and removal of glasses by recreators should be discussed as a major contributory factor.

2.4. Facility Factors
Visibility should include lighting and “blind spots”. Some note should be made of hazards associated with covers and access to out-of-use-pools.

Availability of rescue and resuscitation instructions and equipment, emergency telephones. A subsection should address issues of segregation/separation (e.g. swim/diving; non-swim/swim; walls between toddler/adult areas; canoeing and unusual user groups; lane width and bather density).

In the section addressing diving boards and blocks, problems associated with inexperienced use of high boards as well as slip/fall hazard from blocks and falling from stairs/ladders should be included.

2.5. Staffing and supervisory factors
This new subsection should be added. It should note the importance of both formal and informal (bather-bather) supervision. Formal supervision should include discussion of:

- positioning, visibility and movement (static/patrolling; blind spots; bather density; lighting);
- special use/user problems (e.g. wave machines, learner sessions);
- responsiveness was considered an important theme and should include life-saving and rescue skills (staff, clubs);
- numbers (and relation to seasonality);
- continuity (including shifts, leave, breaks, cover during accident response);
- training (observation, rescue and resuscitation skills);
- positioning and movement.

Chapter 3: Microbiological aspects
It was agreed that a risk-based approach should be used and applied to microorganisms segregated by source. The sources types are faecal, non-faecal human origin (human body surfaces) and surfaces, materials or equipment on which microbes can survive or proliferate (including heating, ventilation and air conditioning systems).

It was further agreed that the review would use the following format and make use of the material being prepared for Volume 5 (summarized for each category below):
I. Risk analysis

Hazard identification/definition/description (what organism presents the hazard)
A. Case reports and epidemiological studies

Risk estimation (quantitative estimation of human exposure)
A. Concentrations
B. Host susceptibility
C. Environmental fate/survival/growth
D. Infectious dose (function of concentration and host susceptibility)
E. Likelihood of health effects.

II. Risk management options (basically using Table 4 as a guide to preparing a narrative for the particular group)

3.1 Faecal/oral route

The faecal/oral transfer of primary pathogens occurs through sewage contamination of the pool or its water supply or from (accidental) faecal releases directly into the pool by bathers (AFRs).

Swimming pools with the greatest risk associated with them are wading/paddling pools or small lakes or ponds because of the large numbers of young children using them.

Most frequently reported outbreaks are caused by:

Protozoa  Giardia (giardiasis)
          Cryptosporidium (cryptosporidiosis)
          Any others identified in Vol. 5

Bacteria  Shigella (shigellosis)
          E. coli O157:H7 (HUS)
          Leptospira (leptospirosis)
          Any others identified in Vol. 5

Viruses  Hepatitis A (hepatitis)
          Norwalk (gastroenteritis)
          Any others identified in Vol. 5.

For protozoa and viruses the infectious dose (ID) is often very low while the ID for bacteria is often low to medium. The numbers of pathogenic organisms in faeces from infected people are high. If disinfection is inadequate, or breaks down, then infectious dose becomes an important factor.

3.2 Non-faecal human origin

Organisms are shed from: hair, skin, mucous membranes, perianal area, wounds, ears, axillary region, urine, and blood.

Transmission is person to person via contaminated water in any type of pool or spa.

The most frequently reported illnesses are:

Bacteria  •  *Pseudomonas aeruginosa* (folliculitis, *otitis externa*)
          •  *Staphylococcus aureus* (impetigo, wound infections, urinary tract
infections, eye infections, otitis externa)

- Any others identified in Vol. 5

**Virus**
- Adenovirus (pharyngo-conjunctivitis)
- Any others identified in Vol. 5

*P. aeruginosa* and *S. aureus* are opportunistic pathogens and consequently high levels of inocula are required to initiate infection. Therefore the concept of infectious dose is not really appropriate for this group of organisms. Like all human enteric viruses the infectious dose for Adenovirus is very low.

### 3.3 Surface and facility associated

This section contains two subgroups of sources of pathogens:

1. **Surfaces of objects or materials in and around the pool or spa directly contaminated by infected individuals with sufficient numbers of primary pathogens to cause infection in other individuals who come in contact with the contaminated surfaces.**

2. **Those situations in which proliferation of natural aquatic organisms on a wet surface or in the water is necessary to achieve sufficient numbers of organisms to initiate infections (typically opportunistic pathogens).** This category includes surfaces, materials or equipment in and around the pool/spa on which microbes can grow (including heating, ventilation and air conditioning systems).

Outbreaks may be caused by:

**Bacteria**
- *Legionella pneumophila* (Pontiac fever)
- *Pseudomonas aeruginosa* ( folliculitis, otitis externa)
- *Mycobacterium marinum* (granuloma)

**Viruses**
- Papilloma virus (Plantar warts)
- Molluscum contagiosum virus (molluscum contagiosum)

**Fungi**
- *Trichophyton spp.* (*tinea pedis*)
- *Epidermophyton floccosum* (*tinea pedis*)

**Amoebae**
- *Naegleria fowleri* (primary amoebic meningoencephalitis)
- *Acanthamoeba* (granulomatous amoebic encephalitis)

For opportunistic pathogens the infectious dose will be high to extremely high. For protozoa and viruses the ID is often low.

### 3.4 Risk management

Analysis of each of these scenarios can identify a number of opportunities to either eliminate or minimize the risk by some form of managed intervention, such as design, treatment, monitoring, training and education as summarized in Table 4.

Additional comments for consideration under risk management

**Faecal/oral route**

Critical analysis of available information on outbreaks and risk associated factors indicated that:

- disinfection can effectively control bacteria and viruses. Outbreaks associated are usually associated with either disinfection breakdown, inadequate disinfection or absence of disinfection;
• disinfection is ineffective against protozoa. Filtration is the most important means of treatment;
• for all pathogens pool evacuation following an AFR is an important infection control measure (but absolute removal can not be guaranteed).

Non-faecal human origin

All bacteria are sensitive to chemical disinfection with viruses less so.

Surface and facility associated

Sensitivity: apart from mycobacteria and amoebae cysts which are resistant to disinfection (*Pseudomonas aeruginosa* to a lesser degree), all are sensitive to disinfection in a swimming pool where maintaining a residual is relatively straightforward. On the other hand, the design and operation of spas makes it difficult to achieve adequate residual disinfectant.

As regards to surfaces of structures (pool surroundings, changing rooms, etc.) it seems probable that the disinfectant levels which adequately control bacteria and viruses are also sufficient to control pathogenic fungi and amoeba.

### Table 4. Managerial actions to reduce risks

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Exposure route/source of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Faecal/oral</td>
</tr>
<tr>
<td>Disinfection</td>
<td>+</td>
</tr>
<tr>
<td>Cleaning</td>
<td>–</td>
</tr>
<tr>
<td>Filtration/flocculation</td>
<td>+</td>
</tr>
<tr>
<td>Hydraulics (load + circulation)</td>
<td>+</td>
</tr>
<tr>
<td>Bather hygiene (e.g. showers)</td>
<td>–</td>
</tr>
<tr>
<td>Monitoring</td>
<td>+</td>
</tr>
<tr>
<td>Maintenance (including HVAC)</td>
<td>–</td>
</tr>
<tr>
<td>Source water quality</td>
<td>–</td>
</tr>
<tr>
<td>Education</td>
<td>+</td>
</tr>
<tr>
<td>Temperature control</td>
<td>–</td>
</tr>
<tr>
<td>Emergency actions</td>
<td>+</td>
</tr>
<tr>
<td>Limit access of animals</td>
<td>+</td>
</tr>
</tbody>
</table>

– = not applicable
+ = applicable
HVAC = heating, ventilation, air-conditioning

**Chapter 4: Chemical aspects**

The purpose of this chapter is to establish what is in the pool water, estimate exposure by ingestion, dermal adsorption and/or inhalation, and then to assess the risk to health by comparison with values given in the GDWQ (*Guidelines for Drinking-water Quality*) or elsewhere. The biggest challenge is in developing the methodology for estimating exposure to chemicals through swimming pool use.

A background paper was presented on the mechanism and possible extent of volatilization of chemicals from the water of the swimming pools into the indoor air. The issue is the extent to which swimmers, employees and spectators are exposed via inhalation to chemicals. There have
been several peer-reviewed publications in this area which provide a preliminary basis for estimating such exposures, the available data dealing primarily with trihalomethanes. However, in order to extrapolate to other chemical contaminants, it is necessary to draw on parallel studies of volatilization in water treatment and natural water systems. One factor that has a substantial impact on the resulting concentrations in the indoor air is ventilation in indoor pools. Ventilation practices in various countries need to be determined to refine the predictions of these air concentrations.

Some extra data will need to be collected and analysis of the exposure data undertaken to provide dosimetry for the final risk assessment. Dosimetry should be developed with reference to a standard child, adult swimmer and competitive swimmer.

**Chapter 5: Managing safety**

The structure for Chapter 5 recommended at the Ann Arbor meeting was endorsed. This chapter should be based upon the assessment of specific hazards and contributory factors in Chapter 2 and it should outline various means available for mitigating and avoiding the safety risks identified there.

An earlier chapter identifies the links between accidents, causes and prevention and introduces a number of new factors relating to the supervision of pools – lifesaving, training, certification. Chapter 5 will have the headings of education, supervision, design, construction and facility operation. Certifications although relevant will be dealt with in a subsequent Chapter (9).

The review should include some comparative data on disinfectant performance. This should be presented in such a way that the rapid inactivation of disinfectants such as chlorine and ozone is contrasted with the slowness of others such as silver.

**Chapter 6: Managing water quality**

No water quality management guidelines can emerge until both the microbiology and chemistry aspects are resolved and brought together. Numerical Guidelines were considered unlikely but a series of best management practice recommendations could be developed.

It was agreed to standardize assumptions, for instance concerning amount of water consumed by each type of bather between chemical and microbiological risk assessments.

It was noted that the draft reflected United Kingdom practice but following revision will respond to other countries and regions. The draft should follow a logical sequence of processes, responding to specific microbiological safety and chemical issues identified by those preparing the drafts of these sections. Text concerning choosing a disinfectant would need to be amended to reflect global views on disinfection. This review should use chlorine as the point of reference, but should not be restrictive in its scope.

Applying the guidelines to different types of pool must evolve in response to the on-going discussions and the source documents circulated to the working group and relate to the classification of pools as dealt with in Chapter 1.

**Chapter 7: Other management problems**

The content of this chapter should be:
7.1. Non-disinfected (full and empty) pools
7.2. Hydrotherapy pools
7.3. Household pools.

Chapter 8: Application of guidelines

As noted under “General recommendations” the group proposed that the volume begin with a summary which would include the material previously intended for Chapter 8. This chapter would therefore be eliminated. It was also recommended that a chapter entitled “Application of the Guidelines” be inserted in its place divided as follows:

8.1. Design and construction guidelines
8.2. Guidelines for facility operation and management.

Chapter 9: Legislation, regulatory frameworks, planning, surveillance and inspection (previous Chapters 9, 10 and 11)

These Chapters were considered to all be part of a single approach to ensuring improvement which must be reinforced by public awareness/education to be fully successful. It was recommended that they be combined and have the following sections:

9.1. Legislative frameworks, actors
9.2. Roles and responsibilities
9.3. Construction standards
9.4. Planning and approval processes
9.5. Surveillance and inspection
9.6. Certification schemes
9.7. Regulatory enforcement.

A check list on inspection procedures should be included as an annex.

It was proposed that all aspects of a swimming pool operation – regulatory and voluntary – should be subject to some degree of assurance. These could range from self-certification through to some form of regulatory endorsement. Certification will need to be linked closely to training.

Chapter 10: Information, education and training

It was recommended that the training be covered alongside information and education, not as part of certification. The information/education component should be aimed at all levels in a society from planners to users.

10. Programme of work

General

The meeting recommended that upon completion each volume be made available as a draft for a limited period in order to enable further feedback to be received.

The individuals who had been assisting WHO in the roles of coordinators for the preparation of the various volumes of the Guidelines agreed to continue in this role as follows:

Volume 1 N/A
Volume 2 Dr Robin Philipp
Accidents aspects of Volumes 2, 3 and 4
The meeting recommended that a small expert group be established to assist in the development of accidents aspects in Volumes 2, 3 and 4. If possible a small meeting to review accidents aspects should be organized in early 1998 following redrafting of the corresponding sections in order to facilitate their finalization.

If resources were to become available a small meeting to address predictive aspects of microbiological risk assessment should be organized.

Volume 2: Health risks arising from recreational use of the marine and freshwater environments
The meeting considered that this volume be considered concluded once the actions described in section 5 of this report were completed. Individuals or institutions who agreed or were proposed to support this finalization are summarized below.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Revision</th>
<th>Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>Goyet, Bartram</td>
</tr>
<tr>
<td>2</td>
<td>Hazards and risks associated with specific recreational activities</td>
<td>Pike</td>
</tr>
<tr>
<td>3</td>
<td>Microbiological hazards and risks</td>
<td>Prüss, Kay, Fleisher</td>
</tr>
<tr>
<td>4</td>
<td>Microbiological aspects of beach sand quality</td>
<td>Mavridou</td>
</tr>
<tr>
<td>5</td>
<td>Algae and cyanobacteria in coastal and estuarine waters</td>
<td>Funari and ISS (Health Institute, Rome) network</td>
</tr>
<tr>
<td>6</td>
<td>Freshwater algae and cyanobacteria</td>
<td>Chorus</td>
</tr>
<tr>
<td>7</td>
<td>Poisonous and venomous organisms</td>
<td>Rowena White</td>
</tr>
<tr>
<td>8</td>
<td>Chemical and physical agents</td>
<td>Fawell</td>
</tr>
<tr>
<td>9</td>
<td>Beach safety: accidents and physical hazards</td>
<td>Mittelstaedt/Jozwiak</td>
</tr>
<tr>
<td>10</td>
<td>Sun, heat and cold</td>
<td>Philipp</td>
</tr>
<tr>
<td>11</td>
<td>Wellbeing and aesthetic aspects</td>
<td>Philipp</td>
</tr>
<tr>
<td>12</td>
<td>Management options for healthy recreational water use</td>
<td>Goyet, Bartram</td>
</tr>
</tbody>
</table>

Volume 3: Swimming pools, spas and similar recreational water environments
The meeting noted that very rapid progress had been made since the preparatory meeting at Ann Arbor, that very considerable draft material was now available and that the discussions and recommendations provided a clear basis for finalization. It recommended that the following people be requested to assist in finalization of a draft that should then be circulated for peer review.
Volume 4: Monitoring and assessment of coastal and freshwater recreational areas

Significant material was available and the discussions and recommendations detailed in section 7 provided a clear basis for finalization. Nevertheless the meeting recommended that this volume required substantial further work. It recommended that the following individuals be requested to assist in finalization of a draft that should then be circulated for peer review.

### Chapter 1: Introduction
Bartram/WHO and Rees (UK)

### Chapter 2: Public and environmental health considerations
To be prepared on completion of Volume 2

### Chapter 3: Programme design
Professor Eleftheriou (Institute of Marine Biology, Creta)

### Chapter 4: Programme implementation
Professor Eleftheriou (Institute of Marine Biology, Creta)

### Chapter 5: Visual inspection and investigation of hazards
Tomas Jozwiak (Poland)/Will Robertson (Canada)/Mittelstaedt (USA)

### Chapter 6: Water quality sampling and analysis: microbiological aspects
Maria Figueras (Spain)/Manuel Borrego (Spain)

### Chapter 7: Monitoring: aesthetic aspects
Allan Williams (UK)/Kathy Pond (Robens Institute, UK); review by Arnold

### Chapter 8: Water quality monitoring: freshwater and marine algae
Chorus (Germany)/Kadar (Hungary); review by Funari (Italy)

### Chapter 9: Water quality monitoring: physicochemical aspects
Jackson

### Chapter 10: Analytical quality control
Pedley/Briggs

### Chapter 11: Epidemiological surveys
Philipp/Kay

### Chapter 12: Programme data processing
Pike
Meeting participants recommended the overall timetable for the programme of work below:

### Guidelines for safe recreational water environments (GSRWE)

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revision of chapters of Volumes 2, 3, 4 and 5</td>
<td>June–December 1997</td>
</tr>
<tr>
<td>Specific chapter peer review</td>
<td>January–March 1998</td>
</tr>
<tr>
<td>Editing of Volumes 2, 3 and 5 to form consultation-draft</td>
<td>January–May 1998</td>
</tr>
<tr>
<td>Publication of consultation-drafts of Volumes 2, 3 and 5</td>
<td>July 1998</td>
</tr>
<tr>
<td>Review meeting on swimming pools volume (subject to resource mobilization)</td>
<td>Spring 1998</td>
</tr>
<tr>
<td>Review meeting on accidents aspects (subject to resource mobilization)</td>
<td>Spring 1998</td>
</tr>
<tr>
<td>Review meeting/s on microbiological predictive capacity and on Volume 5 (subject to resource mobilization)</td>
<td>Summer 1998</td>
</tr>
<tr>
<td>Consolidation of Code of Good Practice for monitoring and assessment</td>
<td>February 1998</td>
</tr>
<tr>
<td>Circulation of Code of Good Practice for monitoring and assessment to peer review</td>
<td>March 1998</td>
</tr>
<tr>
<td>Review meeting for monitoring and assessment volume</td>
<td>April 1998</td>
</tr>
<tr>
<td>Revision and technical finalization of monitoring and assessment volume</td>
<td>April–May 1998</td>
</tr>
<tr>
<td>Editing of monitoring and assessment volume</td>
<td>June–November 1998</td>
</tr>
<tr>
<td>Submission of monitoring and assessment volume to publisher</td>
<td>December 1998</td>
</tr>
<tr>
<td>Approval meeting for health risk assessment volumes</td>
<td>October 1999</td>
</tr>
</tbody>
</table>

### Research priorities

The meeting identified a number of high-priority areas for further research as follows:

- **Further studies to estimate the dose-response relationship between** general faecal pollution and “mild” gastrointestinal symptoms, preferably in areas diverse from northern European temperate coastal waters and undertaken using the randomized trial design were required.

- The literature on accident epidemiology, for both coastal and freshwaters and for swimming pools, spas etc., was felt to be weak in comparison to the importance of health outcomes such as drowning and spinal injury and also for cuts/abrasions, etc.

- The lack of evidence regarding severe health outcomes arising from infectious diseases (e.g. Typhoid, Hepatitis A/E, as well as Cryptosporidium) was considered a major problem in preparing guidance for areas in which such diseases were endemic. The very limited available literature suggested that transmission of these diseases could occur at levels of faecal pollution encountered in some recreational water areas where they were endemic.
• Much attention to date has focused upon demonstration of cause-effect and upon estimation of dose-response. The absence of credible studies testing the effects of interventions is a significant short fall. This applies to all hazard areas except UV exposure.

• Opportunities should be sought to generate information concerning health effects in children, with due regard to ethical considerations, including estimation of the volume of water ingested during recreation.

• Studies were required to clarify the relative exposure and, ideally, health impacts, between and amongst special interest groups.

• Recreational water environments are perceived differently by touristic/domestic users, tourist operators and receiving populations. Further work should be undertaken concerning the association of environmental values with health and wellbeing. Priority should be given to studies of the impact of environmental degradation on tourist behaviour.

• Further research was needed into predictive approaches to information/data collection, especially implying simple heuristic models and readily-collected information. This applies to the range of hazards addressed in the guidelines.

12. Closure

Jamie Bartram thanked everyone for their contributions over the whole period of the meeting. The group extended their appreciation to the Jersey authorities for their support for the meeting and active participation.
Annex 1

Participants

Professor Julian Andelman
Graduate School of Public Health
University of Pittsburgh
Pittsburgh, Pennsylvania 15261
USA
Tel: +1 412 624 3113
Fax: +1 412 624 3040
E-mail: coiner@nsf.org

Dr Maurizio Cavalieri
ACEA spa
Unità Laboratori Acque
Via Marco Polo 31
00154 Rome
Italy
Tel: +39 6 57993586
Fax: +39 6 57993194
E-mail:

Dr Joseph Cotruvo
NSF International
1301 K Street
N.W. Suite 225
Washington DC 20005
USA
Tel: 1 202 289 2140
Fax: 1 202 289 2149
E-mail: cotruvo@nsf.org

Dr Karin Dubsky
Coastwatch Europe
187 Pearse Street
Trinity College
Dublin
Ireland
Or/and
Pod Hybsmankou, 10
15000 Prague 5
Czech Republic
Tel: +353 1 280 2501/+42 0 2 521343
Fax: +353 1 2802191/+420 2 527366
E-mail:

Dr Alfred P. Dufour
Human Exposure Research Division
National Exposure Research Laboratory
Cincinnati
OHIO 45268
USA
Tel: +1 513 569 7303
Fax: +1 513 569 7464
E-mail: Dufour.Alfred@epamail.epa.gov.

Dr Maria Figueras
Unit of Microbiology
Faculty of Medicine
University Rovira and Virgili
C/Sant Liorenc 21
43201 Reus (Tarragona)
Spain
Tel: +34 77 759321
Fax: +34 77 759322
E-mail: mjfs@astor.urv.es
Dr Jay Fleisher  
Department of Preventive Medicine  
Suny State Science Center at Brooklyn  
Box 43, 450 Clarkson Ave  
Brooklyn NY 11203  
USA  
Tel: +44 718 2701075  
Fax: +44 718 270 3386  
E-mail: fleishe1@ix.netcom.com

Dr Enzo Funari  
Istituto Superiore di Sanità  
V.le Regina Elena, 299  
00161 Rome  
Italy  
Tel: +39 6 49902307  
Fax: +39 6 49902307  
E-mail: MARE@ISS.ITALY

Ms Sylvie Goyet  
World Wildlife Fund  
Geneva  
Switzerland  
Tel: +41 22 3649111  
Fax: +41-22-364 66 24  
E-mail: s.goyet@aol.com; Sylvie.Goyet@wwfnet.org

Mr Brian Guthrie  
PWTAG – Pool Water Treatment Advisory Group  
Field House  
Thrandeston, Near Diss  
Norfolk IP21 4BU  
United Kingdom  
Tel: +44 1379 783678  
Fax: +44 1379 783865  
E-mail: s.guthrie@open.uk

Dr Mihaly Kadar  
National Institute of Hygiene  
Gyali ut 2–6  
H-1966 Budapest  
Hungary  
Tel: +36 1 217 0658  
Fax: +36 1 215 0148  
E-mail: h7256csa@ella.hu

Dr George Kamizoulis  
WHO EURO Project Office  
Coordinating Unit for the Mediterranean Action Plan  
P.O. Box 18019  
GR 11610 Athens  
Greece  
Tel: +30 1 72531905  
Fax: +30 1 7253197  
E-mail: WHOMED@compulink.gr

Professor David Kay  
Professor of Environmental Science  
University of Leeds  
Leeds LS2 9JT  
United Kingdom  
Tel: +44 113 233 6461  
Fax: +44 113 233 6716  
E-mail: Dave@lec.leeds.ac.uk.

Dr Inna Kuzanova  
Sanitary and Hygiene Scientific Research Institute  
Tbilisi  
Georgia  
Tel: +995 32 233498  
Fax: +995 32 294786  
E-mail: vake79!vake79.postnet.ge!root@postnet.com.ge

Dr Juan Lopez-Pila  
Umweltbundesamt Institut für Wasser-,  
Boden- und Lufthygiene  
Corrensplatz, 1  
United Kingdom  
Tel: +49 30 89031394  
Fax: +49 30 89031830  
E-mail: lopez@circe.uba.de
D14195 Berlin  
Germany  
Dr Athena Mavridou  
Microbiology Department  
National School of Public Health  
196 Alexandra Avenue  
11521 Athens  
Greece  
Tel: +30 1 642 2278/645 6359  
Fax: +30 1 644 4260  
E-mail: 

Dr Arthur Mittelstaedt  
Recreational Safety Institute  
P.O. Box 392  
Ronkonkoma, New York 11779  
USA  
Tel: +1 516 883 6399  
Fax: +1 516 883 1814  
E-mail: 

Dr Robin Philipp  
Department of Occupational Health and Safety  
United Bristol Healthcare Trust  
White Friars Centre  
Lewins Mead  
Bristol BS12 NT  
United Kingdom  
Tel: +44 117 9282352  
Fax: +44 117 928 3840  
E-mail: 

Dr Edmund Pike  
7 Redhouse Drive  
Sonning Common  
Reading  
Berkshire RG4 9NT  
United Kingdom  
Tel: +44 1491 724 249  
Fax: 
E-mail: 

Dr Kathy Pond  
Robens Institute  
University of Surrey  
Guildford, Surrey GU2 5XH  
United Kingdom  
Tel: +44 1483 259935  
Fax: +44 1483 503517  
E-mail: k.pond@SURREY.AC.UK 

Dr Gareth Rees  
Farnborough College of Technology  
Boundary Road  
Hampshire GU14 6SB  
United Kingdom  
Tel: +44 1252 391 266  
Fax: +44 1252 370036  
E-mail: g.rees@farn-ct.ac.uk 

Dr John Ridgway  
Wrc plc  
Henley Road  
Medmenham  
Marlow  
Buckinghamshire SL7 2HD  
United Kingdom  
Tel: +44 1491 571 531  
Fax: +44 1491 579094  
E-mail: ridgway@wrcplc.co.uk 

Mr William Robertson  
Health Canada  
Environmental Health Centre 0802A  
Tunney’s Pasture  
Health Canada  
Tel: +1 613 957 1505  
Fax: +1 613 952 2574  
E-mail: Will Robertson.HWC@inet.hwc.ca
### Observers

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Address</th>
<th>Contact Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr D. Berry</td>
<td>Chemist</td>
<td>Public Services Department</td>
<td>Tel: +44 1534 601519</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O. Box 412</td>
<td>Fax: +44 1534 30353</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Hill, St Helier</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jersey JE4 8UY</td>
<td></td>
</tr>
<tr>
<td>Mr A. Bruce</td>
<td>Chief Environmental Health Officer</td>
<td>Environmental Health Department</td>
<td>Tel: +44 1534 89933</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Le Bas Centre</td>
<td>Fax: +44 1534 30353</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St Saviour’s Road, St Helier</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jersey JE1 4HR</td>
<td></td>
</tr>
<tr>
<td>Mr R.S. Culverwell</td>
<td>Chief Engineering-Planning</td>
<td>Public Services Department</td>
<td>Tel: +44 1534 601250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O. Box 412</td>
<td>Fax: +44 1534 68950</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Hill, St Helier</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jersey JE4 8UY</td>
<td></td>
</tr>
<tr>
<td>Dr R. Grainger</td>
<td>Medical Officer of Health</td>
<td>Environmental Health Department</td>
<td>Tel: +44 1534 623700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Le Bas Centre</td>
<td>Fax: +44 1534 30353</td>
</tr>
<tr>
<td></td>
<td></td>
<td>St Saviour’s Road, St Helier</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jersey JE1 4HR</td>
<td></td>
</tr>
<tr>
<td>Mr N. Hubbard</td>
<td>States of Jersey Official Analyst</td>
<td>Pier Road, St Helier</td>
<td>Tel: +44 1534 36455</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jersey JE4 8UY</td>
<td>Fax: +44 1534 66746</td>
</tr>
<tr>
<td>Mr Gerry F. Jackson</td>
<td>Environmental Chemist</td>
<td>Public Services Department</td>
<td>Tel: +44 1534 601690</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P.O. Box 412</td>
<td>Fax: +44 1534 33578</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Hill, St Helier</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jersey JE4 8UY</td>
<td></td>
</tr>
<tr>
<td>Dr Huw Harris Jones</td>
<td>Department of Environment</td>
<td></td>
<td>Tel: +44 171 2768257</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fax: +44 171 2768639</td>
</tr>
</tbody>
</table>
London
United Kingdom

Mr Jan James
Managing Director
The Jersey New Waterworks Co. Ltd.
Westmount Road, St Helier
Jersey JE1 1DG
Channel Islands

Mr Bob Lacey
WRc plc
Henley Road
Medmenham
Marlow
Buckinghamshire SL7 2HD
United Kingdom

Dr David Jeffs
Medical Officer of Health
Department of Health
John Henry House
St Martins
Guernsey GU4 6UU
Channel Islands

Mr G. Le Claire
Acting-Director-Environment
Planning and Environment Department
South Hill
St Helier
Jersey JE1 4HR
Channel Islands

Dr I. Muscat
Consultant Microbiologist
Pathology Laboratory
General Hospital
Gloucester Street
St Helier
Jersey JE2 3QS
Channel Islands

Dr M. Romeril
Environmental Advisor
Chief Adviser’s Office
Cyril Le Marquand House
The Parade, St Helier
Jersey JE4 8PF
Channel Islands

Dr Katrin Scheiner-Bobis
Federal Ministry for the Environment

E-mail:
Division IG II 2
Bernkasteler Strasse 8
53048 Bonn
Germany

E-mail: ig222001@up-gate.bmu.de

Ms Clare Simpson
Pathology Laboratory
General Hospital
Gloucester Street, St Helier
Jersey JE2 3QS
Channel Islands

Tel: +44 1534 622612
Fax: +44 1534 888259

Mr Brian Stuttard
Chief Executive Officer
P.O. Box 412
South Hill, St Helier
Jersey JE4 8UY
Channel Islands

Tel: +44 1534 601200
Fax: +44 1534 68950

Mr L.J. Tanguy
Pollution Control Officer
Public Services Department
P.O. Box 412
South Hill, St Helier
Jersey JE4 8UY
Channel Islands

Tel: +44 1534 601515
Fax: +44 1534 33578

Dr Rovena White
32 Aquila Road, St Helier
Jersey JE2 3XD
Channel Islands

Tel: +44 1534 30981
Fax: +44 1534 30981

Mr Terry Williams
Environmental Lawyer
47 Washdyke Lane
Nettleham, Lincoln LN2 2PX
United Kingdom

Tel: +44 1522 750786
Fax: +44 1522 750028

Dr Houssaïn Abouzaïd
Environmental Health Risk Assessment
and Management
Division of Environmental Health
WHO Regional Office for the Eastern Mediterranean
P.O. Box 1517
21511 Alexandria
Egypt

Tel: +203 4830090/6/7/8
Fax: +203 4838 916 or 4824 329

Dr Jamie Bartram
Regional Office for Europe

Tel: +39 6 41217298
Fax: +39 6 4116649
Manager Water and Wastes  
European Centre for Environment and Health  
Rome Division  
Via Vincenzo Bona, 67  
00156 Rome  
Italy  
Dr George Kamizoulis  
WHO EURO Project Office  
Coordinating Unit for the Mediterranean Action Plan  
P.O. Box 18019  
GR 11610 Athens  
Greece  
E-mail: JBA@WHO.IT

Ms Grazia Motturi  
Regional Office for Europe  
European Centre for Environment and Health  
Rome Division  
Via Vincenzo Bona, 67  
00156 Rome  
Italy  
Tel: +39 6 4116640  
Fax: +39 6 4116649  
E-mail: MGM@WHO.IT

Ms Annette Prüss  
Urban Environmental Health  
Division of Operational Support in Environmental Health  
World Health Organization  
20, Avenue Appia  
1211 Genève 27  
Switzerland  
Tel: +41 22 7913584  
Fax: +41 22 7914127  
E-mail: pruessa@WHO.CH

Dr Philip Rushbrook  
Regional Office for Europe  
European Centre for Environment and Health  
Nancy Division  
149, Rue Gabriel Péri  
F-54500 Vandoeuvre Nancy  
France  
Tel: +33 383 83158774  
Fax: +33 383 158773  
E-mail: ECN@who.dk

Dr Henry Salas  
Adviser in Water Pollution Control  
Pan American Health Organization  
Center for Sanitary Engineering and Environmental Sciences (CEPIS)  
Casilla Postal 4337  
Lima 100  
Peru  
Tel: +51 1 4371077  
Fax: +51 1 4378289  
E-mail: HSALAS@CEPIS.ORG.PE
Annex 2

AGENDA

Opening.
Introduction of participants.
Election of officers.
Assessment of health risks associated with recreational use of coastal and freshwaters.
Monitoring and assessment of risks associated with recreational use of coastal and freshwaters.
Microbiological aspects.
Development of an initiative to support guidelines implementation.
Assessment of health risks associated with recreational use of swimming pools and spas.
Closure.
Annex 3

WORKING PAPERS

General
ICP HCE 039 AS 96/1 List of working papers
ICP HCE 039 AS 96/2 Scope and purpose
ICP HCE 039 AS 96/3 Provisional agenda
ICP HCE 039 AS 96/4 Provisional programme
ICP HCE 039 AS 96/5 List of participants
ICP HCE 039 AS 96/6 Tentative list of working groups

Working Group 1
ICP HCE 039 AS 96/7 Preface of GSRWE
ICP HCE 039 AS 96/8 Chapter 2 of GSRWE: Hazards and risks associated with specific recreational activities
ICP HCE 039 AS 96/9 Chapter 3 of GSRWE: Microbiological hazards and risks
ICP HCE 039 AS 96/10 Chapter 5 of GSRWE: Microbiological aspects of beach quality
ICP HCE 039 AS 96/11 Chapter 6 of GSRWE: Algae in coastal and estuarine waters
ICP HCE 039 AS 96/12 Chapter 7 of GSRWE: Freshwater algae
ICP HCE 039 AS 96/13 Chapter 8 of GSRWE: Poisonous and venomous organisms
ICP HCE 039 AS 96/14 Chapter 9 of GSRWE: Chemical and physical agents
ICP HCE 039 AS 96/15 Chapter 10 of GSRWE: Beach safety: accidents and physical hazards
ICP HCE 039 AS 96/16 Chapter 11 of GSRWE: Health effects of exposure to sun and heat
ICP HCE 039 AS 96/17 Chapter 12 of GSRWE: Wellbeing and aesthetic aspects

Working Group 2
ICP HCE 039 AS 96/18 Microbiology Review Document

Working Group 3
Monitoring and assessment of coastal and freshwater recreational areas
ICP HCE 039 AS 96/19 Chapter 1: Introduction
ICP HCE 039 AS 96/20 Chapter 2: Public and environmental health considerations
ICP HCE 039 AS 96/21 Chapter 3: Programme design
ICP HCE 039 AS 96/22 Chapter 4: Programme implementation
ICP HCE 039 AS 96/23 Chapter 5: Visual inspection and investigation of hazards
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Water quality sampling and analysis: microbiological aspects</td>
</tr>
<tr>
<td>7</td>
<td>Monitoring: aesthetic aspects</td>
</tr>
<tr>
<td>8</td>
<td>Water quality monitoring: freshwater and marine algae</td>
</tr>
<tr>
<td>9</td>
<td>Water quality monitoring: physicochemical</td>
</tr>
<tr>
<td>10</td>
<td>Analytical quality control</td>
</tr>
<tr>
<td>11</td>
<td>Epidemiological surveys</td>
</tr>
<tr>
<td>12</td>
<td>Programme data processing, management and storage</td>
</tr>
<tr>
<td>13</td>
<td>Management criteria</td>
</tr>
<tr>
<td>14</td>
<td>Public information strategies</td>
</tr>
<tr>
<td>15</td>
<td>Code of Good Practice for Monitoring and Assessment</td>
</tr>
</tbody>
</table>

**Working Group 4**
Planning for dissemination and implementation

**Working Group 5**
Swimming pools, spas and similar recreational water environments

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Microbiological aspects</td>
</tr>
<tr>
<td>4</td>
<td>Chemical aspects</td>
</tr>
<tr>
<td>5</td>
<td>Managing safety</td>
</tr>
<tr>
<td>6</td>
<td>Managing water quality</td>
</tr>
<tr>
<td>7</td>
<td>Other management problems</td>
</tr>
<tr>
<td>8</td>
<td>Summary of guidelines/application of guidelines</td>
</tr>
<tr>
<td>9</td>
<td>Legislation, regulatory frameworks, planning surveillance and inspection</td>
</tr>
<tr>
<td>10</td>
<td>Information, education and training</td>
</tr>
<tr>
<td>11</td>
<td>Annex 1</td>
</tr>
</tbody>
</table>
(1) – The specific values should be adapted to take account the variations in social, economic, environmental and technical factors in translation into national or local standards and legislation.
(2) – Derivation of reference values for Faecal Streptococci/100 ml.

- **10** → This value is below the no-observed adverse effect level in most epidemiological studies which have attempted to define a NOAEL. Using the indicator level/burden of disease relationship it corresponds to the 95 percentile value which is associated with less than a single excess incidence of enteric symptoms for a family of four healthy adult bathers having 80 exposures per bathing season (rounded value), over a 5 years period.

- **50** → This value is above the lowest-observed-adverse-effect level in most epidemiological studies which have attempted to define a LOAEL. Using the indicator level/burden of disease relationship it corresponds to the 95 percentile value which is associated with a single excess incidence of enteric symptoms for a family of four healthy adult bathers having 80 exposures per bathing season (rounded value).

- **200** → Using the indicator level/burden of disease relationship it corresponds to the 95 percentile value which is associated with a single excess incidence of enteric symptoms for a healthy adult bather having 20 exposures per bathing season (rounded value).

- **1000** → It is derived from limited evidence regarding transmission of typhoid fever in areas of low-level typhoid endemicity. Typhoid is used in this context as an indicator of severe health outcome. It corresponds to a maximum acceptable concentration (MAC) since the potential disease outcome is severe. The exceedence of this level should be considered a public health risk leading to immediate investigation by the competent authorities.
Annex 5

CONTENTS LIST FOR VOLUME 5

1.0 Introduction
   • Purpose
   • Relation to other volumes
   • Structure of document

2.0 Guide to grouping by control
   (a short definition and explanation of the various groups)
   Faecal-oral
   Surface-shed (human origin but non-faecal)
   Surface-borne and autochthonous (biofilms)
   Indicators and index organisms
   Emerging micro-organisms

3.0 MRD Pathogens (alphabetical)
For each organism the following structure will be followed:
   3.1 Description (1/2 page max.)
      Taxonomy, size, shape
   3.2 Public health basis for concern
      • Pathogenicity for humans
      • in-vitro, animal, volunteers studies, dose response (IDSO), routes of infection, infectious dose
   3.3 Recognized disease outbreaks
      • Disease occurrence and association with conditions
      • epidemiological studies
   3.4 Assessment and best methods (1/2 page)
      • Sampling and sample preparations
      • Analytical methods
   3.5 Source, growth and persistence
      • Source; excretion and shedding rates
      • Survival and persistence
   3.6 Control
      • Effects of waste water treatment (for sewage derived only)
      • Effects of filtration, disinfection and pool management activities.
   3.7 Conclusions and recommendations
   3.8 References

4.0 Indicators
   4.1 Indicator concept
      – What does it indicate
      – Relative environmental resistance
      – How they are shed/get into the environment
      – Methods (isolation and enumeration) and comparability between them
      – Limitations to their use on a global scale
4.2 Faecal indicators
Where are they appropriate, density of shedding, persistence relative to pathogens

4.2.1 E. coli
Description, principal methods, what do they measure

4.2.2 Faecal coliforms
Differences with respect to 4.2.1

4.2.3 Total coliforms
Differences with respect to 4.2.1 and 4.2.2

4.2.4 Coliphages
Description, classes of coliphages (somatic, f-phages), principal methods, what do they measure, where are they appropriate; persistence relative to viruses

4.2.5 Clostridium spores
Description, principal methods, what do they measure, where are they appropriate, persistence relative to pathogens

4.3 Surface shed indicators (skin and abiotic surfaces)

4.3.1 Staphilococci
Description, principal methods, what do they measure, where are they appropriate, persistence relative to pathogens

4.3.2 Pseudomonas aeruginosa
Description, principal methods, what do they measure, where are they appropriate, persistence relative to pathogens

4.4 Others
Annex 6

CONTENTS LIST FOR SWIMMING POOLS VOLUME

Preface
Acknowledgements
Acronyms and abbreviations

1. Introduction

2. Accidents
   2.1. Introduction
   2.2. Scale and nature of health effects
   2.3. User factors
   2.4. Facility factors
   2.5. Staffing and supervisor factors

3. Microbiological aspects
   3.1. Faecal/oral route
   3.2. Surface shed
   3.3. Surface and facility associated
   3.4. Risk management

4. Chemical aspects

5. Managing safety

6. Managing water quality

7. Other management problems
   7.1. Non disinfected pools
   7.2. Hydrotherapy pools
   7.3. Household pools

8. Application guidelines
   8.1. Design and construction guidelines
   8.2. Guidelines for facility operation and management

9. Legislation, regulatory frameworks, planning surveillance and inspection
   9.1. Legislative frameworks, actors
   9.2. Roles and responsibilities
   9.3. Construction standards
   9.4. Planning and approval processes
   9.5. Surveillance and inspection
   9.6. Certification schemes
   9.7. Regulatory enforcement

10. Information, education and training