World Health Organization Water Quality and Health
Joint Expert Meeting

18–22 March 2013

Organized in coordination with
Eawag, Dübendorf, Switzerland

Geneva, 2013
CONTENTS

ACRONYMS.......................................................................................................................... v

1. INTRODUCTION.................................................................................................................. 1
   1.1 Background ...................................................................................................................... 1
   1.2 Objectives of the meeting ............................................................................................... 1
   1.3 Participants ...................................................................................................................... 2
   1.4 Organization of the meeting ........................................................................................... 2
   1.5 Opening session .............................................................................................................. 2
   1.6 Declarations of interests ............................................................................................... 3

2. STRATEGY AND HARMONIZATION OF THE WHO WATER QUALITY GUIDELINES .............. 4
   2.1 The WHO Water Quality and Health Strategy ................................................................. 4
   2.2 Harmonization of the three water quality guidelines: linking the guidelines at the policy level .................................................................................................................................. 7
   2.3 Harmonization of health-based targets .......................................................................... 10
   2.4 Capacity building with a focus on health-based targets .................................................. 13

3. WATER QUALITY AND HEALTH EXPERT GROUP AND GUIDELINES DEVELOPMENT PROCESS .................................................................................................................. 14
   3.1 Expert group terms of reference .................................................................................. 15
   3.2 Guideline development at WHO .................................................................................. 16
   3.3 Policies and procedures for updating the WHO water quality guidelines ...................... 18

4. FEEDBACK ON GUIDELINES FROM WHO REGIONAL OFFICES: PERSPECTIVES ON THE WORKPLANS .................................................................................................................. 19
   4.1 WHO Regional Office for Africa .................................................................................... 20
   4.2 WHO Regional Office for the Eastern Mediterranean .................................................... 21
   4.3 WHO Regional Office for Europe .................................................................................. 22
   4.4 WHO Regional Office for South-East Asia .................................................................... 23
   4.5 WHO Regional Office for the Western Pacific ............................................................... 24
   4.6 WHO Regional Office for the Americas ....................................................................... 25
   4.7 Summary and discussion .............................................................................................. 25

5. CROSS-CUTTING ACTIVITIES INCLUDED ON THE GDWQ POST–FOURTH EDITION WORKPLAN AND WATER SAFETY PLANS .......................................................... 27
   5.1 Vulnerable groups .......................................................................................................... 27
   5.2 Indirect potable reuse .................................................................................................... 29
   5.3 Quantitative microbial risk assessment ......................................................................... 30
   5.4 Update on water safety plans ....................................................................................... 32

6. BURDEN OF DISEASE ESTIMATES FOR WATER, SANITATION AND HEALTH ......................... 33

7. WASTEWATER WORKPLAN .............................................................................................. 36
   7.1 Draft wastewater workplan ........................................................................................... 36
   7.2 Update on sanitation safety plans .................................................................................. 38
8. RECREATIONAL WATER WORKPLAN AND CROSS-CUTTING ISSUES ...........41
  8.1 Draft recreational water workplan ..........................................................41
  8.2 Summary of overall work conducted by the WHO Regional Office for Europe on
      Volume 2 of the recreational water guidelines .......................................43
  8.3 Toxic cyanobacteria in water ....................................................................48
  8.4 Cyanobacteria fact sheets .........................................................................50
  8.5 Cylindrospermopsin and microcystin .......................................................51

9. DRINKING-WATER GUIDELINES AND CROSS-CUTTING ISSUES ...........52
  9.1 WHO’s work on radiation protection and health .......................................52
  9.2 Draft drinking-water workplan: introduction ..........................................53
  9.3 Turbidity ....................................................................................................54
  9.4 Alternative disinfectants ............................................................................55
  9.5 International Network on Household Water Treatment and Safe Storage ....58
  9.6 WHO’s food safety programme: microbial and chemical risk assessment
      approaches ..................................................................................................59
  9.7 Update from Radiation Working Group ....................................................61
  9.8 Microbial Aspects Working Group workplan ............................................63
  9.9 Protection and Control Working Group workplan ......................................65
  9.10 Chemical Aspects Working Group workplan ..........................................66

10. OVERALL PRIORITIES FOR HARMONIZATION OF THE WATER
    QUALITY GUIDELINES ..................................................................................69

11. CLOSING OF THE MEETING .....................................................................72

ANNEX 1: List of participants ..........................................................................74

ANNEX 2: Agenda ...............................................................................................83

ANNEX 3: Annotated agenda from Microbial Aspects Working Group for the
       WHO Guidelines for Drinking-water Quality .............................................88

ANNEX 4: Annotated agenda from the Protection and Control Working Group
       for the WHO Guidelines for Drinking-water Quality ...............................101

ANNEX 5: Annotated agenda from the Chemical Aspects Working Group for the
       WHO Guidelines for Drinking-water Quality ............................................107

ANNEX 6: Annotated agenda for WHO Guidelines for Drinking-water Quality
       items not discussed but with follow-up required ........................................126

ANNEX 7: Annotated agenda for all aspects of wastewater ...............................128

ANNEX 8: Annotated agenda for all aspects of recreational water .....................135
ACRONYMS

AIDS acquired immunodeficiency syndrome
AusAID Australian Agency for International Development
BDCM bromodichloromethane
BPA bisphenol A
BSS International Basic Safety Standards
bw body weight
CICAD Concise International Chemical Assessment Document
CT disinfectant concentration × time
DALY disability-adjusted life year
DBP disinfection by-product
DDT dichlorodiphenyltrichloroethane
Eawag Swiss Federal Institute of Aquatic Science and Technology
EBD environmental burden of disease
EFSA European Food Safety Authority
EHC Environmental Health Criteria
EMF electromagnetic fields
EU European Union
FAO Food and Agriculture Organization of the United Nations
FERG Foodborne Disease Burden Epidemiology Reference Group
GDWQ Guidelines for Drinking-water Quality
GEMS Global Enteric Multicenter Study
GEMS/Food Global Environment Monitoring System – Food Contamination Monitoring and Assessment Programme
GLAAS UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water
GLP good laboratory practice
GRADE Grades of Recommendation Assessment, Development and Evaluation
GRC Guidelines Review Committee
GSRWWE Guidelines for Safe Recreational Water Environments
GV guideline value
HACCP hazard analysis and critical control point
HBT health-based target
HIV human immunodeficiency virus
HQ headquarters
HWTS household water treatment and safe storage
IAEA International Atomic Energy Agency
ICID International Commission on Irrigation and Drainage
IHME Institute for Health Metrics and Evaluation
INFOSAN International Food Safety Authorities Network
IPCS International Programme on Chemical Safety
IQ intelligence quotient
IRCSA International Rainwater Catchment Systems Association
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRHA</td>
<td>International Rainwater Harvesting Alliance</td>
</tr>
<tr>
<td>IRIS</td>
<td>Integrated Risk Information System (USEPA)</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>IWA</td>
<td>International Water Association</td>
</tr>
<tr>
<td>IWMI</td>
<td>International Water Management Institute</td>
</tr>
<tr>
<td>JECFA</td>
<td>Joint FAO/WHO Expert Committee on Food Additives</td>
</tr>
<tr>
<td>JEMRA</td>
<td>Joint FAO/WHO Expert Meeting on Microbiological Risk Assessment</td>
</tr>
<tr>
<td>JMP</td>
<td>WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation</td>
</tr>
<tr>
<td>JMPR</td>
<td>Joint FAO/WHO Meeting on Pesticide Residues</td>
</tr>
<tr>
<td>KWR</td>
<td>Kiwa Water Research</td>
</tr>
<tr>
<td>LOAEL</td>
<td>lowest-observed-adverse-effect level</td>
</tr>
<tr>
<td>MCPA</td>
<td>2-methyl-4-chlorophenoxyacetic acid</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goal</td>
</tr>
<tr>
<td>MST</td>
<td>microbiological source tracking</td>
</tr>
<tr>
<td>NaDCC</td>
<td>sodium dichloroisocyanurate</td>
</tr>
<tr>
<td>NDMA</td>
<td>N-nitrosodimethylamine</td>
</tr>
<tr>
<td>NGO</td>
<td>nongovernmental organization</td>
</tr>
<tr>
<td>NOAEL</td>
<td>no-observed-adverse-effect level</td>
</tr>
<tr>
<td>NTP</td>
<td>National Toxicology Program (USA)</td>
</tr>
<tr>
<td>NTU</td>
<td>nephelometric turbidity unit</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
</tr>
<tr>
<td>PAHO</td>
<td>Pan-American Health Organization</td>
</tr>
<tr>
<td>P&amp;P</td>
<td>policies and procedures</td>
</tr>
<tr>
<td>PBPK</td>
<td>physiologically based pharmacokinetic</td>
</tr>
<tr>
<td>PCP</td>
<td>personal care product</td>
</tr>
<tr>
<td>PCS</td>
<td>Programme for the Promotion of Chemical Safety (WHO)</td>
</tr>
<tr>
<td>PFOA</td>
<td>perfluorooctanoate</td>
</tr>
<tr>
<td>PFOS</td>
<td>perfluorooctane sulfonate</td>
</tr>
<tr>
<td>PMTDI</td>
<td>provisional maximum tolerable daily intake</td>
</tr>
<tr>
<td>POP</td>
<td>persistent organic pollutant</td>
</tr>
<tr>
<td>PPCPs</td>
<td>pharmaceuticals and personal care products</td>
</tr>
<tr>
<td>ppy</td>
<td>per person per year</td>
</tr>
<tr>
<td>PTWI</td>
<td>provisional tolerable weekly intake</td>
</tr>
<tr>
<td>PUB</td>
<td>Public Utilities Board (Singapore)</td>
</tr>
<tr>
<td>PUB-NTU</td>
<td>Public Utilities Board–Nanyang Technological University (Singapore)</td>
</tr>
<tr>
<td>QALY</td>
<td>quality-adjusted life year</td>
</tr>
<tr>
<td>QMRA</td>
<td>quantitative microbial risk assessment</td>
</tr>
<tr>
<td>QMSA</td>
<td>quantitative microbial source apportionment</td>
</tr>
<tr>
<td>qPCR</td>
<td>quantitative polymerase chain reaction</td>
</tr>
<tr>
<td>RegNet</td>
<td>International Network of Drinking-water Regulators</td>
</tr>
<tr>
<td>RIVM</td>
<td>National Institute for Public Health and the Environment (the Netherlands)</td>
</tr>
<tr>
<td>SANA</td>
<td>Situation Analysis and Needs Assessment</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>SSP</td>
<td>sanitation safety plan</td>
</tr>
<tr>
<td>TBC</td>
<td>to be confirmed</td>
</tr>
<tr>
<td>TBD</td>
<td>to be determined</td>
</tr>
<tr>
<td>TDI</td>
<td>tolerable daily intake</td>
</tr>
<tr>
<td>TEF</td>
<td>toxic equivalency factor</td>
</tr>
<tr>
<td>THM</td>
<td>trihalomethane</td>
</tr>
<tr>
<td>TMDL</td>
<td>total maximum daily load</td>
</tr>
<tr>
<td>TTC</td>
<td>threshold of toxicological concern</td>
</tr>
<tr>
<td>UBA</td>
<td>Federal Environment Agency (Germany)</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNC</td>
<td>University of North Carolina</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>UNU-INWEH</td>
<td>United Nations University Institute for Water, Environment and Health</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>USEPA</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>UV</td>
<td>ultraviolet</td>
</tr>
<tr>
<td>WASH</td>
<td>water, sanitation and health</td>
</tr>
<tr>
<td>WG</td>
<td>working group</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WHOPES</td>
<td>World Health Organization Pesticides Evaluation Scheme</td>
</tr>
<tr>
<td>WQTAG</td>
<td>Water Quality and Health Technical Advisory Group</td>
</tr>
<tr>
<td>WSH</td>
<td>Water, Sanitation, Health &amp; Hygiene Programme (WHO HQ, Geneva)</td>
</tr>
<tr>
<td>WSP</td>
<td>water safety plan</td>
</tr>
</tbody>
</table>
1. INTRODUCTION

A World Health Organization (WHO) Water Quality and Health Joint Expert Meeting was held in Dübendorf, Switzerland, from 18 to 22 March 2013. The Water, Sanitation, Health & Hygiene (WSH) Programme of WHO Headquarters (HQ) organized the meeting in coordination with the Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dübendorf, Switzerland.

1.1 Background

A WHO Consultation on the Development of a Strategy on Water Quality and Health was held in Tokyo, Japan, from 8 to 10 December 2010. Participants included WHO staff, members of the WHO Drinking-water Quality Committee and representatives of the expert groups responsible for preparing the WHO guidelines related to recreational water environments and the safe use of wastewater, excreta and greywater in agriculture and aquaculture.

It was confirmed during the consultation that an expert group that brings together drinking-water quality, wastewater reuse and recreational water experts was desirable, as there were enough commonalities among the three sets of guidelines for a harmonized approach. Cross-cutting issues identified included health-based targets, health risk assessment and health risk management. All three guidelines are based on the Stockholm Framework. While a formal mechanism to update the drinking-water quality guidelines has been established along with a permanent expert group, it was recognized that more formal mechanisms to update the other two guidelines need to be established. The draft Water Quality and Health Strategy was additionally reviewed, and key parts of the strategy were agreed upon, including guiding principles, the target audience, objectives and associated functions.

This meeting builds upon the outcomes of the Tokyo meeting and brings together a broader expert group to develop the integrated workplan. Technical discussion will build upon the post–Fourth Edition workplan that was developed at the final consultation for the finalization of the Fourth Edition of the Guidelines for Drinking-water Quality (GDWQ), which took place from 6 to 8 December 2010 in Tokyo, Japan, and new draft workplans will be developed for the wastewater reuse and recreational water guidelines.

1.2 Objectives of the meeting

The objectives of the meeting were to:

- present and review administrative and procedural documents for the proposed process for preparing revisions to the WHO water quality guidelines:
  - Guidelines for Drinking-water Quality (two volumes)
  - Guidelines for the Safe Use of Wastewater, Excreta and Greywater (four volumes)
  - Guidelines for Safe Recreational Water Environments (two volumes);

---

• identify specific areas of collaboration for the harmonization of the three water quality guidelines with a view to the publication of revised guidelines for drinking-water, wastewater reuse and recreational water within the strategy period;
• establish mechanisms to regularly update the Guidelines for the Safe Use of Wastewater, Excreta and Greywater and the Guidelines for Safe Recreational Water Environments;
• update and prioritize the post–Fourth Edition workplan for the GDWQ, select priority activities for year 1 and assign focal points for implementation;
• present and refine draft workplans for the Guidelines for the Safe Use of Wastewater, Excreta and Greywater and the Guidelines for Safe Recreational Water Environments, select priority activities for year 1 and assign focal points for implementation.

1.3 Participants

More than 50 participants attended the meeting (some participating by teleconference), including staff from WHO HQ, representatives of all WHO regional offices, representatives of the expert groups responsible for preparing the WHO drinking-water guidelines, the WHO recreational water guidelines and the WHO wastewater reuse guidelines, and observers. A list of participants is given in Annex 1.

1.4 Organization of the meeting

The meeting consisted of a series of plenary sessions, breakout sessions, presentations and moderated discussions by themes, with a focus on harmonization of the three WHO water quality guidelines and the development of prioritized workplans on drinking-water, wastewater reuse and recreational water. The agenda, including the list of session chairs and presenters, is attached as Annex 2.

1.5 Opening session

Janet Hering, Director of Eawag, opened the meeting by providing a brief introduction to Eawag, the Swiss Federal Institute of Aquatic Science and Technology. Eawag is a research institute that is part of a larger family called the ETH domain, consisting of the Federal Institutes of Technology and four research institutes with a common scope of water-related activities. It has a very academic focus, with many professors and post-graduate students conducting research at the institute.

The strategic focus of Eawag is in three areas: 1) water for ecosystem function (e.g. the effect of connectivity on biodiversity); 2) water for human welfare (e.g. nutrient recovery from human waste for agricultural use); and 3) strategies for trade-offs and competing demands (e.g. research on wastewater treatment versus eutrophication/fish abundance). Eawag is a WHO Collaborating Centre and supports the WHO/United Nations Children’s Fund (UNICEF) Joint Monitoring Programme on Water Supply and Sanitation (JMP).

Janet concluded her presentation by wishing participants a productive meeting and a pleasant stay and suggesting that they tour Eawag and meet with some of the institute’s researchers during the week.

Bruce Gordon thanked Eawag for hosting this meeting. He noted that unsafe water continues to place a huge burden on societies around the world, but reducing this health burden lies
within our reach and means. Water and sanitation work at WHO consists very broadly of the provision of norms and monitoring. Examples of WHO’s work on monitoring include water quality monitoring by JMP (JMP uses data sets from national household surveys and censuses, focusing on actual use of improved sources of drinking-water and sanitation facilities), monitoring progress towards achieving the Millennium Development Goals (MDGs) (although the MDG drinking-water target was met in 2010, disparities continue to exist, such as in areas of Africa where only 10% of the population may be getting improved sources of water and areas in southern Asia where the poorest 40% of the population have barely benefited from improvements in sanitation) as well as monitoring what countries are doing to improve their water and sanitation situation through the Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) (countries report that progress towards national targets is slow; however, water safety planning is gaining global momentum, with 81% of respondent countries either encouraging or requiring water safety plans [WSPs] in their policies and regulations or reporting pilot experiences).

JMP goals for water, sanitation and health (WASH) post-2015 should be formulated in the context of a simple, inspirational vision; focus primarily on outcomes; reflect human rights to safe drinking-water and basic sanitation; reflect the dual aspirations of increasing the number of people using water and sanitation and of improving service levels; be global and relevant to all countries; expand beyond homes to schools and health-care centres; and have a clear focus on the poor, disadvantaged and excluded and on the elimination of inequalities and inequities. Also on the post-2015 agenda are sustainable development goals and water resource management. The three normative water quality guidelines provide a basis for monitoring the quality of drinking-water, wastewater and recreational water.

Bruce closed his presentation by reflecting on the importance of water quality regulations based on health (i.e. health-based targets), the concept of preventive risk management (i.e. WSPs) and water quality management at the point of use (i.e. household water treatment). Increasing attention will fall on sanitation and wastewater management in coming years, incorporating a whole water cycle approach. Bruce would like to see as an output of discussions at this meeting a reference or “point of departure” document to act as a roadmap guiding future work on the WHO water quality guidelines, similar to what was produced at the 2003 Final Task Force meeting on drinking-water.

1.6 Declarations of interests

All experts participating in the meeting completed the WHO standard form for declaration of interests prior to the meeting. At the start of the meeting, all participants were asked to confirm their interests and to provide any additional information relevant to the subject matter of the meeting.

The following participants declared current or recent (within the past year) financial interests related to commercial organizations:

- **Cotruvo**  Personal consulting services to Coca Cola, American Chemistry Council and Halosource, to the combined value > US$ 10 000 per annum.

- **Fawell**  Personal consulting services to Coca Cola of < US$ 10 000 per annum.
Joint Expert Meeting, 18–22 March 2013, Dübendorf

- Kay Consulting fees of < US$ 10 000 per annum from CREH Ltd laboratory consultancy company, of which he is the owner and director.

- Sobsey Personal honorarium > US$ 10 000 per annum for board membership on the Water Science Advisory Board for Amway Corp. Mark is also the co-founder of Aquagenex, a company that makes and sells a simple, low-cost test to quantify the microbial quality of water.

The following participants declared non-financial academic interests related to commercial organizations:

- Kay Institutional grant funding from METOK-interteck Ltd for coastal waters research (not current).

- Sobsey Institutional grant funding from Amway Corp. for research for point-of-use water treatment technology (not current).

On the basis of their declared interests above, no significant conflict was registered in relation to the objectives of the meeting.

2. STRATEGY AND HARMONIZATION OF THE WHO WATER QUALITY GUIDELINES

2.1 The WHO Water Quality and Health Strategy

This session, which was chaired initially by Lorna Fewtrell and later by John Fawell, opened with a presentation by Jennifer De France on the WHO Water Quality and Health Strategy. Jennifer explained that World Health Assembly Resolution WHA64.24 specifically requested WHO to formulate an integrated strategy on WASH, which was recently finalized. The strategy is set within an international policy framework involving the MDGs, the recognition by the Rio+20 United Nations Conference on Sustainable Development of the central role of water in sustainable development, the United Nations General Assembly’s recognition of the right to safe and affordable drinking-water and sanitation and the Human Rights Council’s recognition that the right to water and sanitation is derived from the right to an adequate standard of living. It was developed recognizing that harmonized water quality management brings about health, economic and environmental benefits and efficiencies for both WHO and Member States.

The vision of the Water Quality and Health Strategy is to attain the highest possible reduction in waterborne and water-related diseases by providing up-to-date evidence-based guidance and coordination and support for WASH interventions. The mission is for WHO to be the authoritative source on health-based water quality information, for use by water and health regulators, policy-makers, their advisers at global, regional and national levels and other stakeholders, including practitioners and nongovernmental organizations (NGOs). This includes the provision of information and health-based assessments on the various microbial, chemical, radiological and physical human health hazards that may be present in the water cycle and the approaches to manage the risks associated with those hazards.
The strategy includes five strategic objectives: 1) to obtain the most rigorous and relevant evidence on water quality and health; 2) to provide up-to-date, harmonized water quality management guidelines and supporting resources; 3) to strengthen the capacity of Member States to most effectively manage water quality to protect public health; 4) to facilitate the implementation of water quality and health activities through partnerships and support to Member States; and 5) to monitor the impact of these activities on policies and practices to more effectively inform decision-making.

Planned activities for 2013–2020 associated with the first strategic objective include establishing a research agenda to address major knowledge gaps and emerging issues on water quality and health; reviewing health-related evidence to inform water quality management decision-making in different settings and contexts; and carrying out revised assessments of the burden of disease attributable to unsafe drinking-water, wastewater and recreational water.

Activities associated with the second objective include updating all water quality guidelines by the end of the strategy period; continuing to develop supporting documents and other resources to assist in the interpretation and application of the guidelines; and revising the manual on the policies and procedures (P&P) followed in updating the drinking-water quality guidelines to include the wastewater reuse and recreational water guidelines.

For the third strategic objective, WHO will support the strengthening and harmonization of national policy frameworks and institutional arrangements; remain responsive to queries from Member States, including on technical issues and emergency situations; improve water quality surveillance capacities; facilitate the training of stakeholders involved in managing the water cycle; and assist Member States in conducting economic evaluations of their water quality management options.

For the fourth objective, WHO will improve coordination and cooperation between relevant authorities and stakeholders in establishing, implementing and maintaining efficient systems for assessing water quality and responding to water quality issues; facilitate information exchange through the utilization of WHO-hosted water quality networks, other partnerships and existing regional initiatives; and promote a stewardship role for the health sector to foster policy coherence across other sectors with an impact on the safety of water.

Finally, activities to help achieve the fifth strategic objective include developing the tools and processes to assess or verify the effectiveness of selected interventions; reviewing the use and implementation of the WHO water quality guidelines by Member States; ensuring that the findings inform the development of guidelines and supporting resources and activities related to capacity building, implementation and partnerships; and ensuring that the findings inform the water quality monitoring work being led by JMP.

By 2020, the evidence base will have been substantially strengthened, addressing both traditional and emerging issues; a new edition of all three of the water quality guidelines will have been published; capacity will have been developed for preventive risk management; and a proven framework for support will have been developed through experts, networks, collaborating centres and partners.
The strategy states that an expert group is to advise both on technical issues and on implementation and monitoring of the strategy. This expert group will be linked to WHO-hosted networks and collaborating centres.

Much progress has been made on strategic objectives 1–4, but there is a need to improve the linkages in the future as well as strengthen activities related to strategic objective 5. The session closed with a discussion on the following points: How can WHO and its partners work together to support implementation of the strategy? How can the expert group support achievement of strategic objectives 3–5? How can feedback be systematically obtained on the impact of the water quality guidelines?

Key discussion points:

- The expert group members need to understand the process by which the strategy is to be implemented in order to provide useful feedback. The Secretariat was asked to report on progress made on the strategy and how it will be implemented.

- Networks have been created by WHO for the drinking-water quality guidelines, which are working very well. Similar (but separate) networks for both sanitation and recreational water should also be created, where they do not already exist; where networks already exist internationally, should WHO become connected?

- The first step in achieving the integrated strategy is to harmonize the policy framework of the guidelines. It would be useful to have networks, but we need to provide a framework and vision first to give direction. Harmonized guidelines provide the basis for harmonized national policy frameworks.

- There is a reason these three water quality guidelines are thought of in silos (i.e. viewing the three water quality guidelines as three separate entities), but they do not need to be. Harmonization of the guidelines is the first step.

- The “silo” problem exists in countries with a lot of institutional capacity and where governmental structures are already very firmly implemented. It may be easier to start policy harmonization in countries without a lot of institutional capacity. Perhaps these two different settings need to be noted in our approaches.

- It should be recognized that the harmonized framework is not dealing with one set of circumstances, and there is a need to think about how to apply the strategy to different circumstances (e.g. different levels of resources).

- There is a need to identify target countries for implementation of the strategy, raise the profile of WASH within countries and obtain feedback from countries and WHO Collaborating Centres on how to implement the strategy.

- There could be regional consultations to decide how to implement the strategy. Perhaps the WHO regions will develop their own regional strategies using the global strategy as a starting point. The regions need to look at which partners will be involved at the regional level.

- How WHO HQ implements the strategy should be linked to regional implementation.
There is a need to review all the water publications produced by WHO to ensure consistency in the harmonized framework. Handbooks on water quality can be developed for issues that are the same across the three areas to support harmonization.

The key overarching issue is management of water and water resources (both quality and quantity issues) in a more holistic manner. There is a need for overarching discussion in all three guidelines where commonalities are brought together. There is a need for someone to encourage different agencies and departments to start talking to each other.

There are gaps in the guidelines. There is a need for guidance on indirect reuse for potable purposes, which feeds into other areas, such as reuse of wastewater for agriculture, maintaining the quality of rivers and maintaining bathing water quality.

The 2001 document on WASH that triggered re-evaluation of the structures of all three areas was the high-level Stockholm Framework. It may be a good time to revisit the Stockholm Framework and perhaps update it to reflect progress made with efforts to harmonize across the three areas and recognize remaining challenges.

Outcomes and key recommendations:
- Identify priority countries to scale up capacity development and implementation aspects of the strategy.
- Consider establishing international networks to promote the substantive and sustainable improvements to the safety of wastewater and recreational water.

2.2 Harmonization of the three water quality guidelines: linking the guidelines at the policy level

Phil Callan continued with a presentation on the harmonization of the three WHO water quality guidelines and linking the guidelines at the policy level. The second strategic objective of the Water Quality and Health Strategy is to provide up-to-date, harmonized water quality management guidelines and supporting resources. Why is it important to harmonize the water quality guidelines? Harmonization would support the integration of water quality and public health into national health and environmental policies; improve health protection through consistent integrated water quality management interventions; increase the integration of institutional mechanisms to reduce health impacts; streamline interventions for shared challenges of water safety in the three water quality areas; enable integrated approaches in managing potential exposure to hazards from multiple sources; improve the effective use of limited national resources; and provide consistent definitions across the guidelines.

Commonalities among the guidelines include human health protection and promotion, the health-based targets concept, faecal and chemical pollution, the concept of incremental improvement, the concept of preventive water safety planning, the use of quantitative microbial risk assessment (QMRA), the importance of the multiple-barrier approach, big gaps in research and data availability and the encouragement of local adaptation. In addition, all are politically high-profile areas. Differences among the guidelines are in their overall structure, their terminology, details on establishing health-based targets, the level of health protection, degrees of exposure, levels of international recognition/acceptance, impacts on local economies, development of operational instruments, research at different levels,
Joint Expert Meeting, 18–22 March 2013, Dübendorf

definition of target audiences and levels of intersectoral arrangements. Gaps in the guidelines include guidance for local adaptation, the development of sanitation safety plans (SSPs) and recreational water safety plans, guidance on monitoring recreational water, coverage of agricultural irrigation water quality, assessing priorities in wastewater and recreational water, the economics underlying various norms, standards and best practices, the incremental approach in reality and assessment of the quality of evidence supporting each of the guidelines.

The first steps towards harmonization involve establishing the Water Quality and Health Technical Advisory Group (WQTAG) and Guideline Development Groups, revising the policies and procedures by which the water quality guidelines are updated, introducing similar structures (perhaps using the drinking-water guidelines as a good model to follow) and terminology for the three guidelines, and incorporating harmonized guidance on health-based targets, safety planning and surveillance. Other possible steps include developing an overarching policy document to link the three guidelines, systematically reviewing and revising the existing supporting documents, and activities to support the implementation of harmonized management of water-related risks in Member States.

Key discussion points:

- Combining the drinking-water, wastewater and recreational water guidelines into one guideline document would be huge and unwieldy. As they are applied by different bodies, keeping them separate is a good idea. In addition, at the country level, swimming pools are a lower priority for many developing countries around the world that are still striving to achieve access to safe drinking-water and basic sanitation for all.

- The Stockholm Framework is high level. There is a need to look at practical implementation of the key elements (e.g. health-based targets, safety plans, surveillance).

- QMRA is the foundation of the drinking-water and wastewater guidelines, not the recreational guidelines. QMRA may not be useful for all three guidelines, because the types of exposure are different. There is a need to review and update the exposure models that support the three guidelines and use of reference pathogens.

- Within the harmonized guidelines, a start could be made on microbial hazards and molecular methods.

- It would be helpful to try to get as much harmonization as possible. However, it may not be possible to harmonize everything. There is a need to be practical about this.

- There is a need for WHO to move beyond wastewater reuse and include agricultural irrigation water quality. There needs to be a closer relationship with the Food and Agriculture Organization of the United Nations (FAO) on issues such as irrigation.

- There is a need for overarching guidance for decision-makers at a high level.
Exposure is a central commonality among the different guidelines. The sum of commonalities can be framed in examples (e.g. catchment examples). The catchment element can be integrated in WSPs, SSPs and recreational safety plans.

Practical management considerations and implications need to be addressed (e.g. how to manage bathing water inputs). During the preparation of the recreational water guidelines volume on spas and swimming pools, WHO did not initially take existing management practices into account, which necessitated a complete rewrite of the guidelines at a late stage.

Three different sets of guidelines should be maintained, as there are three different target audiences (i.e. agencies that deal with only one aspect), requiring separate guidance. However, pulling out the principles that underlie the three sets of guidelines and harmonizing them are supported.

Harmonization is needed at the field level in terms of what tools are going to be provided in the future at the local level to improve water management. A harmonization process is needed at the policy level as well as at the field level.

Volume 3 of the GDWQ should be revised so that it takes into consideration the whole water system, making it a guidance document that is relevant to all three areas and helpful at the local policy level. However, including recreational water issues may be difficult, because the target audience is very different.

The wastewater reuse guidelines are the least understood and the least useful at the country level. A lot needs to be changed in these guidelines. There is a lot of academic text, much of which could be moved into an appendix.

There is a need to look at water and sanitation together, considering the whole water cycle. Harmonization (with separate guidelines) provides an opportunity to point out that other parts of the entire water cycle should be considered.

Different legal authorities manage wastewater at the local level, so implementation of policy is difficult, especially because it is people downstream from a wastewater discharge who may suffer the consequences of the discharge.

Swimming pools and spas are a very distinct situation; the only commonality is water. They may not need to be part of this activity (but WHO can deal with them in concert with other interested agencies); perhaps the guidelines document could be a stand-alone document.

Swimming pools and spas should also be part of the harmonization process, as there are some areas of overlap. For example, the risk factors (both microbial and chemical) are similar to those for drinking-water, although the exposure is different.

Quite a bit of work has already been done on proposing ways to update Volume 3 of the GDWQ (to be discussed later in the agenda). Issues include separating practical guidance from managerial policy guidance and being more explicit on how to integrate wastewater and sanitation (and perhaps recreational water).
Recreational water use needs guidance to prevent guinea-worm exposure; otherwise, the disease dracunculiasis will never be eradicated. Ghana is still struggling with guinea-worm; although nets are used to filter the water to remove the water fleas that have ingested the Dracunculus larvae, children are swimming in the same water—there is no guidance to prevent this.

An overarching document would be useful, along with examples on how Member States can bring these issues together.

Outcomes and key recommendations:

- Revise the P&P manual to include the recreational and wastewater guidelines and the requirements of the WHO Guidelines Review Committee (GRC).
- Develop an overarching policy document to link the three guidelines, including the key principles of the Stockholm Framework, such as health-based targets and safety plans.
- Harmonize the drinking-water, recreational water and wastewater guidelines based on principles outlined in the Stockholm Framework, adopting similar structures and terminology across the guidelines (based on the GDWQ) and highlighting the importance of incremental improvement.
- Harmonize guidance across the three guidelines on:
  - health-based targets;
  - safety planning (including health risk assessment, management and monitoring);
  - QMRA exposure models;
  - surveillance.
- Prioritize the hazards for each of the three waters, focusing on bacteria, viruses, protozoa and helminths as groups.
- Systematically review and update the evidence and recommendations in existing guidelines in accordance with the GRC processes.
- Simplify the guidelines by reducing “academic text”, much of which could be moved into relevant appendices.
- Other areas that could be harmonized: molecular methods, microbial hazards, prioritization of hazards.

2.3 Harmonization of health-based targets

David Cunliffe continued with a presentation on the harmonization of health-based targets (which are being introduced into the Australian drinking-water guidelines). Health-based targets, like QMRA, are a difficult concept to understand. Health-based targets are embedded within the Stockholm Framework (called health targets), which also includes risk assessment, risk management and public health status. They are based on the concept of acceptable risk.

There are four types of health-based targets, as described in chapter 3 of the GDWQ, moving down in terms of complexity: health outcome target (e.g. defined tolerable burden of disease), water quality target (guideline values), performance target (specified removal of hazards) and specified technology target (defined technologies). The drinking-water guidelines define tolerable disease burden as $10^{-6}$ disability-adjusted life years (DALYs) per person per year, which underpins particularly microbial performance targets; the health outcome for chemical guidelines is usually a no-observed-adverse-effect level (NOAEL) or lowest-observed-adverse-effect level (LOAEL) or an excess lifetime cancer risk of 1 per $10^5$ people. Figure 3.1 in the Fourth Edition of the GDWQ was used to illustrate how to set health-based targets:
a water quality target for fluoride, a performance target for *Campylobacter* and a specified technology target for *Cryptosporidium*. The health-based target approach is well developed for the drinking-water guidelines.

Health-based targets can also be applied to wastewater, recreational natural water, and recreational pools and spas. They may not be called health-based targets in the associated guidelines themselves, but they are included in one form or another nonetheless (although not in all cases; there are no performance or specified technology targets for recreational natural water, for example).

David closed his presentation with a discussion about varying the various types of health-based targets. Health outcome targets could, for example, use a tolerable risk of $10^{-2}$ to $10^{-6}$ DALY for microbiological quality or $10^{-4}$ to $10^{-6}$ for excess lifetime cancer risk. Local circumstances should be taken into consideration in determining the appropriate tolerable risk, such as background illness rates, existing issues and costs. For example, if sanitation is the biggest risk, then use of a tolerable risk of $10^{-4}$ to $10^{-5}$ DALY for drinking-water may be more appropriate; similarly, one may want to start with a tolerable risk of $10^{-2}$ to $10^{-4}$ DALY for wastewater use in circumstances where raw sewage is used for agriculture. Varying water quality targets, such as guideline values for chemicals, could include interim targets (e.g. lead in Europe) or form the basis of improvement programmes (e.g. reducing arsenic concentrations to 50 μg/l as a first step towards achieving the guideline value of 10 μg/l). Varying specified technology targets could be linked to health outcomes or separate from them and could involve, for example, disinfecting all water supplies as a first step and then later adding filtration or coagulation to disinfection. Questions to be discussed included: Is a standard approach to health-based targets feasible in all water quality guidelines? How can this be addressed? Are there gaps or modifications required (general or guideline specific)? How can health-based targets be varied based on local contexts?

**Key discussion points:**

- DALYs and QMRA are not being applied because of the lack of understanding of the concepts. How can WHO explain these better? There is a need to consider capacity building in this discussion.

- DALYs are not always used in selecting drinking-water treatment options. Choices are made based on the quality of the source water. *Cryptosporidium* needs filtration; for other microbes, disinfectant concentration × time (CT) values are available.

- DALYs are useful where there are different qualities of surface water and aid decision-making on, for instance, optimizing treatment. DALYs can be useful for larger water supply systems that have data. For the wastewater guidelines, DALYs are quite useful, although specified technology targets can be used instead. The guidelines need to explain this better.

- For small supplies, specified technology targets are more useful. For larger supplies, DALYs are more useful. DALYs are also useful for regulators and in the prioritization of problems or interventions.
- DALYs in per person per year (pppy) should be clarified, as risk level is being confused with actual risk based on, for example, an event. In reality, the frequency and magnitude of events drive the risk for waterborne outbreaks.

- How to treat background levels and how to deal with outbreak incidents are important; otherwise, the system is always operating under outbreak conditions.

- Is there a compilation of examples showing where DALYs have helped big utilities justify what they are doing? Such a compilation would increase their acceptance for each of the health-based targets and illustrate how they can be varied based on local circumstances.

- In response to the comments that DALYs and QMRA are too difficult for stakeholders to comprehend, there is a need to provide a richer set of examples. With certain conditions in the drinking-water system, the magnitude of risk can be estimated with a simplified alternative to QMRA, such as sanitary inspection.

- A matrix would be useful to help people make decisions for incremental improvement. The usefulness of turbidity as an indicator of water quality should be emphasized, and operational monitoring should be linked into health-based targets.

- The need for sanitary inspection and knowing the system should be emphasized. If tools exist that allow this type of analysis, risks can be determined and decisions made as to what needs to be done without necessarily having to calculate a DALY.

- Health-based targets will never replace sanitary surveys, which remain of critical importance. Catchment control is always paramount for the integrated water cycle.

- When discussing health-based targets in one country, the $10^{-6}$ DALY was taken from the GDWQ, and it was assumed that it would apply to that country; there was no discussion about whether or not it was appropriate. If health-based target setting is maintained in the guidelines on the basis of DALYs, there is a need to be far clearer in terms of identifying suitable targets.

- On specified technology targets, there is a certain beauty of using DALYs; only if there is a concrete target can you validate the technology (i.e. determine if the technology delivers what it is supposed to).

- To date, it is not feasible to calculate DALYs for reference pathogens other than those already used in the drinking-water guidelines. The wastewater guidelines are much clearer, with a specific value for a specific use. It is not that clear in the drinking-water guidelines. There is a desire to use $10^{-6}$ DALY for drinking-water, but the guidelines do not provide advice on how to achieve this for source waters with different qualities.

- Health-based targets have proven useful in both the drinking-water and water reuse guidelines, but require work to further improve them. Health-based targets can be applied to the recreational water guidelines.
The health outcome targets are different, but the same types of health-based targets can be included in all the guidelines (currently specified technology for the recreational waters [swimming pools and spas], health outcome target for the wastewater guidelines, all of them for the drinking-water guidelines). An attempt was made by the Drinking-water Quality Committee to unify chemical risks by applying DALYs, but this did not work. Having safety plans in all the guidelines would be a positive step forward.

Outcomes and key recommendations:

- Revise and harmonize health-based target chapters in the water quality guidelines, including offering options for expressing health-based targets in terms of health outcomes, water quality, performance and specified technology and increasing clarity on DALYs and QMRA. This requires revising the drinking-water and wastewater guidelines and including health-based targets in the recreational water guidelines.
- Address DALYs in per person per year (pppy) in the rewritten version of the guidelines.
- Provide an expanded set of examples for QMRA and DALYs and for each of the health-based targets, including how they are derived and how regulators may vary them.
- Provide guidance on how to adapt health-based targets to local circumstances to achieve incremental improvements, including in settings with no or limited laboratories or human resources.
- Include advice on how health-based targets address both background levels and outbreak incidents.
- Provide advice on log reductions for various pathogens by certain technologies in certain waters.

2.4 Capacity building with a focus on health-based targets

The final discussion in this session, led by John Fawell, was on capacity building, which is a high priority in the implementation of the water quality guidelines. John asked for suggestions as to how best to help in capacity building in this area.

Key discussion points:

- To achieve health-based targets, the quality of water must be known. This requires measuring water quality parameters, whatever is achievable in local contexts. This gets back to surrogates or indicators for microbiological water quality. There are indicators for viruses and protozoa, and methods are getting simple and accessible, so their use should be encouraged, rather than relying solely on E. coli measurement. There is also a need for advice on the log reductions for various pathogens by various technologies in certain waters. This information is currently found in academic journals, so there is a need to provide the information in an easy to use form for users in different circumstances.

- There is a need to separate the practical applications of the guidelines from the scientific parts. There is also a need to ensure that there are no systematic inaccuracies in guideline setting (e.g. conversion ratio between coliforms and pathogens) and how the guidelines are applied.
There is a need for guidance on varying health-based targets based on local contexts in settings with no laboratories or human resources. Can default scenarios based on reasonable assumptions be used, as is done in the context of household water? There is also a need to strengthen the rationale in the guidelines to help people who use the guidelines gain confidence in their implementation.

The guidelines need to be explicit and make it easier for decision-makers at all levels to make informed choices. Decision-makers feel vulnerable and risk averse and do not want to make choices. Our role is to say that in this kind of situation, this is the best choice; how to get there is by going through WSPs, etc. There is a need to outline what technologies can be used to reduce the likelihood that adverse outcomes will occur.

Understanding the audience at the regional and country office level is critical. Low-resource countries should be a priority with respect to where capacity building is required, to ensure that what is developed is practical at both the regional and country levels.

A short (16 page) document on helping to implement the GDWQ went out to regional offices but was never finalized. It is now being resurrected, as there is still a need to support countries in developing locally relevant national standards and management systems, partly in response to discussions with regional offices. That is only part of capacity building. There is a need to work with regional offices, particularly where resources are limited, to determine what is needed and what people in the field need in terms of capacity building.

There is a need to be clear about what capacity building is intended to accomplish. For example, WHO, through a consultant, assisted a country in interpreting the GDWQ and developing national standards. The result was guidelines for a very large set of priority contaminants that were not really important but were retained simply because WHO had recommended them, rather than a select number of microbiological and chemical hazards relevant to the local situation.

The guidelines are getting bigger and bigger, and the language is getting more complex. Converting some of the guidance to simpler roadmaps or simplified web tools should be considered.

Outcomes and key recommendations:
- Finalize the paper on use of the GDWQ for developing national standards and regulations and consider expanding it to include the wastewater and recreational water guidelines.
- Convene regional workshops prior to finalization of the paper.

3. WATER QUALITY AND HEALTH EXPERT GROUP AND GUIDELINES DEVELOPMENT PROCESS

This session, chaired by Oliver Schmoll, was on procedural issues and processes, including the new WQTAG and the WHO GRC, which is responsible for reviewing all WHO guidelines.
3.1 Expert group terms of reference

Kate Medlicott opened the session with a presentation on the expert group terms of reference. She reminded the group that the Tokyo consultation in 2010 recommended the formation of a harmonized technical advisory group to cover drinking-water, wastewater and recreational water. The tasks of this expert group, known as WQTAG, are to:

1) Provide an independent and systematic review of the evidence;
2) Support the development of the research agenda by identifying major knowledge gaps and emerging issues;
3) Identify areas in which WHO should develop or revise the water quality guidelines to assist in the interpretation and implementation of the guidelines;
4) Contribute to the periodic updating of the guidelines;
5) Oversee the process of developing the guidelines and supporting documents;
6) Assist WHO in addressing queries from Member States;
7) Contribute regional perspectives to ensure that the guidelines are relevant;
8) Advise on enabling environmental determinants of water quality management (e.g. policy frameworks, institutional arrangements, capacity building).

WQTAG will consist of a pool of up to 40 members serving in their personal capacities, from which the Guideline Development Groups will be drawn. In the selection of members, consideration will be given to attaining an adequate distribution of technical expertise, geographical representation and gender balance. Members will be selected and appointed after consultation with the WHO regional offices. They will be appointed for four years and will be eligible for reappointment, although WHO can also end appointments within the four-year period. Members must contribute at least 10 days per year. Travel and per diem only are covered. Observers may attend and present, but they cannot participate in formulating recommendations. Members must respect the impartiality and independence required of WHO.

WQTAG is the overarching “umbrella” over the three Guideline Development Groups for drinking-water, wastewater and recreational water, with linkages to WHO-hosted networks and with working groups (e.g. microbial and chemical aspects for the drinking-water guidelines) falling out of those groups.

WQTAG is expected to be in place until 2020, aligned with the Water Quality and Health Strategy period. There will be annual or biennial meetings plus teleconferences or videoconferences. Not all members will attend every meeting; members will be invited based on areas of expertise needed for each meeting. Meetings will be conducted in accordance with the WQTAG P&P manual. All recommendations from WQTAG are advisory to WHO; WHO retains full control over any subsequent decisions or publications.

WHO needs to demonstrate transparency in the selection process for the pool of experts for WQTAG. The Secretariat will issue a public call for nominations for membership. Potential new members will augment longstanding expertise, and mentoring should be built into the composition of the group. Nominations will be reviewed against composition criteria and finalized in the third quarter of 2013. The call for nominations will also seek other expert roles (e.g. peer review, consultants, rapid responders).
Key discussion points:

- The WQTAG Terms of Reference have been reviewed by the legal group at WHO and are considered finalized.

- There will be an international call for experts. Once the Secretariat receives responses from the call for nominations, it will make selections based on technical expertise, geographic representation, coverage of the three waters and gender balance.

- There is an imbalance in membership of the working group towards Europe and the USA. Many factors that have been discussed may be viewed differently in different regions, particularly developing regions; a more balanced view is needed. There will need to be careful consideration of geographic balance when selecting the membership of the WQTAG.

Outcomes and key recommendations:

- Establish the WHO Water Quality and Health Technical Advisory Group (WQTAG).
- Establish three Guideline Development Groups (drinking-water, wastewater, recreational water), with cross-membership to support harmonization of the guidelines. Membership of the Guideline Development Groups will be drawn from the WQTAG.

3.2 Guideline development at WHO

Susan Norris of the WHO GRC gave a presentation (by teleconference) on guideline development at WHO. A WHO guideline is defined as any document that contains WHO recommendations about health interventions (clinical, public health or policy interventions). There are four types of guidelines at WHO; the two that are most likely relevant to this group are standard/focused advice and comprehensive advice (although rapid advice, in the case of a public health emergency, may also be relevant).

The GRC at WHO was established in response to a 2007 paper by Oxman et al. in The Lancet that was highly critical of WHO guidelines, stating that they were insufficiently transparent and not evidence based. The role of the GRC is to develop and implement procedures (contained in the WHO Handbook for Guidelines Development) to ensure that WHO guidelines are consistent with internationally accepted best practices, appropriately based on evidence and transparent.

Susan outlined the nine steps involved in guideline development at WHO. The GRC approves the guideline development proposal early in the process and then approves the final guideline before publication. GRADE (Grades of Recommendation Assessment, Development and Evaluation) is a framework used to grade the quality of evidence and the strength of the recommendations. The GRADE approach examines five domains of quality to permit judgement of the overall quality of the body of evidence for each outcome. Recommendations are judgements based on this quality of the evidence as well as on trade-offs between benefits and harms, values and preferences, and resource uses. The strength of a recommendation reflects the extent to which there is confidence that the desirable effects of a management strategy outweigh the undesirable effects.
Challenges to producing high-quality guidelines at WHO include the paucity of evidence, the low quality of the evidence, resource constraints, diverse user needs, the need to create global guidelines based on regional/local evidence and the remaining culture of expert opinion.

In summary, WHO guidelines must meet the highest-quality standards for evidence-based guidelines, be based on high-quality systematic reviews of all relevant evidence, use GRADE to assess the quality of the evidence and to translate the evidence to recommendations, incorporate multiple processes to minimize bias and optimize usability, and incorporate transparency in all judgements and decision-making.

Key discussion points:

- The 2007 paper by Oxnam et al. did not specifically refer to the drinking-water guidelines but was an across-the-board criticism of WHO guideline development processes.

- It was unclear how this GRC approach would be applied to these guidelines, where the solutions involve engineering and protecting source water quality.

- Achieving safe water involves interventions, and the evidence on which they are based may be anecdotal or case-studies, not necessarily observational data. While these types of standards may lie outside the purview of the GRC, the principle of using the highest-quality evidence needs to underlie the guidelines.

- Keeping pathogens out of the water involves looking to evidence on waterborne outbreaks, but also taking into consideration randomized controlled trials and clinical evidence.

- The GRADE approach for assessing the quality of evidence came from randomized controlled trials. The GRC recommends the use of this approach, as the domains are applicable regardless of the type of data being used.

- Some evidence for the guidelines comes from other organizational sources, such as chemical risk assessments done by the food safety groups, the Joint FAO/WHO Expert Committee on Food Additives (JECFA) and the Joint FAO/WHO Meeting on Pesticide Residues (JMPR). It may be difficult to meet some criteria for evidence quality when the original evidence comes from another group that may not be going through this process. In addition, the end-point in GRC processes is epidemiology, but the water guidelines use QMRA, which provides more compelling evidence than epidemiological evidence in some cases, where there are so many confounders when looking at an epidemiological end-point like diarrhoea.

- If there is a lack of epidemiological data, there is a need to be able to defend the approach used and to justify the use of guideline values. Evidence from other sources can be tricky, but needs to be taken into consideration as part of the evidence quality assessment. When the quality of data from sources cannot be totally verified, as long as it is clearly identified and explained it should be fine.
Guideline values for chemicals are generally not re-reviewed for each edition of the GDWQ. Is there a need to re-evaluate all guideline values for a new edition, even if they have not been changed from one edition to the next?

Ideally, GRC standards should be met for every guideline value being recommended, but this may not be feasible. There is a need to lay out plans for the next years or decades. For example, the WHO international travel and health guide does not meet the GRC standards, but the authors of that guide submitted a proposal to GRC that shows their plan for moving in that direction, starting with one disease and adding more and more diseases to each publication that meet GRC standards.

The expert group will need to be clear about what is a recommendation, base all decisions on the best available scientific evidence and track this decision-making process. This approach will be incorporated into the P&P manual.

The GRC approach is good practice. Development of a guideline document needs to be in step with international practice, ensuring a transparent and credible process.

There are resource implications to all of this. In responding to the GRC requirements, care is required, as more work will hamper the development of the guidelines.

Outcomes and key recommendations:

- Seek clearance from the WHO GRC for the development of the GDWQ and GDWQ Volume 3. Clearance for the other water quality guidelines will be pursued later on if needed.
- Ensure that the guidelines are developed in a transparent, credible process. The GRC requirements will support this objective.

3.3 Policies and procedures for updating the WHO water quality guidelines

Phil Callan closed the session with a presentation on policies and procedures for updating the WHO water quality guidelines. The current P&P manual has been used as a guide for the development of the GDWQ, and there is a need to revise the manual to support the Water Quality and Health Strategy and the harmonization of the water quality guidelines for drinking-water, wastewater and recreational water and to align with GRC processes.

The revised structure will include a background (purpose and content, background information on the guidelines, role of GRC, application of the guidelines), basic principles (for all three waters) and committee procedures (Steering Committee, WQTAG, Guideline Development Groups and working groups, with cross-representation between groups). Other sections will include guidance on good practice/implementation of water quality guidelines, guidance for microbial safety and guidance for chemical safety. There will also be several annexes at the end of the document.

If the water quality guidelines are identified as guidelines by the GRC, a number of steps will need to be followed, and the GRC will need to look at the guidelines at two stages. For all other supporting documents, a similar process is followed, but without submission to the GRC and without the requirement for final clearance by the WHO Assistant Director-General. GRADE will probably not work with the water quality guidelines, but an assessment of the quality of the evidence should still be carried out.
GRC requirements include a Steering Committee (an internal WHO group), a Guideline Development Group, formal planning and scoping assessment, peer review throughout, initial planning clearance through the GRC, evidence retrieval and systematic review of the evidence, evidence quality assessment (GRADE), public domain consultation and GRC final clearance. It was emphasized that the GRC does not review the scientific or technical content, just the process followed.

Major changes include incorporating recreational water and wastewater into the P&P manual, the introduction of WQTAG, the GRC process and how it impacts this process, and WHO Secretariat and final clearance procedures.

**Key discussion points:**

- GRADE is not applicable to public health applications, just clinical applications. What is available for public health? There are other processes to address public health interventions, such as the modified GRADE (GRADE+), which is used in the indoor air quality guidelines at WHO.

- With respect to a systematic review of the evidence, how far back do you go?

- If the guidelines need to go through the GRC process, a systematic review is needed for every recommendation, starting with the higher-priority ones and developing a plan to progressively address the other ones.

- There is a need for regular communication between the different levels at WHO, from WHO HQ to the regional and country levels, regarding the guidelines development process. Similar processes at the regional level will be subject to the same sort of rigor.

- Peer review is required throughout the guidelines development process per GRC requirements. Adding the different layers of peer review elements may affect our overall planning in terms of timing.

- The draft P&P manual was made available to expert group members. The WHO Secretariat requested that participants look at the draft and send in their comments (not editorial comments, just comments of substance) within the next 4 weeks.

**Outcomes and key recommendations:**

- Update the P&P manual to include wastewater and recreational water, the requirements of the GRC and the WQTAG.
- Comments from meeting participants on the draft P&P manual are invited.

**4. FEEDBACK ON GUIDELINES FROM WHO REGIONAL OFFICES: PERSPECTIVES ON THE WORKPLANS**

The theme of capacity building was continued in this regional session. The WHO regional offices were asked to elaborate on their perspectives in terms of needs and capacity building to facilitate practical application of the water quality guidelines.
4.1 WHO Regional Office for Africa

Magaran Bagayoko shared challenges and issues related to water in Africa. In Africa, provision of safe drinking-water is the first priority of the top 10 priorities in the Luanda Commitment on implementation of the 2008 Libreville Declaration on Health and Environment in Africa\(^2\) to be addressed in the years to come. WASH was identified as a priority in 22 countries that have completed their Situation Analysis and Needs Assessment (SANA) in the context of the Libreville Declaration. The 2010 JMP report\(^3\) showed that in eight countries in sub-Saharan Africa, less than half of the population has access to improved drinking-water; in 18 countries, less than a quarter of the population uses improved sanitation facilities. Very few countries in Africa are on track to meet the MDG drinking-water or sanitation target.

Some challenges are that although the MDGs are simple, valid, measurable and realistic, they do not address disparities; there are deficiencies in governance of the sector, with weak investment and weak enforcement of laws and regulations; there is a plethora of partners and stakeholders, including public ministries, private companies and NGOs; and there are significant shortcomings in the infrastructural, technical and institutional capacity of the sector, including obsolescence and deterioration of equipment, insufficiency of water sources in rural areas, inadequacy of means and competencies for water quality control, and rapid and unplanned urbanization resulting in low coverage.

Additional challenges include climate change (drought); contamination of drinking-water catchments and sources (animal faeces, inadequate disposal of human or animal waste); contamination in the distribution system (leaky pipes, obsolete infrastructure, inadequate maintenance); unhygienic handling of stored household water, particularly in rural areas; rapid population growth and urbanization; the systematic monitoring and treatment of water from wells and other sources; limited size of water samples tested versus quantity of water supplied; and the paucity of real-time water quality data for evidence-informed decision-making.

Still other challenges include the disparity of recreational waters in urban and rural areas: in urban areas, they include private swimming pools, national or municipal pools and beaches, whereas in rural areas, they include natural sources, rivers, streams, lakes, beaches and man-made ponds that are also used for other purposes (e.g. drinking, agriculture). In addition, there is a risk of schistosomiasis, guinea-worm and other waterborne diseases; surveillance is not carried out; and treatment is done on an ad hoc basis.

Volume 2 of the wastewater reuse guidelines states that wastewater treatment is of low priority if the local incidence of diarrhoeal disease is high and other interventions are more cost-effective in controlling transmission. It is recommended that a standard be established for a locally appropriate level of tolerable additional burden of disease based on the local incidence of diarrhoeal disease.

Recommendations and perspectives on the water quality guidelines workplan include developing a short and straightforward framework besides the guidelines; reducing the size of the different guidelines; fast-tracking and scaling up implementation of WSPs; agreeing on


core indicators for routine surveillance with emphasis on those most relevant to health, and proposing threshold and policy action deemed to reduce and prevent risks; promoting the use of health-based targets as a means of evidence-informed decision-making; putting emphasis on standards for faecal indicator bacteria in the verification of safe water; promoting the Small Community Water Supply and Management Network; promoting household water treatment and storage; supporting efforts by ministries of health to document and disseminate experiences in drinking-water in relation to the management of waterborne disease epidemics; and supporting efforts by ministries of health to strengthen and extend the system of monitoring the quality of drinking-water, including the technical capacity of the WASH department.

In addition, JMP and GLAAS should benefit from SANA (review SANA tools to collect data required in JMP and SANA); a network of Collaborating Centres (e.g. memorandum of understanding between WHO and Water and Sanitation for Africa) should be established; there is a need for capacity building (in the context of climate change) and a capacity-building needs assessment; and sanitation should be considered as a determinant of water quality.

4.2 WHO Regional Office for the Eastern Mediterranean

Hamed Bakir informed the group that the 22 countries in the WHO Eastern Mediterranean Region were very diverse, ranging from high income to middle income to very low income. In terms of 2010 drinking-water service coverage and the MDG water target, 89 million people remain without coverage; for sanitation, 191 million remain without coverage. WASH is losing ground at WHO and in the public health sector (which should perform a regulatory and surveillance role) in Member States and needs to be raised in priority.

The regional context of water and public health includes the main issues of climate change, water scarcity, funding base, and regulatory and institutional capacities. These are linked to public health (water and sanitation–related disease and malnutrition) via insufficient and interrupted domestic water supplies, water quality degradation, delayed extension of water services to the unserved, desalination for water supply, wastewater used in the irrigation of food crops (not avoidable and may be unregulated), reduced food production and food insecurity.

In the area of governance, countries are expected to strengthen and revitalize the public health role in the WASH sector; integrate preventive water safety management in the updating of drinking-water quality standards; enforce national standards on wastewater use in irrigation; develop national policies on water security requirements for public health protection; and allocate budgetary resources for sustaining and extending WASH services. Existing tools at WHO to aid countries include the GDWQ, the safe wastewater use guidelines, the safe drinking-water from desalination guidelines (but there is a need for more guidance on desalinated water and health), and the guidance on water quantity requirements for public health (currently under development).

In the area of prevention and reduction of risk factors, countries are expected to sustain existing WASH services; accelerate the extension of WASH services to the unserved and improve service to the underserved; implement preventive drinking-water safety management protocols (WSPs); implement a management system for the safe use of wastewater in irrigation; and implement measures to secure sufficient water resources for drinking-water
supplies. Existing tools at WHO include the JMP report, the WSP manual, the GDWQ, the guidelines on safe wastewater use and the guidance on water quantity requirements (under development).

In the area of surveillance, monitoring and evaluation, countries are expected to strengthen their national capacities and processes for sector monitoring, strategic assessment and analysis; strengthen the public health surveillance of drinking-water safety; and strengthen the public health surveillance of the use of wastewater in irrigation.

4.3 WHO Regional Office for Europe

Shinee Enkhtsetseg announced that Roger Aertgeerts had retired from the WHO Regional Office for Europe and that Oliver Schmoll would be taking over his position in May of this year.

There are 53 countries in this region, with diverse needs and problems. In the WHO European Region, two policy frameworks guide the work of the regional office: the Parma Declaration on Environment and Health4 and the Protocol on Water and Health5. Priority areas identified by the Parties to the Protocol include strengthening surveillance of drinking-water quality, particularly in low-resource settings, scale-up of safe management of water and sanitation facilities and small-scale water supplies in rural areas.

A detailed analysis of JMP data on the use of improved drinking-water sources and improved sanitation facilities shows significant disparities between access and equity for urban and rural regions and between poor and rich populations within countries. For example, in rural areas, there is a lack of maintenance of water supply infrastructure and many small-scale supplies. Less than a quarter of the population has a piped water supply in rural areas of some countries, but 89% have piped water on premises overall.

The issue of laboratory capacity was raised. Very few countries report disease incidence. This does not mean that there is no disease incidence; rather, the lack of laboratory capacity (and limitations of the general surveillance structure) leads to underreporting of these diseases (e.g. campylobacteriosis and cryptosporidiosis, for which many countries have no data).

Feedback from the WHO Regional Office for Europe on the development of the water quality guidelines included the following:

- For the GDWQ, there is a need for countries to have guidance on priority parameters for water quality monitoring to avoid a high number of unnecessary tests.
- Guidance on a risk-based water quality monitoring programme is needed.
- Volume 3 on small community supplies needs to be updated (and the WHO Regional Office for Europe would like to actively contribute to this update).
- A practical manual of laboratory analysis procedures for priority parameters would be very useful.
- A review of existing field test kits and provision of advice on effective rapid testing methods are needed.

4 http://www.euro.who.int/en/who-we-are/policy-documents/parma-declaration-on-environment-and-health
• Fact sheets on Legionella, Cryptosporidium and nitrate and nitrite are requested.
• For the wastewater reuse guidelines, SSPs need to be developed.
• Guidance on cost-effective technologies for small-scale communities is needed.
• Health risk assessment of greywater reuse is needed.
• The update of Volume 2 of the recreational water guidelines is requested due to its high relevance to many Member States of the WHO European Region.
• There is a need for clear formal mechanisms for updating the guidelines.

In terms of capacity-building needs, dissemination of already available documents, including their translation into Russian, is needed, as are methodological training for practical application of the guidelines, cost-effective surveillance approaches, strengthening regulatory frameworks and analytical laboratory training. Also, a roster of experts should be deployed in order to organize quick responses in emergency situations.

4.4 WHO Regional Office for South-East Asia

Payden informed the group that although the region has 90% water supply coverage, people do not know how much is safe to drink. Sanitation coverage, in contrast, is low, with only 40% having access to improved sanitation facilities. Wastewater reuse in agriculture is very common and quite unregulated, and its impact on the health of people eating the agricultural products is unknown. Rainwater harvesting is a major source of water in several countries (e.g. Myanmar, Bhutan, Maldives). WSPs were introduced in 2004 and have been implemented or are in the pilot phase in several countries, providing valuable lessons learnt. Most countries have water quality guidelines, but most do not implement them.

Microbiological contamination is of most concern at the household level and in the distribution system, although nitrate is a chemical contaminant of some concern in certain countries. The WHO Regional Office for South-East Asia has supported Timor-Leste in developing standards based on water quality information. A few parameters of concern were selected based on water quality results, and very simple guidelines were developed. If the guideline documentation is more than 20 pages long, it will not be read in many countries. Drinking-water often needs to be stored for long periods, and poor hygienic storage practices are carried out in many homes. Naturally occurring arsenic and fluoride are issues of concern in some countries, and uranium is an emerging issue. The WHO drinking-water guidelines have been used in many countries, which simply adopt the WHO guideline values, except for arsenic, whose guideline value is too low for most countries to achieve.

In terms of feedback on the water quality guidelines, some chapters are not easy to understand and should be made simpler and more practical. There is also a need to supply countries with copies of the GDWQ. Although the four volumes of the wastewater reuse guidelines were introduced in a workshop, countries have not been implementing these guidelines, as they are not easy to understand. Also, there are many stakeholders, and the roles of the various agencies need to be clarified, as many countries do not know who is supposed to implement these guidelines. The recreational water guidelines are not a priority in the WHO South-East Asia Region, as it is still grappling with drinking-water and wastewater issues. An overarching document with a harmonized set of guidelines is a good idea, but it needs to be simple and easily understood, as the WHO Regional Office for South-East Asia does not have experts at the ground level.
In terms of priorities, the WHO Regional Office for South-East Asia questions why the guideline for manganese was removed from the WHO drinking-water guidelines; when a guideline value is removed, it suggests that it is not important and that there is no need to worry about the chemical. The WHO Regional Office for South-East Asia would like WHO to address this issue. For fluoride, which has different levels of exposure, it is confusing that some people promote fluoridated toothpaste whereas others do not advocate it; this needs to be better explained. When asked by Member States which household water treatment technologies should be used, Payden advises reverse osmosis, to be on the safe side, but this technology is not affordable by all; advice from WHO on what household water treatment technologies should be used in various situations would be appreciated. In this regard, the importance of the evaluation scheme for household water treatment technology was noted. WSPs are useful and should be continued in the next edition. The wastewater guidelines should be more useful and should incorporate SSPs and industrial wastewater. Tools are needed to determine whether sanitation systems are functioning.

There is a great need for capacity building. Health-based targets are not understood. In WSPs, the water quality standard (guideline value) is the target. In terms of implementation of the guidelines, the guidelines are launched and shared on the WHO web site; there is a need to engage with countries, to determine whether the guidelines are addressing their needs. There is a need to identify gaps to be addressed in the next edition. There is also a need to look at water quality surveillance by ministries of health and see whether it can be linked with disease surveillance.

The WHO Regional Office for South-East Asia has been receiving expert advice from John Fawell and Kathy Pond; questions were forwarded to them, and the regional office received very timely advice. This advice was much appreciated, and the WHO Regional Office for South-East Asia would like to see that continue.

4.5 WHO Regional Office for the Western Pacific

Nasir Hassan informed the group that the WHO Regional Office for the Western Pacific is one of the regions with the least number of professionals at the regional office, so he is required to deal with issues ranging from water to asbestos. However, almost all countries have an environmental health officer and deal with WASH. The WHO Regional Office for the Western Pacific is in communication with WHO HQ (e.g. Jennifer De France, Bruce Gordon) for advice.

It is crucial to align with the public health sector; to know the disease burden resulting from the water exposure route, particularly for children under the age of 5 years; and to have strong burden of disease information. The most recent data set is from 2004 and is not helpful.

There was no funding to disseminate the Fourth Edition of the GDWQ to countries within the WHO Regional Office for the Western Pacific. The Fourth Edition was also very difficult to understand, particularly for the non-health sector. There is a need for simple, practical guidance; otherwise, it is not useful. Revision of the GDWQ is recommended, as well as the provision of some funding to regions for dissemination at the regional and country office levels.
The WHO Regional Office for the Western Pacific shares many issues with other regions, such as diarrhoea, cholera and other waterborne diseases. Arsenic is a problem in Mekong countries. It needs to be remembered that provision of water is not the same as access to safe water.

4.6 WHO Regional Office for the Americas

Paulo Teixeira agreed with what his colleagues had already said. The region, which is very diverse, covering 35 countries from the USA to Haiti and Guyana, recognizes the GDWQ as one of the most important WHO publications, but the wastewater guidelines are not so well used in the region. The new additions to the Fourth Edition, such as climate change, the expansion of household water treatment, pharmaceuticals and pesticides used for vector control, and the continued emphasis on WSPs are important components of the GDWQ. In the future, perhaps the GDWQ could include more advice on adaptations to local scenarios and consider human rights and equity.

In terms of surveillance, just a few countries in the region have drinking-water surveillance, and the number of parameters being monitored is insufficient. The Pan-American Health Organization (PAHO) is working to develop this in the region, but almost all environmental health units within the ministries of health have disappeared over the last 10 years. If there is no counterpart, it is difficult to implement the guidelines, and there is a need to formally re-establish a strategy to improve environmental health capacities within the ministries of health. WASH is a public health function, and therefore the ministry of health plays an important role. The guidelines should be more explicit on the role of the various ministries in their implementation. Other comments included the small number of laboratories with the capacity to analyse viruses in water, the incompatibility of the lead guideline value with the JECFA recommendation and lack of analytical capacity for radionuclides in most of the countries in the region.

The Fourth Edition will continue to be an essential reference for WASH. It promotes WHO leadership and will be a key component of the region’s water quality strategy. We must multiply our efforts to cooperate with Member States to guarantee water quality and health for all.

4.7 Summary and discussion

Michèle Giddings summarized the main points raised during the regional presentations: rural versus urban disparity; the need for SSPs; water security; affordable household treatment technology (the Household Water Treatment and Safe Storage Network could help identify appropriate technologies); laboratory capacity at both environmental and disease surveillance levels; water supply infrastructure; and the need for water quality guidelines written in simpler language.

Key discussion points:

- David Cunliffe and John Fawell have been working on a document on adapting the water quality guidelines to local situations. A stand-alone document may be useful, but text on incremental improvement and varying targets needs to be incorporated into each guideline. The wastewater reuse guidelines are a good example, where sensible on-site controls may be more appropriate than fancy treatment systems.
Regarding simplification and adapting to local circumstances, there is a need for simple documents appropriate to the local context that are translated into local languages; these could be simplified versions of various chapters of the guidelines.

Regarding laboratory capacity, there are emerging methods for microbiological analysis that are sensitive and field portable. Supporting guidance should be developed for user-friendly methods that can be put into practice in the absence of laboratory capacity.

Countries often consider that they need to invest in expensive reference laboratory facilities. WHO should state whether this is necessary or whether alternatives are sufficient in various contexts.

In terms of simplified documents, perhaps countries should initiate them, rather than WHO HQ. This would help to ensure that the documents are compatible and applicable. WHO HQ can then respond to the documents, rather than the other way around.

Information on the rate of adoption of non-treatment options in Africa would be useful.

Outcomes and key recommendations:
- High-priority areas identified by the WHO regional offices include:
  - Ensuring that future versions of the guidelines are more practical, including reducing the size and complexity of the guidelines;
  - Fast-tracking and scaling up implementation of WSPs;
  - Supporting capacity for development of health-based targets;
  - Strengthening surveillance of drinking-water quality and waterborne disease, particularly for resource-limited settings;
  - Strengthening management of small-scale water supplies;
  - Disseminating experiences with managing waterborne disease epidemics;
  - Fluoride, manganese, nitrate/nitrite, *Legionella* and *Cryptosporidium*;
  - Improving household storage;
  - Providing guidance on sanitation safety planning;
  - Impact of climate change on water availability/scarcity;
  - Strengthening laboratory capacity and developing a practical manual of laboratory analysis procedures.
- Consider developing supporting guidance on laboratory capacity, particularly for emerging methods for microbiological analysis that are sensitive and field portable.
- Consider developing advice on reference laboratories (whether these are necessary or if alternatives are sufficient) as a central strategic point regarding building up a surveillance system.
- Simplify guidelines by reducing “academic text”, much of which could be moved into relevant appendices.
- Consider separating the practical applications of the guidelines from the scientific parts.
5. CROSS-CUTTING ACTIVITIES INCLUDED ON THE GDWQ POST–FOURTH EDITION WORKPLAN AND WATER SAFETY PLANS

5.1 Vulnerable groups

Ana Maria de Roda Husman gave a presentation on vulnerable groups. The Final Task Force meeting in 2003 recommended that guidance be developed to address the specific concerns of vulnerable groups for the Fourth Edition of the GDWQ. The purpose was to provide guidance on means to identify vulnerable groups in geographic regions, explore reasons for their increased risk (e.g. pregnant, immunocompromised) and use this information to propose effective action for reduction of waterborne disease in vulnerable subpopulations.

For the Fourth Edition of the GDWQ, expert group meetings, consultations with WHO and meetings with outside experts were held. Definitions were developed; for example, a “vulnerable subpopulation” was defined as a group of people who suffer greater disease burden by frequency, clinical severity and impact of disease over their lifetime compared with the general population in that geographic region. In addition, terminology was harmonized throughout the GDWQ, and text was developed for chapters 6 and 7.

With regard to harmonization of the guidelines, Ana Maria examined the three water quality guidelines for their use of the term “vulnerable”. The word was rarely used in the recreational water guidelines but was used several times in the wastewater reuse and drinking-water guidelines. Vulnerable groups are also mentioned in other important wastewater and drinking-water documents.

There were some commonalities (it is important to identify vulnerable subpopulations in local settings, but no advice is given on who they are, how to look for them or which interventions are appropriate for which vulnerable group) and differences (nutritional status is a determinant of vulnerability in the wastewater reuse guidelines, but not in the drinking-water guidelines). In addition, there are different routes and levels of exposure of vulnerable subpopulations to the three waters (e.g. ingestion/inhalation for drinking-water and dermal exposure for recreational water), different health outcomes for vulnerable subpopulations and different target audiences. Vulnerable subpopulations need to be considered within the overall WHO framework.

Questions raised for discussion were: How should vulnerable subpopulations exposed to different waters under different local circumstances be identified? How should risk be assessed for vulnerable subpopulations? Should health-based targets be set for vulnerable subpopulations or show greater health and/or cost benefits for these populations?

Key discussion points:

- For recreational water, reference is made to type of user rather than vulnerable population, because the highest risks are not microbial or chemical (e.g. risk factor for drowning is male, adolescent and drunk).

- Ingestion of recreational water is a particularly important route of exposure for children. Children also spend more time in the water. Studies have shown that children have a higher susceptibility to gastrointestinal illness from recreational water exposure.
Children are at greatest risk from radiation in drinking-water. This should be considered in the guidelines.

An issue that needs to be addressed is demographic change as the elderly population increases.

Diet and nutritional status may be important in terms of vulnerability to chemical exposure.

It is difficult to obtain data on vulnerable populations, especially children.

The WHO workshop on heterotrophic plate count in 2003 provided guidance on WHO’s position on providing safe drinking-water for the general population. A person with special needs (e.g. a person with human immunodeficiency virus [HIV]) may need some different intervention. In addition, use of recreational water is a personal choice, unlike drinking-water.

The guidelines do not ignore the issue of vulnerability: the lead drinking-water guideline value is based on children, and the guidelines on recreational water take into consideration that children spend more time in the water and swallow more water. Trying to be all things to all people has led to the guidelines being so large in the first place. Dealing with vulnerable subpopulations when trying to provide safe water around the world is problematic.

Vulnerable subpopulations do not necessarily need to be included in the guidelines.

The Household Water Treatment and Safe Storage Network is promoting treatment and safe storage for vulnerable populations, as use by these subpopulations is likely to have the most impact.

There is a need to harmonize the standpoint on vulnerable groups in the overarching document. The guidelines are applicable to children and the elderly, and so this is within the scope. There is a need to include a consideration of vulnerable groups. There is a need to further the evidence base on this. If there are more data on susceptible populations, then perhaps the guidelines can consider this further.

Vulnerable groups are a developed country issue, but guidelines are for both developed and developing countries.

Outcomes and key recommendations:

- Questions that should be considered in future iterations of the guidelines include:
  - How should vulnerable subpopulations exposed to different waters under different local circumstances be identified?
  - How should risk be assessed for vulnerable subpopulations?
  - Should health-based targets be set for vulnerable subpopulations or show greater health and/or cost benefits for these populations?
- Ensure that future iterations of the guidelines present vulnerable groups more consistently and harmonize the standpoint in the overarching document.
5.2 Indirect potable reuse

John Fawell gave a presentation on planned indirect potable reuse of treated wastewater. It was proposed that WHO produce guidance on this wastewater reuse. Pressure on water resources due to climate change, increases in population and the increasing size of cities has led to the proposal for and, in some cases, the implementation of planned indirect (and perhaps direct) reuse of wastewater in many countries. The end product of treated wastewater would be used to augment drinking-water sources or replace drinking-water for non-potable uses in urban areas.

A number of schemes are being considered in many parts of the world. One proposal being considered is for a water supplier working in an area of water stress who wants to collect and treat wastewater and put it directly into the drinking-water reservoir or feed it upstream of the intake.

The requirement is for internationally recognized guidance to assist regulators, providers and health professionals. It would help support the population’s perception of the acceptability of, and need for, these processes. The guidelines would take the form of a stand-alone document that sets the WHO guidelines into the particular context of potable reuse, which fits with a number of ongoing initiatives, such as the desalination guidance. Other national guidance documents are also available. It is a very appropriate addition to the WHO guidelines, to ensure a focus on public health. Is this something for WHO to consider?

Key discussion points:

- It is timely for WHO to consider water reuse. Issues to be considered include the social acceptability and technological aspects.

- Having water quality guidelines would provide an incentive to countries to improve their collection of wastewater. It provides a basis for countries to start thinking about how to address wastewater management.

- Indirect potable reuse is already happening around the world, and direct reuse of wastewater is being implemented. WHO has the responsibility at the global level to take this up; however, what form this guidance should take is not yet clear.

- Is this about improving communication or establishing guidelines?

- Three or four different activities are aiming in the same direction, such as the United States Environmental Protection Agency’s (USEPA) Guidelines for Water Reuse and the development of direct reuse guidelines by the International Organization for Standardization (ISO) at the request of China, Japan and Israel. Is there any way to integrate these? There is a lot of information out there, but it needs to be put into a form from which one can draw the conclusions that you will achieve high-quality water if you do this properly.

- This is an important topic that needs to be addressed. It should be extended further to other sources of marginal water quality, such as water from combined stormwater and sewers and water collected from runways.
There is a need to differentiate between institutionalized and household reuse, as a different level of treatment would be required.

Outcome and key recommendation:
- Guidance on indirect potable water reuse should be developed.

5.3 Quantitative microbial risk assessment

Lesley Vázquez-Coriano gave a presentation on understanding and applying QMRA. This project has been carried out by Susan Petterson, Gertjan Medema, Lesley Vázquez-Coriano and Maggie Montgomery (WHO) and is supported by the USEPA.

QMRA supports preventive, risk-based approaches to managing water quality (WSPs and SSPs). QMRA allows for scientific evidence from a diverse range of contexts to be quantitatively interpreted in a systematic and objective manner. There is currently a lack of comprehensive documents on QMRA with an applied perspective.

The QMRA document that is currently nearing finalization aims to increase understanding of the four QMRA components (problem formulation, exposure assessment—which includes all pathways, from drinking-water, wastewater reuse and recreational water—health effects assessment and risk characterization); suggests approaches for key challenges (how to use and interpret scientific evidence, how to deal with uncertainty, how to facilitate risk management); and illustrates its application through case-studies (e.g. Cryptosporidium risk from drinking-water systems, health benefits and costs of surface water treatment). The audience for the document is regulators, policy-makers and implementers involved in managing and mitigating water quality risks.

Selected chapters are on interpretation of the evidence (sampling strategy, analysing data from microbial methods, inference of pathogen information from data on indicator organisms, exposure volume and frequency, barrier efficacy and application of dose–response models), use for decision-making (objective must be clearly defined between risk assessor and manager; assumptions, data and methods transparently described; variability and uncertainties identified) and in practice (QMRA for improved system understanding, for system management and for setting regulatory targets) as well as case-studies from all three waters (how was QMRA performed and how did it benefit risk management), each of which follows the same format.

Next steps are to complete the document, send it for external expert review in April/May (expert group meeting participants are asked to review it if possible), revisions and editing in June/July and publication in August. Subsequent activities could include short, simple companion pieces on the continuum of risk assessment and management, joint QMRA and quantitative chemical risk assessment (QCRA) in specific countries (Ethiopia, India), training (toolkits, courses) and future workshops (e.g. 2013 Symposium on Health Related Water Microbiology).

Key discussion points:
- It is important that this document address weaknesses and uncertainties in the use of QMRA. It must make people aware that although QMRA is a powerful tool, its weaknesses must be understood in order for it to be used appropriately. There is
confusion even among participants at this meeting: although one stated that QMRA is used to estimate risks and compare them with health-based targets, not to calculate health-based targets, another pointed out that it is not correct to state that QMRA is not used to calculate health-based targets; it is embedded in DALYs.

- The authors are aware that QMRA is a tool that has not been used properly because of misunderstanding and limitations. The case-studies in the three different media should address those concerns. The authors were limited in developing the case-studies based on limited data, which makes QMRA not as easy to do. How can the issue of limited data be addressed?

- In low-resource settings, there is the big issue of no data. It will be important to see the extent to which the document acknowledges and addresses that situation. This is the biggest challenge to universal application of the document. In low-resource settings, other tools such as sanitary surveys may be more useful.

- Laboratory capacity for estimating viruses or pathogens can be useful in research settings. Laboratories should make available the data and knowledge that they have. Every country does not need to have a reference laboratory.

- It is important to realize that rapid assessment is a very useful approach in small community supplies or low-resource areas.

- QMRA is perceived as a pass/fail exercise, which it should not be. It provides an opportunity for better system understanding. It is important to be honest with respect to the shortcomings of the methodology and how QMRA can support decision-making. This needs to be made clear in the document.

- QMRA is not “the” tool; it is one complementary tool that can support decision-making.

- A lot of work has been put into the QMRA document. One of its purposes is to make QMRA more accessible to people. During the final review, it might be useful to have someone not familiar with it to make sure it is understandable.

Outcomes and key recommendations:

- Progress was noted on development of the QMRA document, and peer reviewers were identified.

- Items that should be addressed in the QMRA document include:
  - the weaknesses and uncertainties in the use of QMRA;
  - when and in what situations QMRA should be used;
  - its applicability in data-limited situations;
  - highlighting that QMRA is a complementary tool (and not THE tool) for decision-making.

- A number of potential next steps post-finalization of the QMRA document were presented, including short, simple companion pieces, training and future workshops. As agreements were not reached on this during the meeting, potential follow-up activities will be looked into during the peer review phase of the document.
5.4 Update on water safety plans

Jennifer De France provided an update on WSPs at WHO. The WSP manual\(^6\) was published in 2009, and a manual on water safety planning for small community water supplies\(^7\) was published last year. Other resources include the WSP quality assurance tool, a WSP case-study guide and template, a roadmap to support country-level implementation of WSPs, the WSPortal and WSP training materials\(^8\).

Resources under development include WSP risk assessment tools for small community water supplies; guidance on WSP auditing; applying the WSP approach to identify, manage and mitigate climate change–associated risks; water quality control in distribution systems; protecting surface water for health; WSPs and operations and maintenance; and WSPs and equity.

Findings from the 2012 GLAAS report\(^9\) showed that 81% of respondent countries are either encouraging or requiring WSPs in their policies and regulations or reporting pilot experiences. Of the countries encouraging WSPs in the WHO South-East Asia Region and the WHO Western Pacific Region, 13 out of 24 have a WSP policy or regulatory requirement.

The water quality partnership between WHO and the Australian Agency for International Development (AusAID) has three phases. The last phase, covering the period from September 2012 to June 2016, is to support the sustainable design, implementation and evaluation of WSPs in several countries in these two regions. Phase 2 was to assess the completeness and quality of WSPs in six of these countries. WSP documents were reviewed. For 22 of them, experts went on site to see how the WSPs were being implemented and found a lot of areas where improvements were needed (e.g. validation, verification). Lessons learnt from this exercise included the need to provide more intensive and targeted training for national WSP trainers; the need to improve the quality of current WSPs before further WSP scale-up and development of model WSPs; the need to enhance national assessment capacity; and the need for more context-specific examples for validation and monitoring.

In conclusion, significant progress has been made in global uptake of WSPs, but there is a need to provide more targeted support.

**Key discussion points:**

- WSPs have not been adopted in the USA, but there is a regulatory requirement that all water supplies need to do a sanitary survey. WHO should take credit that work similar to WSPs is being done in the USA, even though it is not called that.
- Capacity building in this area, involving WHO and partners, is a good demonstration of what can be done.

---


- It is difficult to see immediate positive health outcomes from implementation of WSPs. There is a need to focus on countries that implemented WSPs many years ago. Positive health outcomes cannot be demonstrated from a pilot project.

- There is a need to show more systematically that positive things are happening and to put more rigor into measuring the benefits associated with implementing WSPs.

- WSPs are partly there to stop things from going wrong and to identify when things are starting to go wrong; how to collect those data is a difficult question.

- There are intermediate benefits to implementing WSPs. People start thinking about preventive maintenance, and there is communication among the facility, people in the catchment and consumers.

**Outcomes and key recommendations:**

- Significant progress towards global uptake of WSPs was noted, and it was recognized that there is a need to provide more targeted support on WSP development and implementation.

- In terms of data collection, particularly related to the AusAID-supported WSP project, there is a need to show more systematically that positive things are happening and to put more rigor into measuring the benefits associated with implementing WSPs.

### 6. BURDEN OF DISEASE ESTIMATES FOR WATER, SANITATION AND HEALTH

Annette Prüss-Üstün (by teleconference) gave a presentation on burden of disease estimates for WASH.

Environmental burden of disease (EBD) is a quantification of the health impacts caused by environmental risks at the population level, expressed in deaths and/or incidence and/or summary measures (DALYs, quality-adjusted life years [QALYs], etc.). For broad acceptability, EBD should be based on best available knowledge, internally consistent and transparent, and it should be reached by consensus of the scientific community.

EBD contributes to prioritizing actions in public health, enables comparisons with other health areas through a common language, allows the economic evaluation of health risks, monitors progress and identifies vulnerable population subgroups. Our guidelines specify which levels are safe for health, and EBD specifies health gains from reducing population exposure. Most importantly, EBD raises awareness about health risks and health gains that can be made.

Unsafe water, sanitation and hygiene ranked fourth on the list of risk factors contributing to the percentage of DALYs globally. The latest WHO estimates on WASH burden use 2004 data and methods and need updating. Available WASH global burden of disease estimates from WHO for 2004 are 1.9 million of 2.2 million total diarrhoeal disease (88%), whereas the Institute for Health Metrics and Evaluation (IHME) estimate for 2010 was 0.34 million of 1.4 million total diarrhoea deaths (24%). The large difference could be due to the lack of inclusion of hygiene, the decrease in total diarrhoea deaths, the consideration of piped and
other “improved” water sources as “safe” always, and the lack of risk reduction associated with point-of-use water treatment in the IHME estimate.

The general method for EBD assessment involves multiplying the national/local burden of disease statistics, by disease, by the attributable fraction for a given disease due to a given risk factor, to give the burden of disease attributable to environmental risk factors for a given disease. The attributable fraction is determined using the exposure distribution in a population and the exposure–response relationship, matching the relative risks for piped water, improved water, unsafe water, etc., to the exposure scenario.

WHO plans to update the WASH global burden of disease estimate by developing a new evidence synthesis that takes into account specific exposure scenarios, developing a compilation of water quality data, distributing country populations into exposure scenarios and estimating the attributable disease burden. An expert meeting will be held 8–9 April 2013 to further develop and review these methods.

In terms of recreational water and wastewater reuse, global burden of disease estimates are very work intensive, and the effort required needs to be weighed against the benefit. For recreational water, one would need exposure data (recreational water quality and number of people performing the recreational water activities) and information on the increased risk of diarrhoeal disease by water quality (which is possible as long as one is able to estimate the number of people in contact with the recreational water). For wastewater, one would need to know the quality of surface water used for irrigation, the extent of use or amount of food produced and the associated increased risk balanced against the positive nutritional benefits. It may be better to start with one country, as practices may differ.

In conclusion, by the end of 2013, there should be an updated analysis of the evidence (meta-regression), a collection of water quality data by region and a consensus-based option for the access to water situation according to access to quantity and quality.

Key discussion points:

- Countries have been relying on the 2004 WHO burden of disease data; however, the 2010 IHME publication contains a much different number. How detailed is, and what is the value of, the work being proposed by WHO?

- WHO is aiming for detailed information, by age group and by country, if possible, relying on an updated publication from WHO including full details on diarrhoea by region, country and age group. Only then would it be possible to derive the burden of disease attributable to water and sanitation. This value will be lower than the 2004 number, because the incidence of total diarrhoea has decreased.

- The IHME estimate suggested that there should be no credit given for improving water quality by household water treatment (HWT). It is hoped that the analysis of data in 2013 by WHO would try to find data showing the positive health impact from improved piped water and HWT technologies.

- The scarcity of intervention studies is the issue. WHO is reassessing and updating the evidence to be more specific.
What the rest of the total diarrhoeal incidence can be attributed to is unknown. It is important not to overinterpret the comparison of these two estimates. The Foodborne Disease Burden Epidemiology Reference Group (FERG) is another group coordinated by WHO that is looking at the burden of disease attributable to food. There is consensus on the total diarrhoea deaths for children, and less consensus for adults. They agree that the incidences have decreased or have been overestimated in the past or are underestimated now.

It has been mentioned that it is difficult to estimate burden of disease for total diarrhoea, yet the wastewater reuse guidelines are based on that.

To what extent is it possible to use the results of the Global Enteric Multicenter Study (GEMS), a global pathogen study associated with diarrhoeal disease? Different enteric pathogens were identified and ranked. Is that information useful in this context?

It is useful for a reality check. In terms of a practical approach, there is a need for data on exposure and matching relative risk. Data on pathogen-specific relative risks are not available. There will be a need to increasingly consider these data as they become available.

The group that did that work at the University of Maryland collected a lot of data related to WASH conditions. They are using other statistical approaches to determine diarrhoea incidence attributable to WASH as opposed to other transmission pathways. Kelly Baker is working on WASH contributions.

There are national burden of disease studies at the University of Washington supported by the Gates Foundation (Ali Mahkdad). Do those studies provide the kind of information that is useful for purposes of the WHO burden of disease estimates for WASH, or are they not well enough defined in terms of sources of disease? Annette does not know enough about their work to respond.

It was noted that a burden of disease estimate for recreational water may be methodologically feasible, but not for wastewater use, given the paucity of data and the difficulty in balancing microbiological and chemical risks with nutritional benefits; indeed, it may be counterproductive at this stage to attempt such an estimate.

**Outcomes and key recommendations:**
- It was noted that by the end of 2013, there should be an updated burden of disease estimate for drinking-water, sanitation and hygiene (meta-regression).
- At this time, burden of disease estimates for wastewater will not be pursued due to the significant challenges. Burden of disease estimates for recreational water may be feasible, but will not be pursued now.
7. WASTEWATER WORKPLAN

7.1 Draft wastewater workplan

Kate Medlicott gave a presentation on the draft wastewater workplan, which was prepared by Duncan Mara, who was a key technical contributor for the wastewater guidelines. Duncan was unable to join the meeting due to illness. Kate explained that in plenary, additional issues could be identified, and some priorities need to be selected collectively. Later in the week, priority items need to be incorporated into working group discussions, and a plan of action for after the meeting would be decided on (see Annex 7).

WHO has been promoting the 2006 guidelines in five regional workshops, looking at institutional, economic, health, agricultural, environmental, policy and strategy aspects. The four volumes are comprehensive, with a primary focus on intentional use. There is limited information on chemical risk. The volumes include the multibarrier approach, involve health-based targets expressed as performance targets for log reductions of pathogens, exclude municipal sludge and require multisector collaboration. They are for use in agriculture and aquaculture only.

Country feedback indicates that the volumes are difficult to read and that there is a lack of capacity to understand and implement health-based targets, with countries noting a preference for guideline values for wastewater treatment. Value is seen in the reuse of wastewater and sludge, but Member States are interested in a guideline that assists in the development of national strategies that cover all kinds of reuse, including municipal parks, horticulture, etc. There are rising fears about chemical risks, which need to be addressed. In addition, there is a lack of clarity about which sector should take leadership on implementation of the guidelines and a lack of multisectoral platforms and policy to support implementation. There is also a need for clarity on demarcation of responsibilities.

A key issue raised is the target audience for the guidelines. Should there be a single volume (as in the 1989 guidelines) or four volumes (as in the current guidelines)? There needs to be a clearer distinction between regulatory, planning (SSP) and surveillance functions. There needs to be clearer guidance on chemical risks in all volumes, accounting for risk to human health as well as plant health linked to the work of FAO. Although the scope of the existing guidelines does not cover wastewater with substantial industrial inputs, in reality this is difficult to rule out in cities where there are widespread unregulated industrial discharges.

Technical issues include expressing other types of health-based targets in terms of performance, as currently described in the guidelines, as well as water quality and specified technology to allow greater flexibility. In addition, options for meeting a lower DALY limit, updating the epidemiological evidence throughout the volumes, potential use of norovirus and Ascaris as reference pathogens, and including QMRA or keeping the current recommendations in Volume 2 are other issues to be considered.

Other needs are development of the SSP concept to provide a risk management approach; clarifying institutional responsibilities to implement the multibarrier approach; and linking the SSP to the WSP for source water protection.
Key discussion points:

- The guidelines are inaccessible to the non-expert. High-quality information is hidden among text that needs to be moved to an annex. The next edition of the guidelines should be published as a single volume to reduce repetition.

- SSPs need to be embedded in the guidelines within a harmonized framework of health-based targets, safety plans and surveillance. A revised chapter outline should be developed as a priority.

- There is a need to conduct a literature review from 2005 to the present as a first step to updating the guidelines.

- There is a need to look in more detail into the exposure assessment (dose–response and exposure models) on which the guidelines were based. Specifically, there is a need to determine if lettuce and onions are the most relevant crops for assessment.

- There is a need for a set of criteria on how to prioritize microbial pathogens locally.

- Australia has found that there is not much difference between using norovirus and rotavirus as reference pathogens, and changing may not be worthwhile.

- Chemicals were deliberately not included, as exposures are low compared with drinking-water (but they are more of an issue for biosolids).

- However, a section on chemicals is requested, as a recent study found that the heavy metal content in various food crops in India was very high, and the presence of chemicals in food is an area of high public concern.

- A number of participants noted that expanding to a wider definition of reuse would be useful, including reuse in building and industry as well as reuse of biosolids; however, it would be a very large exercise to include biosolids in the next edition of the guidelines, and the audiences are different. Instead, separate risk-based guidelines for biosolids should be developed, as well as texts for reuse in other priority settings.

- The guidelines are based on an E. coli/pathogen ratio that is derived from very few data and assume that the ratio is independent of the wastewater treatment system. There needs to be a careful examination of the literature to confirm this assumption.

- There is a need to be more flexible in terms of DALYs, providing options of $10^{-5}$ and $10^{-4}$, with greater clarity about how this translates into implementable barriers along the sanitation chain in each health-based target scenario. Lower DALYs for reuse are probably fine. They could be the basis for continuous improvement: for example, $10^{-2}$ DALY is an improvement, and $10^{-4}$ DALY is a significant improvement. This needs to be embedded in the guidelines.

- Linking SSPs with WSPs is very important, particularly in rural contexts where an integrated safety planning approach is more feasible.
Ascaris is a persistent organism. There are new developments in technologies in human faecal waste treatment, some that involve heat. This needs to be taken into consideration in risk reduction. There is still no good indicator system for Ascaris; monitoring for it is still largely not possible or very slow. There may be some new insights by asking about the availability of indicators for Ascaris.

With respect to the interface between chemical and microbial hazards, the impact of antimicrobial-resistant organisms and antibiotics has never been considered by this group.

There are a number of new wastewater treatment options that should be considered, and there is a need for greater guidance on specified technologies, such as lagooning.

There are more stringent controls on recycled water than on river water.

Outcomes and key recommendations:

- Provide options for expressing health-based targets in terms of health outcomes, water quality, performance and specified technology to allow options for users not ready to tackle QMRA and DALY calculations.
- Lower DALYs for reuse should be embedded in the guidelines, with greater guidance on translating the DALY limits into combinations of effective barriers.
- Update the epidemiological evidence throughout the volumes.
- Embed the water safety framework, including health-based targets, safety plans and surveillance, in the wastewater guidelines.
- Consider publishing the wastewater guidelines as a simplified single volume.
- Clarify institutional responsibilities to implement the multibarrier approach.
- Update the evidence supporting the wastewater guidelines to include a review of the literature from 2005 to the present.
- Update chemical risks to human health and plants (working with FAO), and evaluate the impact of antimicrobial-resistant organisms and antibiotics.
- Consider the use of norovirus and Ascaris as reference pathogens now that dose–response data are available.
- Revisit the exposure models on which the guidelines were based.
- Other issues discussed regarding the potential broadening of the scope of the guidelines included:
  - Risk-based guidelines for biosolids use;
  - Use of wastewater for other uses (e.g. industrial, non-potable water in buildings, horticulture).

7.2 Update on sanitation safety plans

Thor-Axel Stenström updated the group on SSPs. The objective of the wastewater guidelines is to maximize the protection of human health and the beneficial use of human waste. Exposure relates to the area of risk assessment, which links to the health-based target. Managing sanitation is a key area of the guidelines. How well it is managed defines health outcome.
The wastewater reuse guidelines started in 1989 and were continued in the 2006 edition. The guidelines follow the pathway between wastewater generation and the consumer. Health-based targets (DALYs) are set to protect the consumer.

Exposure routes include the ingestion of excreta from hands, dermal contact, inhalation of aerosols, contaminated groundwater and surface water, contact with overflowing or leaking contents, consumption of contaminated produce, and contact with flies or mosquitoes. Risk groups include the user, worker, farmer and community/consumer. The usual questions for QMRA need to be asked: who (group at risk), how many (people exposed), where (exposure occurs), routes (direct or indirect contact), how frequently and what dose of exposure?

There is a need to evaluate the critical points of exposure, the barriers that may reduce risks and any other operational or behavioural factors that may affect the risk. To reach the target requires 6–7 log reductions achieved by adding up efficiencies of multiple barriers.

SSPs will be modelled on WSPs. The preventive management/multibarrier approach of SSPs includes wastewater treatment, crop restriction, irrigation method and washing/peeling/cooking. Similarities between SSPs and WSPs include the incremental risk management approach based on hazard analysis and critical control points (HACCP) and the Stockholm Framework, the essential components of system assessment, operational monitoring and assessment, and their systematic nature, following the sanitation or supply chain. Dissimilarities include the diversity in the decision-making process, consideration of multiple routes of exposure and multiple exposed groups, and variation in the implementing agency.

Risk management tasks include describing the sanitation system within the system boundaries (defined during the initial risk assessment phase), identifying hazards/hazardous events for each exposure group, developing and implementing an incremental improvement plan, monitoring the plan and checking that the controls are working, developing a supporting programme and regularly reviewing the SSP. Subtasks are associated with each of these broader tasks.

It is intended that development of the SSP concept will support the practical implementation of the guidelines and promote practical risk assessment and management; SSPs will link with viable business models for resource recovery and reuse; SSPs will be framed to support guidance and public health implementation in the broader context of hydrological and administrative catchment areas; the SSP manual will support implementation of SSPs and field research in priority countries; and SSPs will facilitate the monitoring of changes in policies and practices in wastewater and faecal sludge disposal and use.

The roles of various stakeholders in the implementation of and evaluation of compliance with SSPs were mentioned briefly.

**Key discussion points:**

- Chemicals have not been excluded, but microorganisms are considered a higher risk in most cases from a health point of view.

- From an agricultural point of view, Jordan has excellent guidelines for greywater, which can be referred to and used as a case-study on the implementation of SSPs.
The challenge is to keep the SSPs as simple as possible. It is encouraging to see the similarities between SSPs and WSPs.

In developed countries, major plants are the largest producers of biosolids. A number of countries have successful biosolids programmes. The main issue is keeping it straightforward, keeping things separate but linked, keeping greywater separate from biosolids, etc.

On the chemicals side, the types of crops being grown, whether they accumulate chemicals (e.g. rice accumulates significant amounts of arsenic) and what chemicals might do when consumed are important issues to consider.

Looking at this as a business has advantages. How can developing countries be helped to supply other markets that require a higher quality of produce? This will help bring the whole area to the forefront and provide an across-the-board benefit in terms of capacity building, financial inputs into society and improvements for local use as well. There is a need to identify simple interventions: certain activities will result in certain levels of improvement.

It is important to look at specifications in major purchasing markets for produce; these need to be in concert with the guidelines. Are people from FAO involved in guidance specifications for various uses?

WHO completed the small community WSP manual in 2012. Small communities need to be included from the beginning to avoid mistakes. Sanitation relates not just to agriculture, but also to safe use and disposal of excreta. There is a need to establish links between SSPs and WSPs in terms of an integrated management approach.

WSPs and SSPs are essentially the same thing; in some instances, for example, when an urban area is a catchment for a water supply, the SSP effectively becomes part of the WSP.

Radionuclides concentrate in biosolids, so exposures to them are distinct. Radionuclides also concentrate in wastewater treatment plants.

Nutrient loading of recreational waters can also be affected by runoff from agricultural areas and sewage outfalls.

The roadmap to capacity building with respect to SSPs should be shorter because of the work already done on WSPs. If any of this can be translated into simple documents, it would be very useful to regional and country offices.

The take-home messages are the importance of simplicity; issues of boundaries of SSPs; using a business opportunity to promote SSPs; looking at small farmers and producers, not just large ones; chemical and radioactive waste; and the impact on recreational waters.

Outcomes and key recommendations:

- Progress towards the development of guidance on preparing SSPs was noted, with pilot testing in four cities: Hanoi, Bangalore, Lima and Kampala.
- It was noted that SSPs will follow the model of WSPs, but will focus primarily on reuse, with a scope to address other urban sanitation systems using the risk assessment and management framework.
- There is endorsement from the regional offices that the SSP approach is relevant and can be flexibly applied in a range of sanitation scenarios.

8. RECREATIONAL WATER WORKPLAN AND CROSS-CUTTING ISSUES

8.1 Draft recreational water workplan

David Kay explained that three major issues had been identified by an expert who had helped to develop the 2003 Volume 1 guidelines: 1) epidemiology and health impact assessment; 2) real-time management and discounting; and 3) sanitary profiling and HACCP (microbial source tracking). In the plenary session, additional issues should be identified, and workgroups should later define details and focal points (see Annex 8).

With respect to epidemiology and the health evidence base, Volume 1 of the recreational water guidelines, which was prepared through a large number of expert consultations, is based on United Kingdom studies conducted from 1989 to 1992. This was a very narrow evidence base, involving a dose–response curve for enterococci in temperate European seawater. The dose–response curve was combined with a probability density function to get a disease burden model. A probabilistic approach was used to set standards, based on a 5% illness rate. New information since the standards were published includes new epidemiological studies from Germany and the USA as well as new indicators (molecular markers for faecal indicator organisms; colony-forming units, not molecular methods, were used in the guidelines). The possibility of expanding the applicability of the guidelines to different regions should also be explored.

In terms of real-time management and prediction (from the Annapolis meeting), if water quality can be predicted at a beach and the pollution is not human derived, warning the public through a real-time advisory is the appropriate response. Application of this method can result in major savings to the government. Problems include the use of the bathing day as the modelling unit. As there is a 2 log variation in water quality daily, use of a single spot sample is not reliable. Diurnality (because of sunlight, which kills bacteria, and the tides), censored data and data precision all contribute to variation. Models can give very accurate predictions (e.g. Smart Coasts model). Should WHO be involved in advising on real-time prediction and management? If so, what should they be predicting (e.g. bacterial quality or health risk)? And what model type should be used?

With respect to sanitary profiling and HACCP, which underpin the risk matrix in chapter 4 of Volume 1, bacterial measurements are the main reason for water non-compliance. Microbial source tracking (MST) (to determine whether the pollution comes from humans or animals) seems to be a very useful tool. Problems with molecular approaches at the catchment scale include the fact that ultraviolet (UV) disinfection does not attenuate Bacteroidetes concentrations (UV treatment does not change the molecular marker), which would lead to the wrong answer as to where the pollution is coming from. Other tools include the use of phage tracers. Can the human marker GC number predict the human contribution to sewage effluent?
Emerging tools and evidence include a simple qualitative checkbox assessment and quantitative microbial source apportionment (QMSA) through empirical studies, MST tools (library independent quantitative polymerase chain reaction [qPCR]-based) (Bacteroidetes, virus, phage tracers) and modelling (black box export coefficient models, process-based modelling).

Key discussion points:

- Australia is about to start reviewing its recreational water guidelines, which are based on the WHO guidelines. One challenge is the lack of guidance on secondary contact and cyanobacterial numbers (cylindrospermopsins, Anabaena and saxitoxins); will these issues be taken into consideration in the revised WHO guidelines? They will be looked at in later discussions during the meeting.

- Modelling has challenges, and there is a range of issues to be addressed. Molecular measures and other cultural methods are not perfect. The USEPA has a new set of criteria for recreational water quality, but not much has changed. Regarding the secondary contact issue, the USEPA has done away with it as a designation. Instead, it will continue with the geometric mean value for primary contact.

- The sanitary survey is the key component for determining whether animal or human faecal material is the source of microbial pathogens and risk.

- The reason for sanitary profiling has been ignored. There has been a focus on human inputs, including combined sewage overflows, but the animal versus human issue has not been considered.

- In very poor countries, molecular methods are not useful for day-to-day monitoring; there are lots of problems with sanitary profiling; and it is quite difficult to get coastal models. Is there anything available on chemical tracers? Rhodamine is one chemical tracer that has been used.

- Can non-enteric diseases be included in the guidelines? There is not much information on diseases other than gastrointestinal illness and some respiratory illnesses, which are already included in the guidelines.

- Should climate change and its effect on the diseases of concern be anticipated?

- How would the safety plan approach (e.g. a recreational water safety plan) be included? The safety plan is a unifying theme, and it is very important to include it.

- With respect to the harmonization of health-based targets, Volume 1 is unique, with a health outcome target of <5% risk of illness with gradations. The challenge is how to apply an overlay of level of influence of human waste and how that modulates health outcome. Has any thought been given to the degree that relative input of human input modulates risk of human illness?

- The original standards were based on viral infections, probably human derived. The guidelines acknowledge zoonoses from livestock, but this was not built into compliance assessment per se. Concern is now directed to children being infected by
E. coli O157, which could have an animal origin. Agricultural input may require further consideration in the next edition.

- Sanitary profiling in riverine sites is not feasible, as there is no way to characterize upstream sources. Guidance on this would be appreciated. It is recognized that there are difficulties with large catchments, particularly those that cross boundaries.

- There is a need to reflect on diurnal variation and the value of single sample results versus a longer-term assessment of all the data in a location. This would inform people who need to make improvements on the ground. It is recognized that daily variability must be revisited in the guidelines.

- Would composite sampling be practical in this context? It would overcome variation over short periods of time.

Outcomes and key recommendations:
- All new technical inputs need to be developed within the framework of a guideline structure harmonized with the drinking-water and wastewater guidelines.
- The guidelines will continue to be published in two volumes for swimming pools and spas and coastal and fresh water, recognizing the distinct target audience for the two settings.
- Technical issues for further consideration include:
  - A WHO guidance report on the utility of QMSA, MST and emerging phage tracking to provide useful guidance for the operational community;
  - Developing a work programme to deliver clear guidance on real-time prediction and sample discounting;
  - Developing a strategy and establishing an expert group (comprising regulators and stakeholders) to consider the potential utility of new molecular microbiological approaches as regulatory tools;
  - Providing additional guidance on secondary contact and cyanobacterial numbers (Cylindrospermopsis, Anabaena and saxitoxins);
  - Developing the concept of pool safety plans, incorporating a checklist for assessment of swimming pools modelled on the work of the Mediterranean group;
  - Considering climate change and its effect on diseases of concern;
  - Harmonizing the health-based targets approach, recognizing that there is no need to aim for equivalency;
  - Updating advice on zoonoses from livestock.

8.2 Summary of overall work conducted by the WHO Regional Office for Europe on Volume 2 of the recreational water guidelines

Shinee Enkhtsetseg explained that an expert group meeting on the guidelines for safe pools and spas in Bonn in 2011 recommended the need for revision of Volume 2 of the guidelines, identified new areas of interest, developed an annotated outline, identified contributors and recommended that a consolidated draft be prepared by the 5th International Conference on Swimming Pools and Spas in 2013 (this timing may not be feasible).

The current version of Volume 2 contains six chapters. A proposed outline for the revised guidelines, suggested at the Bonn meeting, included new chapters on (i) health benefits of the recreational water environment, (ii) public health aspects of recreational water use, (iii) social
aspects of recreational water use and (iv) occupational health and safety aspects. In addition, the chapters on managing users and the pool environment and on improving performance would be modified.

Follow-up activities included small group thematic discussions supported by the WHO Regional Office for Europe on occupational health and safety, work done by Mediterranean experts, and meetings on health benefits and public health, all held in 2012.

The drafting group on the health benefits of aquatic exercise has prepared a draft narrative review document, which is now ready. In terms of next steps, the extent to which this document falls within the scope of Volume 2 or whether it should be published as a stand-alone document needs to be decided. The draft chapter includes guidance on the health benefits of immersion and therapeutic aquatic exercise in health care.

The Bonn expert meeting suggested that social aspects in swimming pools should be considered and prepared a short questionnaire. There is limited research in this area. In terms of next steps, the extent to which social aspects fall within the scope of Volume 2 needs to be decided.

For the public health chapter, a chapter outline has been prepared (see discussion below). The public health drafting group will be updated on the recreational water workplan, and next steps and a timeline will be discussed.

For occupational health and safety, there was a small group meeting in 2012, but progress has been slow. An outline has been started by Professor Jan Bakker of the Netherlands, but the lead author needs the support of and contributions by other experts. In terms of next steps, the extent to which occupational health and safety aspects fall within the scope of Volume 2 needs to be decided.

Experts from 20 Mediterranean countries have been involved in the development of a general checklist for the assessment of swimming pools and a checklist for swimming pool operators. A questionnaire survey of national regulators on swimming pools and spas, with five sets of questions on construction, safety, water quality, workers and users, has also been developed. The outcomes of the questionnaire could be used as inputs for further guideline development.

The Robens Centre, a WHO Collaborating Centre at the University of Surrey, supported this work by Mediterranean experts, contributed to the group drafting the health benefits chapter (Kathy Pond) and assisted in the collection of literature data on social aspects and development of the questionnaire.

In terms of guideline development, the next step is to review the scope and update plan and overall coordination of the recreational water workplan by WHO HQ.

A more in-depth presentation and discussion were held on the proposed public health chapter being drafted as an outcome of the 2011 Bonn meeting. David Cunliffe explained that there was a desire to increase the level of information on public health in Volume 2. There is a disconnect between the guidelines on swimming pools and spas and the other water quality guidelines. An outline for a chapter on public health has been prepared, although a lot of text has yet to be drafted in light of the GRC procedures.
The intent of the chapter is to deal with the involvement of public health stakeholders (e.g. United States Centers for Disease Control and Prevention). The outline covers stakeholders and the expertise involved and a range of activities associated with maintaining public health, such as promoting better design of pools, surveillance, communication, etc. There is a section on surveillance of disease and investigating outbreaks; a section on high-risk venues on a public health basis, such as hydrotherapy pools and water slides; a section on health communication involving the public health and aquatic sectors, tourism and various providers; a section on communication with users to minimize the risk of spread of disease from infected people to others; and a section on public health research, investigating illness rates and trade-offs with disinfection by-product (DBP) issues.

David can see the benefits of including this chapter, as well as the health benefits chapter. Should it be included? There is a conference on swimming pools in Rome in April. Feedback is needed from this group on a way forward.

**Key discussion points:**

- There is a need to address requests by countries and a desire not to do activities in isolation in Europe. Advice on social aspects and health benefits is particularly needed.

- Social aspects and health benefits should not be included in the guidelines. Perhaps the occupational section is acceptable because of asthma concerns. There has to be an in-depth discussion before releasing this draft, and a bigger discussion group is needed. Volume 2 is already problematic because it is based on chlorine, not on technology requirements, and there is a big disparity between various countries.

- A broad range of disinfectants are used in pools that are not used in drinking-water, such as bromine, hydrogen peroxide with UV, copper/silver and “green” disinfectants. Clarity and consistency need to be brought to this area through health-based issues.

- Can assessments of the health risks of DBPs be conducted? It would be useful to do a risk–benefit analysis comparing health risks of DBPs with those from infectious disease. However, although microbial risks are actuarial and can actually be measured, DBP risks are mostly hypothetical. It would be interesting but difficult to do with a high degree of rigor. One cannot apply the risk–benefit analysis by Avi Havelaar on the benefits of ozone versus the risk of Cryptosporidium in drinking-water, as the exposure scenarios are different; the major exposures are inhalation from swimming near the surface, heavy dermal exposure and some ingestion.

- Occupational safety has a place in the guidelines, as there is increased exposure.

- A European Union (EU) project within the 7th Framework aims to compare microbial and chemical risks associated with DBPs and swimming pools. There is a quantitative connection for bladder cancer and also some relationships for small gestational age. The focus is on the epidemiological side with respect to swimming pools, considering uptake of DBPs through the skin, which may have an effect on pregnant women, for example. Perhaps this is an issue for the vulnerable groups people to consider?
A proper mechanism of action linking DBPs with causal effects is not there. On birth weight, there is some material from the Imperial College of London showing interesting links between these effects and DBP formation, but when you take into account socioeconomic factors, the residual effect is not significant at all. It is essential that there is no suggestion to avoid using chlorine for disinfecting drinking-water.

Natural ponds, a European development, with circulating water in man-made basins and no treatment, should be considered.

Pool safety plans should be included.

There are small private clubs in Asian countries with exposure to high concentrations of DBPs and no regulations or controls. No data have been collected on this so far.

Other issues that should be considered include therapeutic pools, which may be associated with a higher risk, and the microbial risks of baths containing nibbling fish (and, on a related note, those associated with fish in stored rainwater to eat mosquitoes).

Pools in holiday hotels are generally poorly run and poorly regulated all over the world and are a major source of outbreaks. This needs to be highlighted.

Beaches and swimming pools are under different regulations in Japan.

Public swimming pools and spas are regulated by public health agencies in Australia. Swimming pools belong in the suite of guidelines. With harmonization, the guidelines should include swimming pool safety plans, specified technology as a health-based target, and recommendations on filtration, turnover rates and disinfectant levels. With harmonization, specific chapters, such as on public health benefits, could be added if considered useful.

Harmonization across sectors will be difficult. It may be possible to harmonize the approach, but not the standards.

In terms of harmonization, different risk levels are associated with the three guidelines. Is this reasonable? There are differences in the sense that drinking-water consumption is involuntary, whereas swimming in recreational water is a voluntary risk, so having different levels is sensible. Coupled with the voluntary risk are the positive benefits of swimming. The biggest risk associated with swimming is drowning.

It is difficult to harmonize between chemical and microbial risks. The common metric is DALYs, but there is uncertainty on whether or not it is feasible to apply this to chemical risks.

A comparison of the risk of getting an infection with the risk of getting cancer might be useful for public communication.
- Multidrug-resistant bacteria in therapy and other pools should be taken into account (a vulnerable population issue). It is very difficult to come up with a statement on the possible health risks associated with multidrug-resistant bacteria.

- Guidance that people in a community should avoid going swimming under certain conditions should be provided.

- There is a need to capture inputs from the developing world perspective, concerns and issues in those countries and other resource-limited settings, rather than the developed world perspective. Are the high-level issues identified here relevant to them? There is a need for appropriate guidance to address those kinds of risks (e.g. the guinea-worm nets and children swimming example). Are disease burdens known?

- There is a metric that theoretically provides a comparator, but we cannot arrive at a harmonized standard based on DALYs at the moment.

- How many countries have notification of illnesses related to swimming pools and spas? This belongs in the harmonized framework document (but it is included in the public health chapter). However, unless there is an outbreak, many illnesses will not be identified as having come from going to a swimming pool.

- In terms of the relationships between microbial indicators and pathogen risk, how is the relationship between gastrointestinal risk from exposure to enterococci in the North Sea relevant to pathogen risks to children from guinea-worm and schistosomiasis in Ghana? Different recreational waters have different pathogens; it is very context specific. Member States need to understand where the basis for the guidance came from and how the guidance might need to be adjusted depending on the local water environment. Does this go into the harmonized framework document?

- Key features of recreational water guidance can be applied to shellfish. Should shellfish waters be included somewhere? Sometimes the same agencies are responsible for managing both types of water, and it may be possible to link and harmonize these.

- The transmission pathway (bather to bather or discharges or naturally occurring) could be a way to harmonize the guidelines. David Bradley has added a new risk category of crowding. There is a need to better articulate transmission pathway linkages.

- Harmonization issues all relate to the sanitary profile. There is a need for more guidance on how to prepare sanitary profiles. It is a routine exercise, but it is not actually providing the protection for which it was intended.

- Are the indicators correct, or are there more or better ones? There may be a need to reconsider the use of different indicators (e.g. phage tracers).

- WHO can make a contribution on interpreting the health implications of using different tools in different contexts, maybe not in the guidelines, but in a guidance document. There is a need to define and articulate what these tools and toolboxes should look like.
Currently, WHO HQ and the regional office have very limited staff and financial resources for recreational water. A priority needs to be securing donor support for recreational water to support and coordinate recommendations arising from the meeting.

Liaison with those responsible for the WHO air quality guidelines, whose remit is all non-occupational exposure, might be useful. WHO HQ has been in touch with them for the GRC process and will reconnect with them on this issue.

Outcome and key recommendations:
- A revised harmonized chapter outline is needed as a priority.
- Pool safety plans should be included as the management approach in a future revised Volume 2.
- The continued development of the public health chapter of the recreational water guidelines is supported.
- Key recommendations to the Regional Office for Europe expert working group, including new themes on:
  - Health benefits of recreational water environment
  - Public health aspects of recreational water use
  - Occupational health and safety aspects
  - Social aspects of recreational water,
were endorsed as being relevant to the next edition of the guidelines. Draft chapters currently available may be published in whole or in part within the guidelines, depending on the revised harmonized chapter outline. In addition, it was proposed that the following specific settings be considered:
  - Small private clubs
  - Therapeutic pools (noting drug-resistant organisms)
  - Natural pools
  - Pools in holiday hotels.

8.3 Toxic cyanobacteria in water

Ingrid Chorus explained that the WHO cyanotoxin guidance is very widely used worldwide. The aim of revision of the book on Toxic Cyanobacteria in Water was to update the information in it and support WSP development. Ingrid described the content of various chapters, giving some more detailed examples of the content of specific chapters. She also indicated what progress had been made on each chapter and what remained to be done.

Two issues to discuss are the use of biovolumes instead of cell numbers (size of cells affect toxin concentration, which depends on biomass and not cell numbers) and leaving the guidance levels for recreational exposure as they are (microcystin as related to chlorophyll a), but justifying them only toxicologically, not epidemiologically. (The Pilotto 1997 evidence is weak, and attempts to reproduce it have shown that epidemiological studies may capture mild, self-limiting health outcomes that are probably not due to the cyanotoxins; the health outcomes of concern are those resulting from oral uptake by a smaller number of site users, the effects of which are of substantial concern but are unlikely to show up in the data from such studies.)

It was suggested that acute tolerable intake and both seasonal and lifetime tolerable daily intakes (TDIs) be developed to account for the temporal pattern of exposure, and Ingrid asked
the group whether they accepted her prepared table of tolerable concentrations in drinking-water, food and recreational water and the assumptions used in the calculations.

**Key discussion points:**

- The length of the *Toxic Cyanobacteria in Water* book is a concern, as the new version has many more chapters than the previous one. However, the number of chapters reflects the structure; some are quite short, whereas others are in the process of being reduced in size.

- The meta-analysis of the epidemiological studies would likely not need to go to the GRC, as this is a supporting document only, not a guideline. However, the recommendations are to be backed by rigorous scientific evidence; there is a need for a more systematic review than previously undertaken.

- A group of experts (particularly the Chemical Aspects Working Group) was invited to go through the evidence and propose an appropriate approach.

- With respect to derivation of the guidelines in the *Toxic Cyanobacteria in Water* book, moving from epidemiological evidence to toxicological evidence is not new, but using an intravenous study instead of an oral study to develop a number for acute exposure is not appropriate.

- The numbers in the tables on tolerable concentrations in drinking-water, food and recreational water can be resolved (although tolerable concentrations in food would need to be reviewed by WHO food groups). The more important issue is the intermediate exposure level between acute and lifetime TDIs and the assessment of recreational settings and food. More discussion is needed before this approach can be adopted.

- This new approach to developing guideline values (acute/seasonal/chronic) is a fundamental change and needs consideration by the Chemical Aspects Working Group before publication. Two different sets of values and two different approaches (compared with the drinking-water guidelines) leave WHO open to criticism.

- It needs to be made clear that the proposed table of values is not a table of guideline values. It is an example of how to use a TDI or NOAEL for local settings. Drinking-water guidelines should not be used for recreational settings.

- Providing numbers for food in the table of values is outside of WHO’s remit. It was noted that the USEPA includes food in their recreational water guidelines; more information on how this is done would be helpful.

- The USEPA prefers biomass volume to cell counts.

- In terms of analytical capabilities for toxins, it is very difficult to get a pure standard of microcystin-LR or other toxins for method development.

---

10 Additional discussion on the *Toxic Cyanobacteria in Water* book that occurred during the meeting of the Chemical Aspects Working Group is summarized in Annex 5.
It should be noted that samples can be deep-frozen and shipped for laboratory analysis.

In low-resource countries affected by cyanobacteria, access to laboratories is difficult. In addition, cyanotoxin analyses are not affordable, but microscopy is. One approach to providing practical advice for such settings will be flagged as finding support for occasional analyses of the toxin/biomass ratios so that microscopy data can be used to estimate toxin exposure.

The approaches used in all documents that apply to cyanobacterial toxins (i.e. the recreational water guidelines, the drinking-water guidelines and the cyanobacterial fact sheets) need to be consistent and harmonized. Otherwise, the documents will be undermined.

Health Canada is aiming to have its revised guideline document on cyanobacteria available for public consultation by next spring, and the USEPA’s guidance will be completed by January 2014.

The chapter drafts for the *Toxic Cyanobacteria in Water* book will be ready for WHO peer review by autumn 2013. The approach needs to be approved and harmonized before the proposed table of values can be finalized.

If the decision is made to not use the epidemiological data for deriving the numbers for recreational guidelines, it needs to be explained why. A group of experts should make that decision.

**Outcomes and key recommendations:**

- The progress of the revision of the book on *Toxic Cyanobacteria in Water* was noted.
- Two issues that require a detailed review of the evidence include the use of biovolumes instead of cell numbers and the proposed approach to developing guideline values. Detailed comments are needed on the draft chapters related to these issues by the Chemicals Aspects Working Group after the meeting.

### 8.4 Cyanobacteria fact sheets

**Phil Callan** explained that two fact sheets on the management of cyanobacteria in drinking-water and recreational water had been drafted to provide information on what actions to take and when to take action if there is a bloom. The fact sheets are based on the drinking-water guidelines, the recreational water guidelines and the *Toxic Cyanobacteria in Water* book. The structures of the two fact sheets are similar. The fact sheet on cyanobacteria in drinking-water is a practical guide, containing information on health and aesthetic effects, environmental conditions that promote growth, monitoring and testing of source water, prevention and control of blooms, detailed treatment options, risk management and the WSP approach, and regulatory conclusions. The recreational water fact sheet is similar, but it promotes a guideline of a cyanobacterial biovolume of 2–10 mm$^3$/ml, which differs from both the numbers in the original guidelines document and Ingrid Chorus’s proposed revision of the *Toxic Cyanobacteria in Water* book.

Is there a need for these fact sheets, or should the development wait until everything has been resolved (given that the *Toxic Cyanobacteria in Water* book is still under revision)? The fact
sheets do not contain enough information on source water management and need to embrace the WSP approach more fully.

**Key discussion points:**

- All WHO publications need to be consistent, so there is a need to hold off on the cyanobacteria fact sheets unless the guidance is consistent with the information in the existing guidelines, including guideline values.

- There is a need for the information in the fact sheets to be disseminated to countries that need it.

**Outcome and key recommendation:**

- There was agreement that development of the fact sheet on cyanobacteria in recreational water should be halted until *Toxic Cyanobacteria in Water* was revised; however, the fact sheet on cyanobacteria in drinking-water should be completed as soon as possible.

### 8.5 Cylindrospermopsin and microcystin

**Ingrid Chorus** reminded participants that the 2005 meeting of the Drinking-water Quality Committee agreed to prepare a background document on cylindrospermopsin. The International Programme on Chemical Safety (IPCS) was asked to evaluate the available literature on cylindrospermopsin and to report whether data were sufficient for a toxicological assessment, because cylindrospermopsin meets the criteria for review according to the P&P manual. IPCS passed on this request to the International Agency for Research on Cancer, which decided that there were not enough data on carcinogenicity to classify cylindrospermopsin; a review of available toxicological data was not carried out. No second independent toxicological study following Organisation for Economic Co-operation and Development (OECD) protocol has been conducted. If this gap could be filled, could a guideline for cylindrospermopin be derived? Ingrid feels that a guideline should be established for cylindrospermopin. It would be highly valuable for countries to draw on this without needing to include it in national legislation; the guideline should be used only if cylindrospermopin is found in local situations.

With respect to the microcystin background document, it needs to be clarified whether it is on all cyanotoxins or just microcystins. The document itself needs updating in terms of the occurrence data and factors driving the toxicity of blooms, a few details need to be corrected, climate change needs to be addressed, and the toxicity and human exposure assessments need to be reviewed and updated. As well, if the document is on cyanotoxins, it needs to discuss cylindrospermopin’s occurrence and persistence.

**Key discussion points:**

- There is a need to consider providing guidance on the different toxins and cell concentrations, rather than providing only the microcystin number. Australia

---

concluded that there was insufficient information for a guideline for cylindrospermopsin, but provides a screening level. The situation is similar for saxitoxins. Using microcystin as a surrogate for Anabaena etc. is not a defensible approach. It is not feasible to produce new documents until an endorsed approach has been established.

- The USEPA does not have guidelines for cyanotoxins yet; it will choose a more conservative lifetime exposure when developing its guidelines.

- Health Canada and the USEPA have been updating their toxicological profiles on cyanobacteria, which include health effects reviews of microcystins, anatoxin A and cylindrospermopsin. Canada now has a formal guideline for microcystins in recreational water as well as an existing guideline for total microcystins (based on microcystin-LR) in drinking-water. Cyanobacteria are a good candidate for illustrating the effectiveness of source water protection plans.

**Outcome and key recommendations:**

- Consider providing guidance on the different toxins and cell concentrations, rather than providing only the microcystin number. However, as long as this can be based only on the work conducted in Australia, there is insufficient information for a guideline for cylindrospermopsin (as confirmed by the recently completed Health Canada and USEPA toxicological review). A second independent toxicological study conducted in compliance with good laboratory practice (GLP) would therefore be highly welcome.

- Consider the USEPA and Health Canada updates of their toxicological profiles for cyanotoxins when these become available.

- A number of revisions to the microcystin fact sheet were identified.

9. DRINKING-WATER GUIDELINES AND CROSS-CUTTING ISSUES

9.1 WHO’s work on radiation protection and health

**María Perez** (by teleconference) informed the group that ionizing radiation, or radionuclides, was relevant to the drinking-water guidelines. There are four types of exposure to radionuclides: existing exposures (radon), planned exposures (medical, occupational, public), emergency exposures (accidents or deliberate events) and chronic exposure from past accidents (Chernobyl). Non-ionizing radiation consists of electromagnetic fields (e.g. International EMF Project investigating health effects from mobile telephones) and UV radiation (e.g. INTERSUN Project on the health effects of solar radiation, tanning beds, etc.).

A new edition of the International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources (BSS) was published in 2011, which is co-sponsored by six UN agencies, including WHO, and two intergovernmental agencies. It provides a robust framework of agreed norms and standards for radiation safety. Reference is made to the WHO guidelines in the BSS.

The Inter-Agency Committee on Radiation Safety aims to promote collaboration between international organizations in matters of radiation safety and to promote consistency and coordination of policies with respect to areas of common interest. It will monitor coordination
of activities related to radioactivity concentrations in food, water, commodities and other environmental materials to identify gaps or overlaps. A questionnaire on activities, scope and mandate, including reference to the WHO drinking-water guidelines, will be circulated to members of the committee in 2013.

WHO established an expert working group to review chapter 9 of the Third Edition of the GDWQ, and that expert working group was maintained for review of the Fourth Edition. Indoor radon exposure is being considered at WHO, as is the use of radiation in health care (diagnosis and treatment), in terms of controlling the risks and maximizing the benefits. Prevention of adverse effects and unintended exposures is also a big challenge. The WHO Global Initiative on Radiation Safety in Health Care Settings focuses on public health aspects related to the risks and benefits of the use of radiation in health care.

WHO responded to the Fukushima nuclear power plant accident with a variety of short-term response actions. An emergency response plan was immediately activated, relevant WHO technical programmes were engaged, technical support was provided to national authorities on food, water, travel, trade, etc., and information was provided to public, governments and the media. Lessons learnt included the importance of providing timely and accurate information. It needed to be emphasized that the WHO drinking-water guidelines are not applicable in emergency situations, although WHO provided technical support. Health risk assessment reports on the accident have been published; their scope is radiation doses and risks to the public and workers, considering different age groups and global geographic coverage. Exposure pathways include inhalation, food, drinking-water and external radiation. Different approaches are required for the general population and emergency workers.

A risk communication tool on radiation and food safety was started in 2012 as a joint project with the WHO Department of Food Safety and Zoonoses. A first draft has been completed and is to be circulated for review. It aims to provide guidance to policy-makers, national and local governments and health workers.

**Key discussion points:**

- The lifetime risk calculated for the guidance provided is related to dose, 0.1 mSv, which is equivalent to the lifetime dose for chemicals in drinking-water. Risks in children are higher. The nominal risk is 5 in 1 million for all ages.

**Outcomes and key recommendations:**
- Progress on various activities was noted, including a health risk assessment report on the Fukushima nuclear power plant accident and a risk communication tool on radiation and food safety.
- WHO’s response to the Fukushima nuclear power plant accident with a variety of short-term response actions was noted.
- It was noted that the WHO drinking-water guidelines are not applicable in emergency situations.

**9.2 Draft drinking-water workplan: introduction**

Mark Sobsey explained that the workplans and agenda items approach for specific chemicals and microbes go back to the development of addenda for the Second Edition of the GDWQ. The workplan approach with numbered agenda items was developed as part of the effort to
complete the Third Edition and prepare for addenda, as a way to organize and keep track of progress on proposed additions, changes and updates to content, for both the edition in progress and the rolling revisions (now called updates and amendments) of the existing edition.

Each agenda item in the workplan approach includes a reference and agenda item number based on identification in a previous working group meeting; a description of the issue being considered and a plan of work to address the issue, as decided at a previous working group meeting; an indication of progress made; and actions required for the upcoming working group meeting, including an identification of who was tasked and what tasks were needed to complete the workplan. Agenda items were applicable to the various working groups and combinations thereof, as well as for all working groups together.

At this meeting, agenda items that require action were identified, with time frames and prioritization of activities and identification of leads or focal points for those activities with a high priority (to be initiated or continued within the next year).

At the 2010 Tokyo meeting, workplans were developed for the post–Fourth Edition GDWQ. There is a need for harmonization of the workplans across the different guidelines for common topics. Examples of possible cross-cutting workplan issues and agenda items include health-based targets, QMRA (indicators, antimicrobial-resistant bacteria), vulnerable populations, networks, contaminant mixtures, surface water, nanoparticles and nanotechnologies, water reuse (potable and non-potable, direct and indirect) and hygienic water storage (household, urban, harvested rainwater). Which of these issues should be addressed? How do they get addressed in the context of the three waters? Should they be addressed holistically?

Outcomes and key recommendations:
- Proposed cross-cutting activities are health-based targets, QMRA (indicators, antimicrobial-resistant bacteria), vulnerable populations, networks, contaminant mixtures, surface water, nanoparticles and nanotechnologies, water reuse (potable and non-potable, direct and indirect) and hygienic water storage (household, urban, harvested rainwater). There is a need to consider which of these activities should be addressed holistically across drinking-water, wastewater and recreational water.

9.3 Turbidity

David Cunliffe explained that the text on turbidity had been expanded in the Fourth Edition of the GDWQ, but its main discussion was left in chapter 10 on acceptability. Turbidity has a broader range than that. Issues raised include public acceptability (4 nephelometric turbidity units [NTU] as the point of noticeability), disinfection (upper limit of 1 NTU) and measurement of filtration effectiveness (large plants should stay below 0.5 NTU at all times; surface water should be treated to below 0.3 NTU; small supplies should aim for less than 5 NTU and preferably less than 1 NTU). Chapter 7 has some advice about turbidity interfering with disinfection, but few data are provided.

Advice on turbidity should be expanded, breaking it down into its various components (use as a surrogate for performance measurement, acceptability, disinfection) in both chapter 7 and chapter 10.
A fact sheet on turbidity from Australia was provided.

**Key discussion points:**

- Health Canada has updated its turbidity guideline, which is linked to microbiology, based on individual filters and not called a health parameter.

- The text in the GDWQ needs fixing, as regulators are confused. This will need to be done quickly, as the guidelines are being misused. Perhaps a fact sheet on turbidity would be helpful.

- Turbidity plays a strong role in signalling changes in raw water quality.

- There is a need to provide more detailed guidance on turbidity, similar to the USEPA approach (achieving x log removals, linked directly with the QMRA approach). It should be clearly explained that the turbidity units one wants to achieve depend on what one is concerned about (different NTUs for different pathogens and hence different log removals).

- Low-cost turbidity measurement is not yet available.

**Outcomes and key recommendations:**

- Text in the GDWQ on turbidity needs to be revised, as the guidelines are being misused.

- There is a need to expand advice on turbidity, breaking it down into its various components (use as a surrogate for performance measurement in operational monitoring, acceptability, disinfection) in both chapter 7 and chapter 10 of the GDWQ. The usefulness of turbidity as an indicator of water quality needs to be emphasized.

- Development of a fact sheet on turbidity should be considered.

**9.4 Alternative disinfectants**

Joe Cotruvo explained that alternative second-level disinfectants are being used, particularly in smaller communities, without an adequate evaluation of their safety and efficacy data. These products are being used in point-of-use devices, pools, foods and cooling waters, but are generally not being used in public drinking-water supplies. Examples include metals (silver, copper), oxidants (iodine, bromine, peroxides), chloroisocyanurates and quaternary ammoniums.

Lorna Fewtrell has prepared a background document on silver alternative disinfectants, including ionic silver, silver nanoparticles and silver/copper. Once the background document is nearly finalized, a fact sheet will be developed. (She was also asked to prepare a fact sheet on copper, but only one paper was identified.) Her task was to explore their efficacy, health impacts, mechanisms of action and DBPs. She searched PubMed and identified 131 abstracts, 48 of which were relevant to drinking-water. After going through their reference lists, she ended up with 115 papers. The silver background document was provided to participants.

---

12 Additional discussion on alternative disinfectants by the Chemical Aspects Working Group is summarized in Annex 5.
The literature is disparate on how well silver works in combination with other things (except for its use in ceramic filters). Disinfection efficacy in drinking-water, in recreational water and for Legionella control was discussed. In drinking-water, waste silver, ionic silver and silver nanoparticles on various carriers have been tested mainly on bacteria at different spiking concentrations for different contact times. The log reduction varies, but it is often at least 3 log removal. Silver levels are sometimes measured in final water, but not always.

For drinking-water, a ceramic filter that is silver coated inside and out has been designed to be produced locally and used as a point-of-use device in households. Its efficacy is variable, with little impact against viruses, and there are issues with flow rates, but the filter does seem to reduce levels of diarrhoea. For recreational water, silver in combination with copper has been used in swimming pools with low halogen concentrations. The literature is quite old. Although there is quite rapid log removal, it is unlikely to be effective against many viruses; its efficacy is similar to that of chlorine. With respect to Legionella control in hospital hot water systems, silver may take weeks to be effective, and the development of resistance is possible.

In summary, silver can be effective, but not always and not against everything. Silver nanoparticles seem to be more effective than other forms. Silver may or may not end up in the final drinking-water. A long contact time may be required. Silver is tasteless and odourless, and no DBPs are produced.

**Key discussion points:**

- Health Canada studies with nanosilver particles suggest that DBPs may be formed where chloramination is used, although the research studies are continuing. Silver is well known as a dehalogenating agent.

- Silver-coated activated charcoal is not always effective in limiting biofilm formation.

- There is good evidence that the impact of silver-coated ceramic filters is due to the filters rather than to the silver. Unpublished evidence has shown regrowth in filtered water that was refrigerated, probably because the silver leached out.

- Silver plus copper can be used together in swimming pools. Silver is not applicable on its own in swimming pools because of the long contact time required.

- Research needs include determining log removal, applicability in the field and concentration of silver in drinking-water after use of silver devices.

- The increased use of silver is becoming an issue, because it is difficult to get a handle on the exposure situation.

*Joe Cotruvo* explained that fact sheets on other alternative disinfectants could be prepared, discussing their chemistry, uses, efficacy, DBPs, etc. and deciding whether WHO should recommend their use. These include iodine, which has short-term use by travellers and in emergencies, has known efficacy, is an essential nutrient and is associated with adverse effects and other issues, such as the formation of iodoDBPs and the need to balance risks and benefits; bromine, which is not essential, is used in pools, ships and industrial settings and in point-of-use devices, has a comparable efficacy to chlorine and forms bromoDBPs and
possibly bromate; and peroxides, which are used in food processing and pools, are oxidant stressors, are readily metabolized, have high CT values and lack information on their efficacy and toxicity.

Key discussion points:

- The use of peracetic acid for wastewater treatment is worthy of exploration.
- What about long-term use of iodine? It can be bought at the drugstore as a supplementary source of iodine for iodine deficiency, which is associated with severe effects. The TDI for iodine gives the upper bound of the total amount of iodine intake that is tolerable.
- Iodine is more effective than chlorine against Cryptosporidium.
- Advanced oxidation processes, in which peroxides are combined with UV, for example, and quaternary ammonium compounds could also be explored.

John Fawell discussed dichloroisocyanurates and trichloroisocyanurates, which produce hypochlorous acid and cyanuric acid in water. They are widely used in swimming pools, and there is an increased request to use these in public water systems, particularly small supplies. JECFA evaluated their toxicity and established a TDI for cyanuric acid. Chloroisocyanurates are easy to transport and store and more stable in UV. More chlorine is available in trichloroisocyanurate, so less cyanuric acid would be produced. Issues include the need to watch for the buildup of cyanuric acid with “topping up” of chloroisocyanurates in water containers/tanks and the similarity in structure between cyanuric acid and melamine, suggesting that kidney calculi may be precipitated.

Key discussion points:

- There is pressure to use chloroisocyanurates in Brazil. There needs to be a reasonable level of control. It is stable in the environment, but it is not known how long it persists. WHO has established a guideline value for it, although the guidelines note that it is primarily used in emergency situations.
- Where there is less opportunity for buildup of cyanuric acid, sodium dichloroisocyanuric acid tablets have been promoted by NGOs. This has been done partly because WHO included it in the GDWQ, even though it states that it is primarily for emergency use. The trade-off is between simple means of chlorination and microorganisms.

Outcomes and key recommendations:

- It was noted that a fact sheet on silver alternative disinfectants is being developed, including ionic silver, silver nanoparticles and silver/copper. Other disinfectants discussed during this session include dichloroisocyanurates and trichloroisocyanurates, iodine, bromine, peroxides, peracetic acid and quaternary ammonium compounds.
- The development of the following fact sheets on other alternative disinfectants, discussing their chemistry, uses, efficacy and DBPs (confirmed during Chemical Aspects Working Group meeting as well), is supported:
dichloroisocyanurates; iodine; bromine; peroxides (possibly).

9.5 International Network on Household Water Treatment and Safe Storage

Maggie Montgomery (by teleconference) explained that household water treatment and safe storage (HWTS) was an important health intervention, reducing the incidence of diarrhoea. It is included in the WHO/UNICEF seven-point strategy for diarrhoea control and the forthcoming WHO/UNICEF Global Action Plan to Prevent Childhood Pneumonia and Diarrhoea. To achieve the benefits, optimal choice and consistent and correct use by at-risk populations are needed. Two related WHO documents have been published recently, including the WHO/UNICEF Toolkit for Monitoring and Evaluating HWTS.

The HWTS network is co-hosted by WHO and UNICEF, with communications by the University of North Carolina (UNC) Water Institute. The Phase II strategy (2011–2016) has four main areas: support national policy and framework development, strengthen the evidence base, evaluate and disseminate best practices, and realize tangible results in scaling up. The global network targets address the key areas of work.

The mission statement of the global HWTS strategy focuses on vulnerable populations and use of HWTS within environmental health programmes (not as a stand-alone intervention).

Regional workshops have brought together mid-level managers from various countries, and progress has been made towards increasing access to HWTS and developing national action plans. The focus is on inclusion of HWTS in national health policies: child and maternal health, nutrition, HIV/acquired immunodeficiency syndrome (AIDS) and tuberculosis, and emergencies.

WHO commissioned a task force (made up of WHO staff from all relevant areas) on HWTS and communicable disease prevention to focus on the health impacts of HWTS. Its objectives are to review evidence, discuss policy and develop plans for future collaborative work. It will meet in Geneva in April 2013. Expected outcomes include a background paper on the health impact of HWTS on various vulnerable groups, a summary statement on scaling up HWTS and action plans for internal WHO collaborations.

Integration with other disease areas has been proposed to increase access to and use of HWTS. WHO is working with the United States Agency for International Development (USAID) and UNICEF to develop a WASH and nutrition document (similar to the HIV document). WHO is also working on efforts where WASH is the basis for preventing and controlling disease (e.g. cholera and hepatitis in Africa).

An international scheme to evaluate HWTS was established by WHO to promote and coordinate independent and consistent testing and evaluation of products based on WHO performance criteria and to support national governments in building technical capacity of research institutions and strengthening national regulation of HWTS. The scheme includes

13 Jennifer De France was scheduled to make a presentation on the International Network of Drinking-water Regulators (RegNet), the Small Community Water Supply Management Network and the Operations and Maintenance Network, but did not do so because of time constraints.
capacity-building activities, such as national and regional workshops, online training to understand health-based targets, partnerships to strengthen laboratory capacity and support for strengthening regulatory structures.

**Key discussion points:**

- Could the HWTS network advise the regions on removal of chemical contaminants in the home? The network does not address chemicals at the moment. The issues of arsenic and fluoride have been addressed at a geogenic international conference, and a larger discussion on when HWT is applicable in geogenic situations is warranted (although the applicability is probably limited). Maybe other chemicals could benefit from HWT.

- WHO is commended for establishing the HWTS network. The concept of decentralized point-of-use treatment is critical. A study found that the cost of HWT was less than that of central treatment, depending on population size.

**Outcome and key recommendations:**
- The network was noted.

### 9.6 WHO’s food safety programme: microbial and chemical risk assessment approaches

**Angelika Tritscher** of WHO’s Department of Food Safety and Zoonoses gave a presentation (by teleconference) on the department’s scientific advice and related activities. Drinking-water and food safety are similar. Under method development and harmonization lie the issues of chemical and microbiological risk assessment, risk–benefit assessment and exposure assessment. Applied risk assessment is carried out by various committees, such as the Joint FAO/WHO Expert Meeting on Microbiological Risk Assessment (JEMRA), JECFA and JMPR, as well as ad hoc committees on, for example, melamine and bisphenol A. Also included are fast-track risk assessments to provide rapid response to emerging issues either to colleagues or to Member States.

Scientific advice work of the department feeds into the Codex standard-setting process, national/regional food legislation and other WHO programmes, including the drinking-water guidelines, the WHO Pesticides Evaluation Scheme (WHOPES) and the International Food Safety Authorities Network (INFOSAN).

With respect to microbiological risk assessment methodology, the Microbiological Risk Assessment (MRA) series includes a set of guidelines for the risk assessment of microbiological hazards in food and water as well as publications relating to commodity/pathogen-specific risk assessment. Risk assessment is linked to risk management through the MRA series as well as through supporting publications (e.g. safe preparation of powdered infant formula) and web-based risk assessment tools for better understanding of microbiological risk assessment (e.g. assessment of performance of sampling plans).

What’s next with respect to microbiological risk assessment? There is a call for data and experts on microbiological hazards associated with low-moisture foods; a call for data on the control of specific zoonotic parasites in meat; and an elaboration of the statistical and mathematical aspects of microbiological criteria (in the food context).
With respect to chemical risk assessment, Environmental Health Criteria monograph 240 (EHC 240) on *Principles and Methods for the Risk Assessment of Chemicals in Food* as well as EHC 239 on modelling of dose–response for the risk assessment of chemicals both have parts applicable to drinking-water, as hazard assessment is independent of route of exposure. There are applied risk assessment series on food additives and contaminants, veterinary drug residues and pesticide residues, which feed directly into Codex and other work.

What’s next with respect to chemical risk assessment? New work on principles and methods includes application of the threshold of toxicological concern (TTC); the decision-tree approach to risk assessment of veterinary drugs; implementation of EHC 240; use of epidemiological data in risk assessment; and improving exposure assessment. Recent evaluations of contaminants, such as lead, cadmium and arsenic, need to be followed up with recommendations for action, and the food and water areas need to work closely together, especially with respect to arsenic.

The Global Environment Monitoring System – Food Contaminant Monitoring and Assessment Programme (GEMS/Food) collects global data on contaminants in food and global food consumption data through a web portal. It is an important information source on trends in levels of chemicals in food and their contribution to human exposure. The data are disseminated via FOSCOLLAB, a global platform to better guide risk analysis and decision-making in food safety through improved data sharing and access. FOSCOLLAB integrates existing sources of data and information (contaminants only at present, but new sources, particularly microbiological hazards, will be integrated in future). It is a modular system, so more databases will be added with time. It was just launched, and feedback from users is being solicited. A working group is to ensure the reliability of data quality. It would be desirable to integrate the drinking-water guidelines into this database.

Finally, advice provided by the department on the Fukushima accident included information on both food and water.

**Key discussion points:**

- Melamine in relation to the production of cyanuric acid from the use of sodium dichloroisocyanuric acid will be discussed by the Chemical Aspects Working Group.

- The department had only start-up funding for the databases and has run out of resources. New funds are needed to get the system of databases up and running (and all contributions are welcome).

- The drinking-water guidelines should be added to the database. Participants should look at the database and send feedback to Angelika.

- The nanotechnology paper (a collaboration with FAO) will be put up on the web, and Angelika will send Jennifer De France the link. The paper focuses on the health risks of nanoparticles, which are covered by existing risk management paradigms. Data currently available are not complete. Nanoparticulate food additives have to undergo the same approval as any other food additive, but a limiting factor is the lack of data. There is the potential for collaboration in this area. Drinking-water and food groups need to work much more closely together in many areas.
What is the department’s agenda for additional assessments relevant to drinking-water (e.g. mixtures, chromium(VI), nitrosamines, perchlorate)? The Concise International Chemical Assessment Document (CICAD) on chromium(VI) is about to be published by IPCS (not Angelika’s department), and it is already several years out of date. With respect to mixtures, the chemicals team is doing important work in that area; where food is the main exposure source, the group intake is based on a common metabolite or derived using the toxic equivalency factor approach. For perchlorate, there is no intention to revise the assessment. Pending requests will be discussed at a meeting to be held in a few weeks.

**Outcome and key recommendations:**

- Advice was sought on additional assessments relevant to drinking-water:
  - mixtures;
  - chromium(VI);
  - nitrosamines.
- If WSH conducts work on chemical mixtures and nanoparticles, the work that the food safety team has conducted should be taken into consideration.
- The addition of WHO guideline values to FOSCOLLAB should be considered.

### 9.7 Update from Radiation Working Group

Joanne Brown reported on potential work for radiation aspects in the water quality guidelines. She was involved in writing chapter 9 of the GDWQ and presented ideas for updating chapter 9 as well as potential areas for other future work. The presentation included feedback from some of the other experts involved in the revision of chapter 9 as well as other radiation experts.

Some of the questions and challenges for taking chapter 9 forward in the future include knowing where to measure (source, post-treatment, etc.); whether children should be considered in subsequent guideline values, as their risks can be higher; clearer guidance on interpretation of screening measurements for compliance; more guidance on natural radionuclides (most likely the reason for exceeding guideline values); whether guideline values apply for medical isotopes in wastewater; and information on analytical methods and limitations of screening techniques for some radionuclides.

There is confusion over the use of different guidance levels/action levels in the event of an accident/incident. There needs to be further clear explanation in the GDWQ as to when emergency and “normal” guideline values and criteria apply. It has been suggested that a paper written with WHO and other authors in the open literature may be useful (to include the experience in Japan, where the drinking-water guideline value was raised for the emergency situation, but has now been lowered).

With respect to harmonization, a risk-based approach is needed to determine priorities compared with other contaminants. Monitoring is needed to demonstrate that radiological aspects are not a priority, and lots of countries do not have the capacity to do the monitoring required. Monitoring needs to be simple and straightforward. Can technology (treatment) be used to provide assurance that levels of radioactivity are controlled and therefore to minimize the monitoring needed? For example, turbidity is being used in Japan as a secondary indicator of caesium levels in drinking-water. There is also a need for simple analytical methods for all countries.
Other issues include the effectiveness of household and other treatment at the community or regional level; radon in spas; rainwater harvesting (after an accident); irrigation of crops with wastewater and transfer to foods; and concentrations of radionuclides in sludge for reuse and their impact on workers producing waste products (probably only after incidents).

In summary, there is a need to balance radiological aspects with overall priorities for achieving safe water; update chapter 9 to make sure it is clear and understandable; and link to risk communication work. This work can be done without large resources, but the workplan needs to be agreed with the Secretariat and Radiation Working Group.

**Key discussion points:**

- Guidance on the safe disposal of treatment devices (e.g. radiologically contaminated point-of-use filters) is needed.
- There is great interest in chapter 9 from other Member States because of the Fukushima incident. Can the chapter be translated into different languages, or is there a fact sheet based on that chapter that is user friendly and more readily understandable by non-radiation people?
- There is a need to capture the substance of the discussion regarding using turbidity to monitor removal (rainfall increases turbidity and is also responsible for the transfer of radionuclides, such as caesium).
- The radiation terminology is generally difficult for people to understand. More emphasis should be placed on half-lives; when it is safe to drink the water depends on what radionuclide is in it. The risk goals in radionuclide calculations are different from the traditional risk goals used in the guidelines for carcinogens and for microbial pathogens; there is a need to explain that the goals are close but different due to the different methodologies used. Radiation is hard to simplify, but the guidance only needs to be usable (people need to understand principles); the units and terminology are not that important to understand.
- Many countries struggle with interpretation of the screening values, misinterpreting the screening values as guidance levels.
- A significant issue is that the drinking-water guidelines do not apply to emergency situations, which is problematic with respect to the risk communication side. IAEA operational emergency standards were not in agreement with the Japanese interim emergency standards, and WHO had to respond, but not as adequately as it would have liked. There is now tension because of the IAEA perspective. The idea of publishing a paper is potentially worth exploring. The guidelines should not be opened up to emergency situations, but there should be a systematic approach to responding to these situations.

**Outcomes and key recommendations:**

- Challenges for taking chapter 9 forward in the future include:
  - Knowing where to measure (source, post-treatment, etc.);
  - Whether children should be considered in subsequent guideline values, as their risks can be higher;
- Clearer guidance on interpretation of screening measurements for compliance;
- Guidance on natural radionuclides;
- Application of the guideline values for medical isotopes in wastewater;
- Information on analytical methods and limitations of screening techniques for some radionuclides;
- Guidance on the safe disposal of treatment devices (e.g. radiologically contaminated point-of-use filters).

- There needs to be further clear explanation in the GDWQ as to when emergency and “normal” guideline values and criteria apply.
- Guidance on using turbidity to monitor removal of radionuclides needs to be expanded.
- With respect to harmonization, a risk-based approach should be highlighted to determine the priority of radiological contaminants compared with other contaminants.

9.8 Microbial Aspects Working Group workplan

Ana Maria de Roda Husman informed the group that high-priority items on the Microbial Aspects Working Group workplan included work on the multiple-barrier approach and interactions with various technologies. This work is also relevant to chemical and radiological contaminants. The plan is to analyse the public literature to provide text for the distribution book and the GDWQ. The work is being led by Gertjan Medema and David Cunliffe.

The topic of short-term fluctuations in levels of microbial contaminants was also identified as a high-priority item. It is important to review the QMRA document and make sure that short-term fluctuations are considered. Gertjan Medema and Thor-Axel Stenström were asked to lead the task of reviewing the QMRA document and providing text for chapter 7 of the GDWQ.

A new agenda item identified as a high priority was the relationship between indicator organisms (E. coli) and reference pathogens, to allow the prediction of pathogen concentrations. Information on indicators and how they relate to pathogens in water is not plentiful, and a further evidence review is needed. Phillip Amoah, David Kay and Rafael Bastos will take the lead.

Also identified as a high priority was the agenda item on microbial methods. If you perform QMRA based on data generated using different types of methods, it will affect the outcome. Gertjan Medema, Ana Maria de Roda Husman and Rafael Bastos will consult with the QMRA group to determine whether text on microbial methods should be included.

A medium priority is to review the Water Treatment and Pathogen Control book (by Mark LeChevallier) to update it and to include WSPs, validation methods and information on surrogates. David Cunliffe, Rafael Bastos and Mark Sobsey are the focal points for this activity.

Other items include the QMRA toolbox (which was very welcome, as it relates to several chapters in the guidelines), a revised book on Legionella and the rapid testing decision-tree. With respect to the recreational water workplan, the Microbial Aspects Working Group
discussed such issues as the need for pool safety plans, modelling and new tools. All were of low or moderate priority, except for secondary contact with cyanobacteria.

The Microbial Aspects and Protection and Control Working Groups both feel strongly about the harmonization process. Ana Maria feels that combining WSPs, pool or recreational water safety plans and SSPs would be beneficial. If more could be done that is useful for people around the world (e.g. fact sheets on organisms combined for different waters), that would be beneficial.

More details on the agenda items discussed by the Microbial Aspects Working Group, as well as on the agenda items discussed by both the Microbial Aspects and Protection and Control Working Groups, may be found in Annex 3.

Key discussion points:

- Were alternative disinfectants discussed in terms of efficacy, CT values and other microbiological issues? There are huge gaps in knowledge, and the Microbial Aspects Working Group needs to give due consideration to this issue. The issue was discussed, but was not given a high priority.

- Alternative disinfectants were discussed in plenary, and the Chemical Aspects Working Group has identified high priorities for silver, sodium dichloroisocyanurate, iodine and bromine. Both working groups need to be involved.

- Was there any discussion on the quality of dose–response data? The data are limited, resulting in gross assumptions about their applicability to vulnerable populations. There is a need to communicate that more data are needed. Are there recommendations on this issue from this working group? The issue was discussed, but was not given a high priority.

- Turbidity, which was raised in plenary, was discussed, and a way forward was proposed.

- The multiple barriers topic is very complicated, and perhaps it belongs in a separate document, rather than in the guidelines. However, the influence of the various steps in the treatment process on each other needs to be addressed, as some processes positively influence each other and others negatively. Examples need to be included in the supporting documents.

- The guidelines are getting bigger, and all suggestions being made here are going to expand them even further. There is a need to re-examine the logic and rationale of the guidelines and recommendations and supporting information. The microbial guidelines are the most important, plus a few chemicals. The guidelines should be restructured to create different categories of information. This would simplify the guidelines for national governments in terms of what to regulate and reduce their resource demands. Taking a de novo look at what the guidelines should incorporate and how they can be reassembled to be most effective is highly recommended.

- Items for the next edition were rated as moderate, because they are long term; those rated as high priority need information for a document being developed more
immediately. Lower priority does not mean that the tasks are not seen as important; all will be completed by 2020.

Outcomes and key recommendations:

- High-priority items (1–2 years) were noted:
  - Multiple-barrier approach and interactions with various technologies. This is relevant for chemical and radiological contaminants too. This work is to inform the work on water quality control in distributions as well as the GDWQ;
  - Short-term fluctuations in levels of microbial contaminants for the QMRA document and the GDWQ;
  - Relationship between indicator organisms (E. coli) and reference pathogens, to allow the prediction of pathogen concentrations;
  - Microbial methods;
  - Turbidity.
- Medium-priority items (2–3 years) were noted:
  - Review the Water Treatment and Pathogen Control book (by Mark LeChevallier) to update it and to include WSPs, validation methods and information on surrogates;
  - A new book on Legionella;
  - Fact sheets on individual organisms (e.g. Cryptosporidium);
  - Rapid testing decision-tree;
  - Secondary contact with cyanobacteria.
- Low- to moderate-priority items (5+ years) were noted:
  - The need for pool safety plans, modelling and new tools.

9.9 Protection and Control Working Group workplan

Oliver Schmoll informed the group that the Protection and Control Working Group had only five agenda items and was therefore able to discuss them in much technical detail. He summarized the basic outcomes of the discussions and referred to the annotated agenda (see Annex 4) for more detail.\(^\text{14}\)

Update of Volume 3 has been on the agenda for a long time. The working group confirmed the need to update the volume, which received the highest priority rating. Jan Willem Rosenboom and Han Heijnen reviewed the scope of the current volume and drew a few main conclusions. As the current volume has a mixed target audience, it was recommended that the material be split into separate documents, one the updated Volume 3 targeting managers, planners and regulators at an intermediate level, and a second complementary volume containing material supporting fieldworkers, including sanitary inspection, sampling, testing, calibration, etc. The next step is to move ahead and define the way forward. Jan Willem will remain the focal point for the update of the two documents, with help from Phil Callan.

Revision of Volume 3 will commence later in 2013. Jan Willem will go back to the field guide draft, available since 2009, to include the necessary updates so that the two documents are complementary. A draft is expected to be available in 2014. Contributors and reviewers have been suggested, and a number of technical comments have been identified.

With respect to the update of the evidence base on safe storage and handling in households, unsafe storage and handling are significant sources of contamination, with additional

\(^{14}\) Items discussed jointly with the Microbial Aspects Working Group are summarized in Annex 3.
concerns regarding chemicals and mosquito breeding. It was concluded that safe storage and handling have been largely unrecognized. There is a body of new evidence that needs to be looked at and reviewed to see if an update is required for the GDWQ. This should address three different aspects: containers used to collect water at the community level, roof storage systems in piped supplies (intermittent) and home storage; all three are related to the management of safe water at the household level. Joe Brown will be asked by Mark Sobsey if he is willing to review the evidence over the next 1–2 years. The output will be provided to the working group, which will then decide on a way forward regarding either revision of the GDWQ text or a series of fact sheets or slim guidance documents.

Regarding the development of three free-standing monographs to support WSPs (surface water, rainwater and distribution books), concepts, contents, processes and next steps were discussed for each, and a few technical issues were raised. All three monographs aim to support WSP development for respective steps in the system. The working group identified high priority levels for all three books, to maintain momentum and encourage the authors to finalize them. It was concluded that all three documents will have a minor impact on the Fifth Edition, as they are already covered in chapter 6 or chapter 4 of the GDWQ. Therefore, it is not expected that their development will have any impact on the current text, and only very minor updates (i.e. updated references) will be required.

**Key discussion points:**

- There has been a clear plea to include a holistic approach at the local field level to integrate all aspects related to all three waters. It is proposed that this could be a stand-alone chapter in Volume 3. Radiological aspects are not discussed, but Joanne Brown’s comments will be brought on board.

**Outcomes and key recommendations:**

- GDWQ Volume 3 will be updated to harmonize with the GDWQ, to target managers, planners and regulators at an intermediate level.
- A field guide containing material supporting fieldworkers, calibration, sanitary inspection, sampling, etc., is to be developed.
- Ongoing activities to support WSPs (surface water, rainwater and distribution) are supported, and work should be initiated on reviewing the evidence on safe storage and handling in households.

### 9.10 Chemical Aspects Working Group workplan

Michèle Giddings explained that some of the agenda items included on the Chemical Aspects Working Group workplan had already been discussed in plenary (e.g. silver alternative disinfectants). High-priority items included updates of various background documents (chlorate, nitrate/nitrite, barium and selenium). Japan will be preparing a discussion paper on nickel for the next meeting, including new information that may affect the allocation factor used in developing the guideline value. The alternative disinfectants will need to be considered by the Microbial Aspects Working Group, whereas nitrate/nitrite needs to be reviewed by the Protection and Control Working Group (nitrification in distribution systems).

There was considerable discussion on how to deal with pesticides. Background documents have been developed based on JMPR assessments, and more pesticides are being added to the
workplan (including pesticides used on rice paddies in Japan). A suggestion has been made to change all guideline values for pesticides to health-based (guidance) values, with a one-page fact sheet including the basis of the reference value. It will be made clear that national authorities should select only those of relevance in each local situation to develop national standards. They can refer back to the JMPR evaluation (or similar national or international assessment) as the authoritative reference.

For further details on items discussed by the Chemical Aspects Working Group, see Annex 5.

**Key discussion points:**

- The problem is the constant requests for information on pesticides that may get into drinking-water. Continuation of the usual process of preparing large background documents is becoming an onerous task. As JMPR evaluations are used, there is little point in duplicating that process. It makes sense to produce a health-based value, taking all pesticides out of the list of guideline values and making it clear that they are health-based values. Member States would then need to select only those pesticides of relevance to them. This process would commence with pesticides currently in the GDWQ and be expanded to include pesticides used in rice paddies in Japan that potentially get into drinking-water. Additional information would be included on monitoring, determining when it is appropriate to incorporate these health-based values into national standards, etc. This is a change in the way the GDWQ would operate for pesticides, and the Chemical Aspects Working Group would like the endorsement of this meeting that this is a reasonable way forward.

- This approach to pesticides sounds excellent and could potentially be extended to other chemicals. The message should be that all guideline values are not to be copied to national standards, only those needed to regulate chemicals that are important in the local situation. This would be a good way to move forward to reduce the number of chemicals that are regulated nationally.

- The paper on the translation of the guidelines to national standards, prepared by David Cunliffe and John Fawell, may be helpful in this regard.

- Guideline values and health-based reference values have been misunderstood by some Member States. A guideline value suggests that more emphasis should be placed on it entering the national standards. Will this approach solve the issue? The underlying issue for the Member States is the massive number of chemicals they have to deal with. Is this change going to help them prioritize? They may wonder why WHO is withdrawing all those guideline values.

- This new approach will not be carried out in isolation; a number of things need to be done along with it to make sure that it works. There will be a process to explain the change more widely, with a circular going out to Member States and information provided to regional offices. There is a need to move away from the current approach, or it will not be possible to provide the appropriate level of advice. The way to move forward is to provide information, educate the Member States and link this in with the paper on application of the guidelines. There is a need to improve the way chemical guidelines are presented to Member States and help them determine how to select
what goes into their standards, emphasizing the need to monitor and enforce the appropriate standards for their particular situation or jurisdiction.

- Japan’s list of pesticides may not be used anywhere else, so it is appropriate to provide them with advice without encouraging national standards in countries where they are not used.

- There is a need to continue to provide advice on emerging chemicals, such as pharmaceuticals and personal care products and nanoparticles.

- The discussion about identifying priority chemicals is extremely valuable; in the context of potable reuse, which of these chemicals should there be concern about managing? There is a need to provide guidance on identifying chemicals that are always important (e.g. nitrate/nitrite) versus those at the other end of the spectrum. This is a very important exercise that belongs someplace, as readily accessible information is needed.

- The Chemical Aspects Working Group was unable to provide input on the wastewater and recreational water workplan issues without guidance from members of those groups.

**Outcomes and key recommendations:**

- **High-priority items were noted:**
  - Silver and other alternative disinfectants;
  - Manganese (clarify health-based value);
  - Chlorate (revise background document);
  - Nitrate/nitrite (revise background document);
  - Barium (revise background document);
  - Selenium (address comments received);
  - Nickel (discussion paper for next meeting);
  - Pesticides (revise format of fact sheet and develop/revise fact sheets for reassessed JMPR pesticides followed by pesticides used in rice paddies).

- **Medium-priority items were noted:**
  - Perchlorate (prepare background document);
  - Bromate (revise background document);
  - Bromodichloromethane (BDCM) (revise background document);
  - Perfluorooctane sulfonate (PFOS)/perfluorooctanoate (PFOA) (prepare background document);
  - Update treatment tables;
  - Nanoparticles;
  - Organotins (updated background document).

- **Low-priority items were noted.**

See Appendix 5 for details.
10. OVERALL PRIORITIES FOR HARMONIZATION OF THE WATER QUALITY GUIDELINES

Jennifer De France summarized the discussion on key cross-cutting plenary items that did not necessarily get picked up in the working group sessions.

With respect to harmonization of the three guidelines, WHO will proceed with an overarching document including the key principles of the Stockholm Framework, such as health-based targets, safety plans and independent surveillance. The Framework needs to be included in each of the three guidelines, using consistent terminology and highlighting the importance of incremental improvement.

WHO regional offices advised the meeting about their capacity-building needs and their need for advice on selecting priority parameters. John Fawell and David Cunliffe will continue to work on the document on translating the guidelines into national standards. This work may be expanded to include the wastewater and recreational water guidelines, or perhaps separate documents would be better. Participants should send comments on this document to Jennifer. This is just one component of capacity building. As this document is developed, there will be a consultation in a couple of countries or regions to provide training on how to develop national standards; feedback from this exercise can feed into finalization of the documents.

The issue of laboratory capacity was also raised by the WHO regional offices. WHO needs to provide support for this; there is no solution at present, but it is noted that this is an important area.

With respect to the scope of the wastewater guidelines, there is a need to provide more information on sanitation in general, include biosolids and other forms of reuse, etc.

Key discussion points:

- The two volumes of the recreational water guidelines are very different and may require different paths forward.

- The term “surveillance” means something different in different areas. Even monitoring and evaluation mean different things to NGOs and to the regions. There is a need to improve communication to harmonize terminology. Some of this is happening through some of the networks, but more is needed.

- More discussion is needed on how to go about harmonizing the guidelines. The guidelines are unwieldy and difficult to understand and use. To follow through on integration may make the guidelines larger. There is a need to take a step back and look at what is being proposed and rethink the structure: what belongs in a guideline and in a supporting document, how does it apply across the three waters, how should the existing guidelines be reorganized. Further discussions will be required on the mechanism.

- The harmonization of the guidelines will result in three sets of guidelines (drinking-water, recreational water and wastewater), with similar structures, common key principles and an overarching document that discusses these key principles.
➢ The structure of the harmonized document needs to be decided before the start of the revision.

➢ The guidelines should be more action-oriented and should include decision support tools.

➢ Before harmonizing the guidelines, the guidelines will need to be assessed for any systematic errors. A broader group of people needs to comment on this before harmonization can proceed.

➢ The guidelines are a scientific point of reference in water quality, a point of departure for developing regulations. Supporting documents are important adjuncts to the guidelines, but there is uncertainty around who is reading them and whether they are useful. An evaluation is needed of their value. The guidelines could also be complemented by fact sheets explaining specific issues (e.g. cyanobacteria) in layman language. Such a series of fact sheets would be very valuable.

➢ The guidelines need to be read several times to really understand what is being recommended: a preventive approach, microbial parameters are more important than chemical parameters, etc. There are very few recommendations. Other WHO guidelines are very slim, and details are not that important. The GDWQ contain a great deal of detail and very few recommendations, which are hard to find. The recommendations need to be highlighted in an executive summary, and the details should be available elsewhere.

➢ There is a lack of infrastructure to support the standards. Laboratory capacity is also an important issue. There is a new initiative in the Mekong region to map laboratories and capacity. Many do not have the capacity to measure pesticides, so they do not incorporate them in their standards. Laboratories are not required in every country; however, the results from samples sent away for analysis often come back too late. There is a need to strengthen infrastructure and capacity in this area.

➢ There is a need to revisit the paradigm for water quality analysis. The old paradigm is laboratories with lots of expensive equipment. Water quality testing needs to be brought into the field, with field test kits for both microbial and chemical (e.g. arsenic) parameters. There should be a focus on increasing that sort of laboratory capacity. It is easier to train, more cost-effective and more accessible, and it creates greater coverage. This group should be promoting moving in that direction.

➢ It is more economical to collect a bunch of samples and send them for analysis, even though results may not return quickly; rapid analysis kits get expensive. Reliance on monitoring should be reduced. The guidelines need to help people decide which chemicals should be focused on.

➢ The number of chemicals in the guidelines could be reduced, as they do not all have the same likelihood of occurrence. The list could be limited to 30 or 40 microbial and chemical parameters. This would help authorities focus on real priorities. Such a reduction would include advisory information on where to look for guidance. There is a need to aim for brevity in documents to improve readability.
Regarding the monitoring and surveillance issue, all principles being discussed have been in the guidelines in previous editions (including Volume 3 of the Second Edition). What action or targeted initiatives are needed to get the message out in a better format?

An electronic version of the guidelines, reformatted for tablets and smartphones, would improve the accessibility of the guidelines. There is little need today for a 500-page book as the only means to disseminate the guidelines.

There are three separate functions: regulatory (government), service delivery (NGOs, operator, utility, includes monitoring and evaluation) and surveillance to provide feedback to the other two functions. Countries should be encouraged to think systematically about those functions.

With decentralized water supplies (households, community systems), governments may abdicate their responsibility to provide a safe water supply. This needs to be approached with caution, as encouraging household treatment is an effective additional barrier. Governments should not delegate this responsibility to the consumer.

Water quantity is an important issue. Water quality is not really an issue if there is no water.

The new scope of the water and health guidelines includes water quantity/water scarcity, climate change and health guidance.

The development of the guidelines should be more inclusive, so that the needs of the regions are reflected in the guidelines. The composition of the WQTAG will assist in this regard.

Holding technical advisory group meetings in regional countries is a good idea. It will give WHO an opportunity to see the impact of its guidance first-hand.

Outcomes and key recommendations:

- Consider an evaluation to determine the value of the documents supporting the guidelines.
- Develop easy-to-read fact sheets explaining specific issues (e.g. cyanobacteria).
- Consider highlighting specific recommendations in the guidelines in an executive summary.
- Consider limiting the number of chemicals and microbial parameters in the guidelines to 30–40, as they do not all have the same likelihood of occurrence.
The way forward:

- WHO appreciates the feedback and discussions on what belongs in the guidelines and supporting documents. The safety framework in the three guidelines should follow a similar structure (based on the GDWQ). Systematic errors in the guidelines need to be taken care of. There is a need to think about how to get more systematic information to make sure that the guidelines reflect the current evidence base. There also needs to be a more systematic process to get feedback directly from the regions.

- Next steps include developing an overarching document with the key principles, updating the P&P manual to include the other two waters, following up on the high-priority items identified from the individual workplans and thinking about how to get better evidence to see what else needs to be updated in the guidelines.

- This was a challenging but useful meeting, as it covered a great deal, harmonization plus the individual workplans for the three guidelines. Future meetings will focus more on technical issues, as there was insufficient time to make decisions on many of the items at this meeting.

- Regarding the research agenda, there is a need to put things up on the WHO web site so that the broader research community can start generating the evidence needed to fill in knowledge gaps.

- The rapporteurs’ notes for the three groups will be consolidated into a meeting report, and the meeting report will be sent out for feedback to all participants, including those invited but unable to attend.

- The terms of reference for the technical advisory group plus consultants, peer reviewers, etc. will be finalized, and a call for nominations will be put out on listserve and sent to WHO Collaborating Centres in the next couple of months. WHO HQ and the regional offices will decide who should participate in the overarching WQTAG and on the roster for other functions. The Guideline Development Groups will then be pulled from the overall group.

- WHO wants all those currently involved to continue to be involved in some capacity.

- Perhaps there should be four groups, dividing the recreational water guidelines into two separate groups, as different groups and different expertise have been involved to date. However, titles should become less important if the harmonization agenda is taken forward, with a common core accompanied by a series of guidance documents.

11. CLOSING OF THE MEETING

A video message from Dr. Carrisa F. Etienne, Director of PAHO, on World Water Day, 22 March 2013, was played for meeting participants. The message this year is “water water everywhere … if we only shared”.

The WHO Secretariat noted that our job is to get the science right and also to deal with the issues of communication, implementation and capacity building. As we transition into a new
Joint Expert Meeting, 18–22 March 2013, Dübendorf

process, everyone is going to be involved in some way. WHO is grateful for the institutional memory, dedication and passion of those who have been involved for a long time. The Secretariat thanked the new people for their patience and for speaking out, as well as those who prepared briefs or presentations in advance, the rapporteurs, chairs, moderators of sessions and the regional offices.

The contributions from the WHO regional offices were acknowledged. Experts appreciated working with the WHO regional offices, and it is hoped that the meeting provided an opportunity for the direct line of communication between experts and WHO regional offices to address challenges in the regions.

The efforts of Jennifer De France and Kate Medlicott, as well as Phil Callan, in organizing the meeting were acknowledged.

WHO thanked the governments of the United Kingdom, Japan, the USA and Australia for supporting the meeting.

The meeting was then closed.
ANNEX 1: List of participants

LIST OF PARTICIPANTS

Dr Kazi Matin Ahmed
Department of Geology
Faculty of Earth and Environmental Sciences
University of Dhaka
Curzon Hall Campus
Dhaka 1000
Bangladesh

Dr Philip Amoah
International Water Management Institute (IWMI) Ghana Office
PMB CT 112 Cantonments
Accra
Ghana

* Dr Mari Asami
Department of Water Supply Engineering
National Institute of Public Health
2-3-6 Minami, Wako, Saitama 351-0197
Japan

** Dr Jamie Bartram
Director of Global Water Institute
Gillings School of Global Public Health
The University of North Carolina at Chapel Hill
166 Rosenau Hall, CB #7431
135 Dauer Drive
Chapel Hill, NC 27599-7431
USA

Dr Rafael Bastos
Universidade Federal de Viçosa
Departamento de Engenharia Civil
Viçosa-MG
CEP 36570-000
Brazil

* Dr Ruth Bevan
Lecturer in Human Health and Risk Assessment, and Project/Resource Manager
Cranfield Health
Vincent Building
Cranfield University
Bedfordshire MK43 0AL

* Did not attend entire meeting; ** Invited but unable to attend; # Participated via teleconference
United Kingdom

**Ms Joanne Brown**
Centre for Radiation, Chemical and Environmental Hazards
Health Protection Agency
Chilton
Didcot
Oxfordshire, OX11 0RQ
United Kingdom

**Mr Philip Callan**
28 Helen Mayo Crescent
Bonython ACT 2905
Australia

**Dr Ingrid Chorus**
Federal Environment Agency (Umweltbundesamt)
Corrensplatz 1
14195 Berlin
Germany

**Dr Joe Cotruvo**
Joseph Cotruvo Associates/NSF International Collaborating Centre
5015 46th Street NW
Washington DC 20016
USA

* **Dr Derrick Crump**
Director, Institute of Environment and Health (IEH)
Cranfield Health
Vincent Building
Cranfield University
Bedfordshire MK43 0AL
United Kingdom

**Dr David Cunliffe**
Department of Health
Public Health
PO Box 6
Rundle Mall
Adelaide SA 5001
Australia

**Dr Pay Drechsel**
International Water Management Institute (IWMI)
PO Box 2075
Colombo, Sri Lanka

**Dr Ana Maria de Roda Husman**
National Institute of Public Health and the Environment (RIVM)
Center for Infectious Disease Control
Laboratory for Zoonoses and Environmental Microbiology (LZO; Bag 63)
Department Environment
PO Box 1 / Antonie van Leeuwenhoeklaan 9
3720 BA Bilthoven
The Netherlands

Professor John Fawell
Independent Consultant
9 Dandridge Drive
 Bourne End.
 Bucks, SL8 5UW
 United Kingdom

* Dr Lorna Fewtrell
Coppice House
Quakers Coppice
Crewe
Cheshire, CW1 6FA
United Kingdom

Ms Michèle Giddings
Health Canada
Water Quality & Science Division
Water and Air Quality Bureau
3rd Floor (Rm 3-005A)
269 Laurier Avenue West, A.L. 4903A
Ottawa, Ontario
Canada K1A 0K9

Dr Akihiko Hirose
Division of Risk Assessment
National Institute of Health Sciences
1-18-1 Kamiyoga
Setagaya-ku
158-8501 - Tokyo
Japan

Professor Christiane Hoeller
Sachgebiet Hygiene
Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit
Veterinärstr. 2
85764 Oberschleißheim, Germany

** Dr Guy Howard
Department for International Development
Abercrombie House
Eaglesham Road
East Kilbride, G75 8EA
United Kingdom
**Professor Paul Hunter**  
University of Leeds  
School of Medicine, Health Policy & Practice  
Department of Health Protection  
Norwich Research Park  
GB-Norwich, NR4 7TJ  
United Kingdom

*Professor David Kay*  
Environment and Health  
Centre for Research into Environment and Health (CREH), University of Wales Lampeter  
SA48 7ED - Ceredigion, Wales  
United Kingdom

*Dr Richard Johnston*  
Eawag  
Überlandstrasse 133  
PO Box 611  
8600 Dübendorf  
Switzerland

*Professor Duncan Mara*  
University of Leeds  
School of Civil Engineering  
LS2 9JT - Leeds, West Yorkshire  
United Kingdom

Dr Peter Marsden  
Drinking Water Inspectorate  
Area 4A  
Ergon House  
Horseferry Road  
London SW1P 2AL  
United Kingdom

Dr Yoshihiko Matsui  
Faculty of Engineering  
Hokkaido University  
N13W8  
Sapporo 060-8628  
Japan

Dr Calum McPhail  
Environment Quality Unit Manager  
Scottish Environment Protection Agency  
5 Redwood Crescent  
Peel Park  
East Kilbride  
Glasgow G74 5PP
United Kingdom

**Dr Gertjan Medema**  
Water Quality & Health Research Group  
Kiwa Water Research  
PO Box 1072  
3430 BB Nieuwegein  
The Netherlands

**Dr Maria Ines Josefina Navarro**  
Institute of Engineering, Universidad Nacional Autónoma de México (UNAM)  
Apdo. Postal 70472  
Ciudad Universitaria  
04510 Coyoacán,  
Mexico DF  
Mexico

**# Dr Edward Ohanian**  
Associate Director for Science  
Office of Water (Mail Code 4301T)  
United States Environmental Protection Agency (USEPA)  
Ariel Rios Building  
1200 Pennsylvania Avenue, NW  
Washington, DC 20460-0001  
USA

**Professor Choon Nam Ong**  
Environmental Research Institute  
National University of Singapore  
Lower Kent Ridges Road  
Singapore 119077

* Dr Erik Pedersen*  
Water, Sanitation & Education Centre, Supply Division  
UNICEF  
2100 Copenhagen  
Oceanvej 10-12  
Denmark

**# Dr Katherine Pond**  
Robens Centre for Public and Environmental Health  
Wolfson Building  
2AW02  
University of Surrey  
Guildford GU2 7XH  
United Kingdom

**Mr Jan Willem Rosenboom**  
Senior Program Officer, Water, Sanitation and Hygiene  
Bill & Melinda Gates Foundation
PO Box 2350
Seattle, WA 98102
USA

Mr Oliver Schmoll
Federal Environment Agency (Umweltbundesamt)
Department for Drinking Water and Bathing Water Hygiene
Heinrich-Heine-Strasse 12
08645 Bad Elster
Germany

Ms Marla Sheffer
1553 Marcoux Drive
Orleans, Ontario K1E 2K5
Canada

Professor Mark Sobsey
University of North Carolina at Chapel Hill
CB No.7431
Rosenau Hall, Room 149C
Chapel Hill, North Carolina 27599-7431
USA

Professor Thor-Axel Stenström
Stockholm Environment Institute
Bioresources Group
Kräftriket 2B
SE-10691 - Stockholm
Sweden
and
Institute for Water and Wastewater Technology (iWWT)
Durban University of Technology
PO Box 1334
Durban 4000
South Africa

Dr Marta Vargha
National Institute of Environmental Health, Hungary
Department of Water Microbiology
Gyali ut 2-6
1097 Budapest
Hungary

Dr Lesley Vázquez-Coriano
United States Environmental Protection Agency (USEPA)
Office of Science and Technology
Office of Water, Health and Ecological Criteria Division
1200 Pennsylvania Avenue, NW (MC 4304T)
Washington, DC 20460
USA
Dr Timothy Wade  
United States Environmental Protection Agency (USEPA)  
Human Studies Facility  
MD 58C  
RTP  
North Carolina 27711  
USA

**WHO Secretariat**

**WHO Staff:**

Ms Jennifer De France  
Water, Sanitation, Health & Hygiene (WSH)  
World Health Organization  
20 Avenue Appia  
1211 Geneva 27  
Switzerland

Mr Bruce Gordon  
Water, Sanitation, Health & Hygiene (WSH)  
World Health Organization  
20 Avenue Appia  
1211 Geneva 27  
Switzerland

Ms Kate Medlicott  
Water, Sanitation, Health & Hygiene (WSH)  
World Health Organization  
20 Avenue Appia  
1211 Geneva 27  
Switzerland

**Secondee to WHO (WSH):**

Dr Graham Alabaster  
Urban Basic Services Branch  
United Nations Human Settlements Programme  
Geneva Office

Mr Kah Cheong Lai  
Public Utilities Board, Singapore  
40 Scotts Road  
#10-01 Environment Building  
Singapore 228231
Additional WHO staff presentations:

# Dr Maggie Montgomery
Water, Sanitation, Health & Hygiene (WSH)
World Health Organization
20 Avenue Appia
1211 Geneva 27
Switzerland

# Ms Susan Norris
WHO Press (WHP)
World Health Organization
20 Avenue Appia
1211 Geneva 27
Switzerland

# Ms Annette Prüss-Üstün
Evidence and Policy on Environmental Health
World Health Organization
20 Avenue Appia
1211 Geneva 27
Switzerland

# Ms Maria Perez
Radiation and Environmental Health Programme
World Health Organization
20 Avenue Appia
1211 Geneva 27
Switzerland

# Dr Angelika Tritscher
Risk Assessment and Management (RAM)
World Health Organization
20 Avenue Appia
1211 Geneva 27
Switzerland

WHO Regional Offices

* Dr Magaran Monzon Bagayoko
World Health Organization
WHO Regional Office for Africa
PO Box 6
Brazzaville
Congo

* Paulo Fernando Piza Teixeira
Regional Advisor on Urban Health
Pan-American Health Organization / World Health Organization
525, 23rd Street NW
Washington DC
USA

* Mr Hamed Abdelqader Bakir
World Health Organization
WHO Regional Office for the Eastern Mediterranean
Centre for Environmental Health
PO Box 926 967
Amman 11190
Jordan

* Dr Shinee Enkhtsetseg
World Health Organization
WHO European Centre for Environment and Health, Bonn
Hermann-Ehlers-Str. 10
D-53113 Bonn, Germany

* Dr Mohd Nasir Hassan
World Health Organization
WHO Regional Office for the Western Pacific
PO Box 2932
Manila 1099
Philippines

* Mrs Payden
World Health Organization
WHO Regional Office for South-East Asia
World Health House
Indraprastha Estate
Mahatma Gandhi Road
New Delhi 110 002
India

Observers

* Dr Stephan Hug
Eawag

* Professor Dr Thomas Egli
Eawag

* Professor Dr Hans-Joachim Mosler
Eawag

* Dr Christian Zurbrügg
Eawag

* Dr Michael Berg
Eawag
### ANNEX 2: Agenda

#### Day 1: Monday 18 March, Conference Room C20

<table>
<thead>
<tr>
<th>Time</th>
<th>Agenda item</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830–0900</td>
<td>Daily preparatory meeting of chairs and rapporteurs</td>
<td></td>
</tr>
<tr>
<td>0900–1030</td>
<td><strong>Session 1 - Introductions, objectives and updates</strong></td>
<td><strong>Chair: Bruce Gordon</strong></td>
</tr>
<tr>
<td>0900–0930</td>
<td>Welcome and update on key achievements on water quality and health</td>
<td>Bruce Gordon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Janet Hering, Directorate Eawag</td>
</tr>
<tr>
<td>0930–1000</td>
<td>Round of introductions and declaration of interests</td>
<td>Bruce Gordon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jennifer De France</td>
</tr>
<tr>
<td>1000–1030</td>
<td>Objectives and methods of work</td>
<td>Jennifer De France</td>
</tr>
<tr>
<td>1030–1100</td>
<td><strong>Coffee</strong></td>
<td></td>
</tr>
<tr>
<td>1100–1230</td>
<td><strong>Session 2 – Strategy and harmonization of the WHO water quality guidelines</strong></td>
<td><strong>Chair: Lorna Fewtrell</strong></td>
</tr>
<tr>
<td>1100–1145</td>
<td>The WHO Water Quality and Health Strategy</td>
<td>Jennifer De France</td>
</tr>
<tr>
<td></td>
<td>Plenary discussion</td>
<td></td>
</tr>
<tr>
<td>1145–1230</td>
<td>Harmonization of the three WHO water quality guidelines</td>
<td>Phil Callan</td>
</tr>
<tr>
<td></td>
<td>Linking the guidelines at policy level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plenary discussion</td>
<td></td>
</tr>
<tr>
<td>1230–1330</td>
<td><strong>Lunch</strong></td>
<td></td>
</tr>
<tr>
<td>1330–1500</td>
<td><strong>Session 3 – Harmonization of the WHO water quality guidelines (cont.)</strong></td>
<td><strong>Chair: John Fawell</strong></td>
</tr>
<tr>
<td>1330–1500</td>
<td>Harmonization of health-based targets</td>
<td>David Cunliffe</td>
</tr>
<tr>
<td></td>
<td>(See annotated agenda items ## 1–3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plenary discussion</td>
<td></td>
</tr>
<tr>
<td>1500–1530</td>
<td><strong>Coffee</strong></td>
<td></td>
</tr>
<tr>
<td>1530–1700</td>
<td><strong>Session 4 - Water quality and health expert group and guidelines development process</strong></td>
<td><strong>Chair: Oliver Schmoll</strong></td>
</tr>
<tr>
<td>1530–1545</td>
<td>Expert group terms of reference</td>
<td>Kate Medlicott</td>
</tr>
<tr>
<td>1545–1615</td>
<td>Guideline development at WHO</td>
<td>Susan Norris (via teleconference)</td>
</tr>
<tr>
<td>1615–1700</td>
<td>Policies and procedures for updating the WHO water quality guidelines (See annotated agenda item # 4)</td>
<td>Phil Callan</td>
</tr>
<tr>
<td>1730–</td>
<td><strong>Apéro (hosted by Eawag)</strong></td>
<td>Basement cafeteria</td>
</tr>
</tbody>
</table>
Day 2: Tuesday 19 March, Conference Room C20

<table>
<thead>
<tr>
<th>Time</th>
<th>Agenda item</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830–0900</td>
<td>Daily preparatory meeting of chairs and rapporteurs</td>
<td></td>
</tr>
<tr>
<td>0900–1030</td>
<td>Session 1 - Feedback from the WHO regional offices on the guidelines: perspectives on the workplans</td>
<td>Chair: Michèle Giddings</td>
</tr>
<tr>
<td>0900–1000</td>
<td>• AFRO</td>
<td>Magaran Bagayoko</td>
</tr>
<tr>
<td></td>
<td>• AMRO</td>
<td>Paulo Teixeira</td>
</tr>
<tr>
<td></td>
<td>• EMRO</td>
<td>Hamed Bakir</td>
</tr>
<tr>
<td></td>
<td>• EURO</td>
<td>Shinee Enkhtsetseg</td>
</tr>
<tr>
<td></td>
<td>• SEARO</td>
<td>Payden</td>
</tr>
<tr>
<td></td>
<td>• WPRO</td>
<td>Nasir Hassan</td>
</tr>
<tr>
<td>1000–1030</td>
<td>Plenary discussion</td>
<td></td>
</tr>
<tr>
<td>1030–1100</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1100–1230</td>
<td>Session 2 – Cross-cutting activities included on the GDWQ post 4th Ed. workplan and WSPs</td>
<td>Chair: Thor-Axel Stenström</td>
</tr>
<tr>
<td>1100–1120</td>
<td>Vulnerable groups (See annotated agenda item #5)</td>
<td>Ana Maria de Roda Huisman</td>
</tr>
<tr>
<td>1120–1140</td>
<td>Indirect potable reuse (See annotated agenda item #6)</td>
<td>John Fawell</td>
</tr>
<tr>
<td>1140–1210</td>
<td>QMRA (See annotated agenda item #7)</td>
<td>Gertjan Medema</td>
</tr>
<tr>
<td>1210–1230</td>
<td>Update on WSPs</td>
<td>Jennifer De France</td>
</tr>
<tr>
<td>1230–1330</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>1315–1400</td>
<td>Tour of Eawag</td>
<td></td>
</tr>
<tr>
<td>1400–1500</td>
<td>Session 3 – Burden of disease and wastewater workplan</td>
<td>Chair: Graham Alabaster</td>
</tr>
<tr>
<td>1400–1420</td>
<td>Burden of disease estimates for WSH</td>
<td>Annette Prüss-Üstün (via teleconference)</td>
</tr>
<tr>
<td>1420–1500</td>
<td>Presentation and discussion of draft wastewater workplan</td>
<td>Duncan Mara</td>
</tr>
<tr>
<td>1500–1530</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1530–1700</td>
<td>Session 4 - Wastewater workplan (cont.)</td>
<td>Chair: Graham Alabaster</td>
</tr>
<tr>
<td>1530–1550</td>
<td>Update on SSPs</td>
<td>Thor-Axel Stenström / Kate Medlicott</td>
</tr>
<tr>
<td>1550–1700</td>
<td>Plenary discussion</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Agenda item</td>
<td>Notes</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>0830–0900</td>
<td>Daily preparatory meeting of chairs and rapporteurs</td>
<td></td>
</tr>
<tr>
<td>0900–0930</td>
<td>Session 1 – Recreational water workplan</td>
<td>Chair: Mark Sobsey</td>
</tr>
<tr>
<td>0900–0920</td>
<td>Presentation of draft workplan</td>
<td>David Kay</td>
</tr>
<tr>
<td>0920–0940</td>
<td>Summary of overall work conducted by EURO on Vol. 2</td>
<td>Shinee Enkhtsetseg</td>
</tr>
<tr>
<td>1000–1010</td>
<td>Public health chapter</td>
<td>David Cunliffe</td>
</tr>
<tr>
<td>1000–1030</td>
<td>Plenary discussion</td>
<td></td>
</tr>
<tr>
<td>1030–1100</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1100–1230</td>
<td>Session 2 – Recreational water workplan (cont.) and cross-cutting activities included on the GDWQ post 4th Ed. workplan</td>
<td>Chair: Mark Sobsey and Choon Nam Ong</td>
</tr>
<tr>
<td>1100–1130</td>
<td>Plenary discussion on recreation water cont.</td>
<td>Ingrid Chorus</td>
</tr>
<tr>
<td>1130–1200</td>
<td>Toxic cyanobacteria in water (See annotated agenda item #8)</td>
<td>Ingrid Chorus</td>
</tr>
<tr>
<td>1200–1215</td>
<td>Cyanobacteria fact sheets (See annotated agenda item #9)</td>
<td>Phil Callan</td>
</tr>
<tr>
<td>1215–1230</td>
<td>Cyclodispermospin and microcystin (See annotated agenda item #10–11)</td>
<td>Ingrid Chorus</td>
</tr>
<tr>
<td>1230–1330</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>1330–1500</td>
<td>Session 3 – Post 4th Ed. workplan involving all WGs and update on WHO’s radiation work</td>
<td>Chair: Jan Willem Rosenboom</td>
</tr>
<tr>
<td>1330–1345</td>
<td>WHO’s work on radiation</td>
<td>María Pérez (via teleconference)</td>
</tr>
<tr>
<td>1345–1355</td>
<td>Presentation of draft drinking-water workplan</td>
<td>Mark Sobsey</td>
</tr>
<tr>
<td>1355–1410</td>
<td>Turbidity (See annotated agenda item #12)</td>
<td>David Cunliffe</td>
</tr>
<tr>
<td>1410–1445</td>
<td>Alternative disinfectants (See annotated agenda item #13–16)</td>
<td>Joe Cotruvo, Lorna Fewtrell and John Fawell</td>
</tr>
<tr>
<td>1445–1500</td>
<td>WHO Networks: HWTSN, RegNet, SCWSMN, OMN</td>
<td>Maggie Montgomery (via teleconference), Jennifer De France</td>
</tr>
<tr>
<td>1500–1530</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1530–1700</td>
<td>Session 4 – Group work – Review of the remaining issues on the post 4th Ed. Workplan</td>
<td>(See annotated agenda)</td>
</tr>
<tr>
<td></td>
<td>(See annotated agenda)</td>
<td>Chair: David Cunliffe</td>
</tr>
<tr>
<td></td>
<td>Conference room C20: Microbial Aspects</td>
<td>Rapporteur: Lesley Vázquez-Coriano</td>
</tr>
<tr>
<td></td>
<td>Conference room C20: Protection and Control Aspects</td>
<td>Chair: Jan Willem Rosenboom</td>
</tr>
<tr>
<td></td>
<td>Conference room D77: Chemical Aspects</td>
<td>Rapporteur: Oliver Schmoll</td>
</tr>
<tr>
<td>1730–</td>
<td>Apéro</td>
<td>Chair: Michèle Giddings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rapporteur: Marla Sheffer</td>
</tr>
</tbody>
</table>
### Day 4: Thursday 21 March, Conference Room C20 and D77

<table>
<thead>
<tr>
<th>Time</th>
<th>Agenda item</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830–0900</td>
<td>Daily preparatory meeting of chairs and rapporteurs</td>
<td></td>
</tr>
<tr>
<td>0900–1030</td>
<td>Session 1 – Risk assessment and group work – Review of the remaining issues on the post 4th Ed. workplan</td>
<td></td>
</tr>
<tr>
<td>0900–0915</td>
<td>WHO’s food safety programme: microbial and chemical risk assessment approaches</td>
<td>Angelika Tritscher (via teleconference)</td>
</tr>
<tr>
<td>0915–1030</td>
<td>(See annotated agenda)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conference room C20: Microbial Aspects / Protection and Control</td>
<td>Chair: David Cunliffe</td>
</tr>
<tr>
<td></td>
<td>Conference room D77: Chemical Aspects</td>
<td>Rapporteur: Lesley Vázquez-Coriano</td>
</tr>
<tr>
<td>1030–1100</td>
<td>Coffee</td>
<td>Chair: Michèle Giddings</td>
</tr>
<tr>
<td>1100–1230</td>
<td>Session 2 – Group work (cont.)</td>
<td>Rapporteur: Marla Sheffer</td>
</tr>
<tr>
<td>1230–1330</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>1330–1500</td>
<td>Session 3 – Group work (cont.)</td>
<td></td>
</tr>
<tr>
<td>1500–1530</td>
<td>Coffee</td>
<td></td>
</tr>
<tr>
<td>1530–1700</td>
<td>Session 4 – Group work (cont.)</td>
<td>Identification of additional issues, prioritization and refinement of wastewater, recreational water and drinking-water workplans</td>
</tr>
</tbody>
</table>
**Day 5: Tuesday 22 March, Conference Room C20**

<table>
<thead>
<tr>
<th>Time</th>
<th>Agenda item</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830-0900</td>
<td>Daily preparatory meeting of chairs and rapporteurs</td>
<td></td>
</tr>
<tr>
<td>0900-1030</td>
<td><strong>Session 1 – Wrap-up / Group feedback</strong></td>
<td>Chair: David Cunliffe</td>
</tr>
<tr>
<td>0900-0925</td>
<td>Reporting back from Microbial Aspects WG</td>
<td>Ana Maria de Roda Husman</td>
</tr>
<tr>
<td>0925-0950</td>
<td>Reporting back from Protection and Control WG</td>
<td>Oliver Schmoll</td>
</tr>
<tr>
<td>0950-1015</td>
<td>Reporting back from Chemical Aspects WG</td>
<td>Michèle Giddings</td>
</tr>
<tr>
<td>1015-1030</td>
<td>Update from Radiation WG</td>
<td>Joanne Brown</td>
</tr>
<tr>
<td>1030-1100</td>
<td><em>Coffee</em></td>
<td></td>
</tr>
<tr>
<td>1100-1230</td>
<td><strong>Session 2 – Wrap-up / Group feedback (cont.)</strong></td>
<td>Chair: David Cunliffe</td>
</tr>
<tr>
<td>1100-1215</td>
<td>Discussion on overall priorities for harmonization of the water quality guidelines, drinking-water, wastewater and recreational water</td>
<td></td>
</tr>
<tr>
<td>1215-1230</td>
<td>Closing</td>
<td>Bruce Gordon, WHO</td>
</tr>
<tr>
<td>1230-1330</td>
<td><em>Lunch</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Departures</td>
<td></td>
</tr>
</tbody>
</table>
ANNEX 3: Annotated agenda from Microbial Aspects Working Group for the WHO Guidelines for Drinking-water Quality

<table>
<thead>
<tr>
<th>Microbial Aspects Working Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ref. No.</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Thursday 21 March, Sessions 1–4 – Conference Room C20</td>
</tr>
<tr>
<td>45</td>
</tr>
</tbody>
</table>

March 2013 discussions

**Summary:** Add text to connect QMRA with other sections using the QMRA document; QMRA document could support in providing the basis for creating the link.

**Way forward:** Include text from the QMRA document to each of the chapters.

**Priority (High 1–2 years; Medium 2–3; Low 5+):** Low, pending finalization of the QMRA document.

**Focal point:** Lesley Vazquez, David Cunliffe, Rafael Bastos

**Implications for the guidelines:** No

| 46     | [54]                                     | Pathogenic and non-pathogenic species/strains | Fact that some microbes have pathogenic and non-pathogenic or less pathogenic versions and that many of these are microbes having environmental reservoirs in which they proliferate needs to be developed | Ana Maria de Roda Husman to develop a proposed workplan, including for fact sheets | Ana Maria de Roda Husman to propose a way forward |

---

16 Agenda items that were not discussed at this meeting but for which follow-up action is required are listed in Annex 6.
### Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>addressed in regards to both Tables 7.1 and 7.2 and the corresponding microbe fact sheets. Needs to be done post–4th edition.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### March 2013 discussions

**Summary:** 46, 47, 48

Tables 7.1 and 7.2 list a range of pathogens; for some we have the type and subtype, but for others we don’t. The question is how to address those that we don’t have the information for. Another problem in environmental reservoirs is the presence of *Legionella*. It is recommended to use the table as a summary for the fact sheets and include the information on the fact sheets. However, these fact sheets need to be reviewed and referenced. They also need to be harmonized with the other guidelines to include all areas (recreational and wastewater). A reference to use could be the WHO document on zoonotic pathogens.

**Way forward:**

Revise the fact sheets and remove them from the Guidelines (drop chapter 11) to make them a stand-alone publication, referencing them to each of the guidelines. Have one fact sheet for each pathogen dealing with all the issues. For now leave the table as is and after reviewing the fact sheets, include brief summary information in chapter 7 (Tables 7.1 and 7.2).

**Pilot:** Identify a template with an example organism (*Cryptosporidium* or Norovirus)

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):**

Moderate: Prepare the template.

Low: Revise and develop the stand-alone fact sheet document.

**Focal point:** Ana Maria de Roda Husman and members from the other competence areas.

**Implications for the guidelines:** Yes, for all.

| 47 | 38 [60] | Tables 7.1 and 7.2 | Need to be extensively revised, along with corresponding fact sheets. Table 7.1: pathogens transmitted through drinking-water; 7.2: organisms for which transmission through | Roll into discussions on microbe fact sheets |                                |
## Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>150 [62]</td>
<td>Zoonosis fact sheets</td>
<td>Drinking-water has been suggested but for which evidence is inconclusive. Post-4th edition (not urgent, by 5th edition, references out of date, most recent reference is dated 2003).</td>
<td>Roll into discussions on microbe fact sheets</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>[55]</td>
<td>Aggregating multiple steps for overall water treatment performance</td>
<td>Detailed consideration of issue of validity of aggregating effects of multiple steps on overall water treatment performance on microbial reduction is needed. Needs to be done post-4th edition.</td>
<td>Gertjan Medema to provide background information</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>[65]</td>
<td>Multiple-barrier approach</td>
<td>Emphasize efficacy of barriers; add source protection measures, treatment measures, protection against recontamination, protection of distribution systems. Roll into work on chapter 7 work on multiple log reductions, waiting for QMRA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

March 2013 discussions

Summary: Aggregating multiple steps:

Gertjan Medema developed a two-page summary on the issue and provided recommendations. The summary did not discuss the advantages of having multiple treatments. Monte Carlo studies in Australia have found advantages with the use of multiple water treatment processes. Peter Teunis also discussed this in his 2005 paper. From the recreational point of view (swimming pools) in Europe, they use/prefer treatment as a group of multiple steps instead of individual. However, from the risk assessment point of view, it is hard to determine the efficacy of each individual process. From the drinking-water point of view, there’s a concern about lower efficacy. KWR, Han Heijnen studies showed that efficacy from multiple steps is lower than the efficacy from each of the processes individually. However, studies in Australia have found multiple steps to be effective and new wastewater treatment plants can demonstrate log reductions. We can use this as an opportunity to do statistical and mathematical evaluation on the efficacy of the treatments and strategies as independent processes and as aggregates.

It also depends on the use of the surrogates, e.g. bacteria versus viruses. It would be worth determining if we are underestimating or overestimating the efficacy of the treatments. This has been done in the United Kingdom and has been found to be very difficult and to be a complex issue, especially on the use of surrogates and on how wastewater treatment impacts recreational water quality. Australia has done the same in wastewater and has found the same problems with the surrogates (e.g. correlation between surrogates and pathogens). There’s a need to analyse the statistical background information on the efficacy of aggregating multiple steps on water treatment performance in reducing pathogens. We need to approach this taking into consideration local circumstances and looking for potential systematic errors in the Guidelines. Optimization of wastewater treatment needs to be focused on microbial reduction.

Way forward: To review examples and papers from KWR to evaluate the advantages and disadvantages. Also, follow Gertjan’s recommendations to add text/edit chapter 7, section 7.3.2 on the integration between unit processes and the need to incorporate moments of poor performance when aggregating the efficacy of unit processes to overall treatment efficacy. Also, we need to address this issue in all guidance documents and to include it in the current draft QMRA guidebook and the LeChavellier document, if reviewed. Future research is recommended and required, especially on the advantages and negative effects of the aggregation.

Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):

High: Analysis of the published literature on the potential significance and systematic errors.

Moderate: Development of the text and incorporation in the Guidelines.

Focal points:

Gertjan Medema: Do the review and add text to the QMRA. Also, do the literature review on drinking-water.

Ana Maria de Roda Husman and Mark Sobsey: Do the literature review on central treatment and household water treatment.

David Cunliffe and Phillip Amoah: Do literature review on wastewater.

Implications for the guidelines: Yes, for all.

Summary: Multiple-barrier approach

This is a worldwide issue that affects not only North America, Australia and Europe, but also developing countries, especially the problem of intermittent distribution. Some
### Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>39 [61]</td>
<td>Short-term fluctuations in levels of microbial contaminants</td>
<td>Issue of short-term increases in pathogen levels in drinking-water due to treatment interruptions, source water quality degradation, distribution system intrusions, etc. that lead to short-term increases in waterborne infection and illness risk is complex, high-level topic that could result in revisions in QMRA guidance and was addressed in November 2009 QMRA workshop. <a href="#">Teunis document from 2005</a></td>
<td>This is included in the QMRA document as well as an interpretation of how such fluctuations may influence risk. Needs to be included in GDWQ in chapter 7.</td>
<td>Lesley Vázquez-Coriano to propose a way forward</td>
</tr>
</tbody>
</table>

of these issues will be addressed in the distribution system guidelines in development. We need to ensure that the catchment to tap paradigm is addressed in the Guidelines, but it should be referenced in all WHO documents. Some of the guidelines discussing these issues are old documents, and some are in development.

**Way forward:** Follow up Gertjan recommendations to add paragraphs in chapter 7 on catchment protection of surface water, catchment protection of groundwater, safe piped water distribution and storage, safe water in buildings and safe storage in household water systems, based on the supporting documents. We should also evaluate those supporting documents and reference them to the WHO guideline documents and books.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):**

Low: Text on various guidelines

High: Text on the distribution system guideline

Moderate: Text on water treatment

**Focal points:**

Protection and Control Working Group: Need to find a contact to work on text on guidelines

David Cunliffe: Text on distribution system document

Gertjam Medema: Text on water treatment

**Implications for the guidelines:** Yes, for all

[Teunis document from 2005](#)
## Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>was not published; we need to look at it and see if it’s still relevant; QMRA toolbox should take short-term fluctuations into account; agenda item was to have been included in Mark LeChevallier’s text when updated; because we’re not proceeding with Mark LeChevallier text in short term, Teunis document is in limbo; had decided not to publish 2005 text as a stand-alone document</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** Short-term fluctuations document by Peter Teunis was not published. However, a short version of the document was included in section 7.1.3 in the GDWQ. This issue affects all areas. In recreational waters, indicators vary, and it is important to look at issues related to the catchment processes—for example, issues of fluctuations in distribution systems, drowning in recreational waters, outbreaks because of breaks in wastewater systems, etc. Short term or infrequency of events is the driver for management decisions. What are the implications of major event fluctuations and the relationships with outbreaks? Is it correct to include short-term waterborne outbreaks in deriving health-based targets averaged over a year? Health-based targets should be based on normal variation in the system and not on 100-year events or extreme events. Short-term fluctuations or system breakdowns should be defined to differentiate from natural noise or variability. However, responses are different—for example, increase in monitoring for drinking-water, but not for recreational waters. In risk assessment, the frequency of the event is essential, so short-term fluctuations could determine risk. Recurring problems, peaks and management actions to be taken. Outbreaks are the final events of short-term fluctuations in drinking-water, recreational water and wastewater. Seasonal fluctuations should be considered.

**Way forward:** Review the QMRA document and distinguish short-term fluctuations. Determine if the text included in section 7.1.3 is enough or if it should be reviewed. Review the consequences of the outbreaks.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):**
High: Review the QMRA document.

**Focal points:**
Gertjan Medema/Thor-Axel Stenstrom: Distinguish short-term fluctuations in term of risk assessment and review and edit text in section 7.1.3
### Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>47 [63]</td>
<td>Addendum Microbiological agents in drinking-water</td>
<td><em>Aeromonas</em> drafted and reviewed, but not further progressed; <em>Giardia</em> dropped; need for new document on enteric hepatitis viruses uncertain (Ana Maria de Roda Husman to seek willing author; if none found, consider dropping from agenda); Bruce Gordon to inquire about availability of existing WHO documents on <em>Vibrio cholerae</em>. Low priority, see what else is being done at WHO, decide by 5th edition</td>
<td></td>
<td>David Cunliffe to propose a way forward</td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:**
There was a microbiological addendum for the 2nd edition including text on *Aeromonas*, protozoa, *V. cholerae*, etc. The feedback was that this was low priority. Also the Cryptosporidium document has not had a high level of recognition, partially because it was insufficiently promoted. We could probably get sufficient information from the microbes fact sheet, including methodologies.

**Way forward:** Recommendation is to not continue with this effort and not develop the addendum. If there’s an organism of major significance, we should review and determine importance, e.g. *Mycobacterium* and *Legionella*. Ana Maria will ask Maria Jose Figueras to review the fact sheet on *Aeromonas*.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):** Low

**Focal point:** Ana Maria for the *Aeromonas* fact sheet

**Implications for the guidelines:** No
### Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>[69]</td>
<td>Microbial water quality data are lacking (database)</td>
<td>[Need to reconsider this, newer efforts in this area; Robert Bos thinks it may not belong with this group, maybe JMP] Include on post–4th edition, but needs to be championed.</td>
<td>Mark Sobsey to give an update and propose a way forward. If pursue, may also want to include the data from the GEMS studies, which will for the first time provide an indication of the major etiological agents of diarrhoeal disease over several years in vulnerable groups in 7 countries. Also would need to link to WHO burden of disease effort.</td>
<td>Mark Sobsey to propose a way forward</td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:**

The GDWQ has values on pathogen concentrations in water as default values developed from expert opinions and judgements. They were not developed using extensive published data. There is the interest in developing a database with microbial water quality data to make it accessible to stakeholders and to support settings where the data resources are low.

How can we make this database available? Joan Rose (USA) has taken some actions in developing data on microbial occurrence, and other data on microbial water quality. Data for faecal indicator bacteria can be obtained through surveys. We need to determine if these data sources that are available (USA, Europe) are adequate or if we need to develop a data collection approach to make data available to stakeholders for making decisions.

We need to determine the value of the data and for what purpose they will be used. From past experience, it is known that assessment of data on the relationship between pathogens and indicators and data on the concentrations of the pathogens in water has been limited. The usefulness of the data depends on having the data in a context, not only numbers, but also the conditions of the water collected, for example, including information on the parameters, sources, methods used and other water characteristics. Would be useful to get a consistent approach to allow you to look at the data in a systematic way and could be used for quantitative/qualitative assessments, modelling, etc. Make sure the data are comparable, since there are different methods and systems. The other issue is who will be developing these data, some issues on the quality of the data and on the quantity of data. Jamie Bartram gave a presentation last year on the different data sources, how to improve them and the challenges to link the different data sources together.

**Way forward:**

Identify the range of information needed to be included in a water quality collection survey.

Start collecting data on faecal indicators, related to JMP.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years): Low**

**Focal points:** Jamie Bartram, Joan Rose (sewage data), Rick Johnston (UNICEF and Eawag) and Lisa Manascalco (USAID). Also UN Water Task Force on Developing Indicators on Wastewater and Gertjan Medema.

**Implications for the guidelines:** Yes, for all
## Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>New item</td>
<td>Reference pathogens</td>
<td>Choice of reference pathogens. Should norovirus be included in GDWQ? Also need to look at helminths. Also consider relevance to wastewater and recreational water guidelines.</td>
<td></td>
<td><strong>David Cunliffe</strong> to lead discussions</td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** Identified in chapter 7 that reference pathogens (index pathogens and indicators) used for performance targets differed from place to place. People recognized the need to include norovirus as reference pathogen in wastewater and also to add helminths. These are complicated issues. Some are related to norovirus and dose–response; the use of protozoa as the reference pathogens for helminths; the issue of reference pathogens in terms of the risk for all groups, etc. In the drinking–water guidelines, there is text on the terminology describing reference, index and indicators, but we need to include common terminology on helminths, indicators, index and reference pathogens in all the guidelines. The problem with using reference pathogens is how to address the terminology across the guidance regarding helminths versus *Ascaris*. *Ascaris* is relevant to sludge and wastewater, but for reuse in agriculture, there are other helminths that are relevant. Duncan has done some work with *Ascaris*, and it needs to be evaluated.

**Way forward:**
This issue needs to be discussed after reviewing the data including seasonality and potential reference data such as DALYs and dose–response data. Increase the text on viruses, bacteria and provide examples. Need to find data on helminths.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):** Medium

**Focal points:**
Gertjan Medema: Use the QMRA guidebook as reference for the discussion on the text review.
Duncan Mara

**Implications for the guidelines:** Yes, for all

---

55 New item Legionella

GDWQ, including fact sheet, should be reviewed. *Legionella* spp. in institutional hot water systems, the risks posed and the recommended management solutions probably need further consideration. Aspects that may be inadequately addressed in the GDWQ and supporting documents are recommendations for surveillance and analytical methods for detection and molecular typing.


**Actions for March 2013 meeting**

**David Cunliffe** to update WGs
## Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>

### March 2013 discussions

**Summary:**
There’s the suggestion from the chemical group to pay more attention to *Legionella*. The range of sources are expanding, e.g. more detection from cold water and on new devices with hot/cold water and compressors. WHO has a stand-alone text on *Legionella*. There is text in the guidelines and swimming pool guidelines. Is an issue of vulnerable populations as well. Although is primarily an issue in drinking-water, this issue impacts recreational water guidelines, especially their presence in pools and natural ponds, and in rainwater and flood water. It should be covered in wastewater guidelines as well, since it has been raised as a potential issue for reused waters, although there’s no clear evidence to support the relationship.

**Way forward:**
Edit text on chapter 6 (Special circumstances). Build up on risk analysis/WSP. Update information when fact sheets are reviewed. Suggests to review the *Legionella* document. Important to look at alternative sources of exposure.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years)**
Medium: Edit text on the GDWQ chapter 6
Low: *Legionella* document review

**Focal point:** David Cunliffe

**Implications for the guidelines:** Yes, for all

| 56 | New item | Other | WG members propose additional issues (Micro aspects) that should be considered in post-4th edition GDWQ workplan for wastewater and recreational water workplans |

### March 2013 discussions

**Summary:**
1. The relationship of *E. coli* and reference pathogens in wastewater guidelines.
2. Lack of the relationship between indicator organisms and pathogens in all guidelines
   a. **Summary:** WHO has tried to predict pathogen concentrations using indicators. For the 4th edition, no relationship was found; therefore, further review is needed.
## Microbial Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>

b. **Way forward:** Do a further evidence review  

c. **Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):** High  
d. **Focal points:** Phillip Amoah, David Kay and Rafael Bastos  
e. **Implications for the guidelines:** Yes, for all

3. **Simplify guidelines text by a better use of appendices and stand-alone documents.**  
   a. **Summary:** Better focus of the guidelines document – retaining the important messages and putting the details in annexes or appendices. For example, removing the fact sheets from the GDWQ as a stand-alone document, QMRA document, and other data from chapter 7. Include the information as supporting documents and appendices. To include the main message and common message from all guidelines in the body of text in the guidelines (for the everyday reader) and include more technical information in appendices and using electronic references and resources.
   b. **Way forward:** Get feedback from the other workgroups  
c. **Focal points:** Jennifer De France and Kate Medlicott  
d. **Implications for the guidelines:** Yes, for all

4. **Antimicrobial resistance in wastewater**  
   a. **Summary:** Recent publications on antimicrobial resistance in wastewater. Issue needs to be addressed. Important to learn what is the relevance of the antimicrobially resistant bacteria and understanding the different mechanisms in transference of antimicrobial resistance genes. Recycling water may be a source of contamination. We should focus on the relative risk, transmission and epidemiology data. Should be considered in recreational water guidelines also, although no scientific evidence data have been suggested. Is recommended to also consider the relative distribution in different sources.
   b. **Way forward:** Literature review and consideration of the issues identified  
   a. **Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):** Medium  
b. **Focal points:** Duncan Mara(?) and David Kay

5. **Review of epidemiology and exposure models for wastewater**  
   a. **Summary:** The use of certain foods to develop the models, re-evaluate the science behind exposure model development  
   b. **Way forward:** Do the review of the exposure data when the guideline is revised and evaluate why certain food groups were used in the derivation of the data. Make sure die-off, average consumption and food type are taken into consideration. Also, re-evaluate the epidemiology and make sure the calculations are correct.
   c. **Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):** Medium, with the development of the guideline and the re-evaluation of the data.  
d. **Focal points:** Rafael Bastos and Duncan Mara(?) if available
### Microbial Aspects and Protection and Control Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>57 [56]</td>
<td>Microbial methods</td>
<td>A brief paragraph will be added in the methods section on types of microbial methods: culture, microscopy, nucleic acid amplification/detection and immunoassays. Need to address methods for microbes more extensively than now done, including fact sheets Section 7.5 to be amended post–4th edition (also harmonization with QMRA toolbox).</td>
<td>QMRA toolkit does not discuss methods. WHO/RIVM project reviewing microbial methods and development of risk-based monitoring programmes. There is also the WHO/IWA publication Assessing Microbial Safety of Drinking-water. The former project therefore needs to build upon the latter document or supersede it. This work can inform the update of section 7.5.</td>
<td>Ana Maria de Roda Husman to update WG</td>
<td></td>
</tr>
</tbody>
</table>

### Thursday 21 March, Sessions 1–4 – Conference Room C20

<table>
<thead>
<tr>
<th>March 2013 discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary: Need to include text on general information on the methods and on the value of the different methods. When and for what to use a particular method, e.g. qPCR to detect bacteria versus using it for virus detection. Include examples, limitations for each of the methods and data interpretation for methods that will help you best characterize the data. Include information in the QMRA guideline. A WHO project is in development on rapid testing to help in the decision-making in low-resource settings. A pilot will be done.</td>
</tr>
<tr>
<td>Way forward: Include a section (text) in each of the guidelines and in the QMRA guideline. Include the text in the rapid testing project as well.</td>
</tr>
<tr>
<td>Priority (High 1–2 years; Medium 2–3 years; Low 5+ years): Medium: For including the text in the guidelines and rapid test project. High: Consult with the QMRA group to determine if it should be included.</td>
</tr>
<tr>
<td>Focal points: Gertjan Medema, Ana Maria de Roda Husman and Rafael Bastos</td>
</tr>
<tr>
<td>Implications for the guidelines: Yes, for all</td>
</tr>
</tbody>
</table>

| 58 | 29 [59] | Water treatment and pathogen control: process efficiency in achieving safe drinking-water | Publication originally produced in 2004, second edition 2008. Mark LeChevallier welcomes co-author; need to decide on next steps towards new edition, including finding a willing co-author. Not a high-priority task, but Jennifer De France and John Fawell can talk to Mark LeChevallier. | Mark Sobsey to lead discussions |

| 99 |
### Microbial Aspects and Protection and Control Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No.</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. + Ref. No. in 2010 report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:**
The book needs to be updated and needs contribution for review. Also needs to be harmonized with the other activities related to the guidelines and other documents in development. There is also an effort to review Volume 3 including current technologies. A suggestion to include in the guidelines more information on treatment effectiveness and turbidity, e.g. CT values and performance values related to the QMRA approach – related to item 45. Vast information has been published, and this will be a major effort; turbidity will be included and addressed in the guidelines, specifically in chapter 7. Maybe we need to refer to other documents where there are more data. There is variability in systems and different performance values. Consider identification and use of parameters to determine treatment performance. We may need to articulate better that there are other tools available, such as the use of other surrogate indicators. It was suggested to develop fact sheets (1–5 pages) to be adapted in different settings on field approaches, such as how to estimate CT values, how to manage turbidity, etc. This will apply to wastewater and swimming pools.

**Way forward:** Review the *Water Treatment and Pathogen Control* book to update and to include WSPs, validation methods and information on surrogates. Review the QMRA toolbox and compare with the guidelines to update the text. Update Tables 7.7 and 7.8 with log reductions and with some information on CT values and turbidity. Cross-link both tables to guidelines and documents with more information, for example, on CT values for chlorine. Review Volume 3. Include a note on Table 7.10 on the limitations of the use of *E. coli* as an indicator for other pathogens and reference to the validation of household treatment methods and adapted to other treatment systems.

**Priority (High 1–2 years; Medium 2–3 years; Low 5+ years):**
High: Review the QMRA guideline

Medium: Review book, Volume 3, include notes in Tables 7.7, 7.8 and 7.10

**Focal point:** David Cunliffe, Rafael Bastos and Mark Sobsey on the text on chapter 7 and tables

**Implications for the guidelines:** Yes, for all
ANNEX 4: Annotated agenda from the Protection and Control Working Group for the WHO Guidelines for Drinking-water Quality

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No.</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>22 [57]</td>
<td>Rainwater harvesting</td>
<td>Stand-alone document needs to be developed providing technical guidance on stability, storage and monitoring of rainwater and information on health concerns associated with rainwater harvesting systems [HWTS Network interested in this issue, may link up with network; small community water supply network could also be involved. There are also 3 rainwater harvesting organizations, IRHA (Geneva), IRCSA (USA) and Rainfoundation (Netherlands)]</td>
<td>4th edition has been reviewed to ensure rainwater harvesting is appropriately referenced. 2 page concept note prepared by Han Heijnen and presented at GDWQ meeting in 2008. Han Heijnen has prepared concept note. Australia has produced guidance on the use of rainwater tanks in 2011, <a href="http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-enhealth-raintank-cn.htm">http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-enhealth-raintank-cn.htm</a>.</td>
<td></td>
<td>TBC</td>
</tr>
</tbody>
</table>

**Wednesday 21 March, Session 4 - Conference Room C20**

**March 2013 discussions**

**Summary of discussion:**
WG confirms increasing global relevance of rainwater harvesting (climate change, water-stressed/arid regions); increasing number of technologies marketed.

**Contents:** In addition to the topics covered in the concept note, include:
- Small section on assessing necessity of using rainwater as a source;
- So far, focus of document was on rainwater as source of drinking-water; document should also briefly address other household uses of rainwater;
- In dual systems where rainwater complements piped systems, cross-connections need to be addressed;
- Add sentence on radioactivity in chapter 3.

IWA has a specialist group on rainwater harvesting; also, three international rainwater harvesting organizations exist; they should be included in the peer review process.

---

\(^{17}\) Agenda items that were not discussed at this meeting but for which follow-up action is required are listed in Annex 6.
<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>[68]</td>
<td>Hygienic storage of water</td>
<td>Post–4th edition (need help from HWTS network, also small supplies). [Covered in bits and pieces only, need to look at it holistically, generic WSPs that can be applied across the board – need to include in WSPs chapter]</td>
<td>There is new evidence on the effectiveness of safe storage (alone) in protecting water quality (and preventing further contamination). WHO/UNICEF toolkit for monitoring and evaluating HWTS programmes covers this too, <a href="http://www.who.int/household_water/resources/toolkit_monitoring_evaluating/en/">http://www.who.int/household_water/resources/toolkit_monitoring_evaluating/en/</a>. Needs to also cover harvested rainwater and other stored water systems that may be at scales beyond individual households. Nearly 10 years since the systematic review by Wright et al., there is a need for someone to review and summarize the information from the last decade and determine impacts on GDWQ. There also continues to be a “disconnect” between rainwater harvesting and HWTS. Need to see how the two areas are addressed in the GDWQ and the need for revision.</td>
<td>Mark Sobsey to prepare a briefing note.</td>
<td></td>
</tr>
</tbody>
</table>

**Joint Expert Meeting, 18–22 March 2013, Dübendorf**

**Protection and Control Working Group**

Document should have strong linkage to and be harmonized with point-of-use treatment and safe storage documents.

Minor impact on chapter 6 of 5th edition of GDWQ.

**Priority for 5th edition:** High

**Focal point/lead:** Han Heijnen

Contributors as per briefing note

**Implications for other guidelines:** Potential small cross-over to wastewater guidelines: rainwater may be used for horticulture and combined with greywater

**Expected output:** Free-standing monograph

**Target audience:** Environmental health officers/institutions advising communities

**Time frame:** As per briefing note

**March 2013 discussions**

**Way forward:** To include a text on the advantages/disadvantages of rainwater harvesting

**Summary of discussion:**

Unsafe storage, in some circumstances, may be a significant source of microbial contamination; chemical contamination may also be of concern (e.g. materials of storage containers); mosquito breeding is also an issue.

Safe storage and handling aspects have lately been under-recognized in GDWQ context; last systematic review is more than 10 years old; more studies are available today;
### Summary of discussion:

The document is intended to support water safety planning processes in surface water catchments and to provide technical background information for WSP development. The document addresses:

- catchment uses, including hazardous events;
- transport and attenuation of hazards in the environment and surface water bodies;
- how to assess risks in catchments at different levels of sophistication in different settings;
- control measures for different catchment uses and in surface water abstraction.

A reworked draft has been prepared and discussed with WHO HQ in September 2012; the following gaps/areas of improvement were identified:

1. Updating the chapter on microbial hazards to better inform water safety planning and to include quantitative data on pathogen loads (RIVM/Ana Maria de Roda Husman leads on the revision);
2. Peer review by HWTS network and the GDWQ rainwater harvesting group.
3. Moderate impact on chapters 1 and 6 of the 5th edition of GDWQ.
4. Priority for the 5th edition: High
5. Focal point/lead: Mark Sobsey to contact Joe Brown to lead on the systematic review
6. Implications for other guidelines: Volume 3 GDWQ
7. Expected output: First, systematic literature review, situation analysis, synthesis and recommendations. Secondly, development of fact sheets and/or slim guidance document
8. Target audience: Expert group
9. Time frame: 1–2 years

---

**Protection and Control Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>27 [58]</td>
<td>Protecting surface waters for health</td>
<td>Draft was to have been prepared for late 2010; aim is concise document (100–120 pp.) to support WSP development.</td>
<td>UBA and WHO have agreed to finalize publication by December 2013.</td>
<td>Oliver Schmoll to update WG</td>
<td></td>
</tr>
</tbody>
</table>
**Protection and Control Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>[66]</td>
<td>Water quality control in distribution systems</td>
<td>This is important issue, should be addressed; Safe Piped Water (Richard Ainsworth, 2004) not being updated</td>
<td>Guidance being developed on using WSPs to manage risks in distribution systems per recommendations from a scoping meeting in July 2011.</td>
<td></td>
<td>Kah Cheong Lai to update WG</td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary of discussion:**
Reference document to support WSP development for distribution systems, following up Ainsworth (2004).
Safe management of distribution systems is of increasing relevance (urbanization, population growth, ageing infrastructures). Topics to be addressed in the document include cross-connections, leakages, intermittent supplies, low pressure, backflow, storage reservoir management, good practices in construction and maintenance work, corrosion control, material selection.
In addition, stagnation issues need to be addressed, e.g. in depopulating areas and in oversized systems.
An advisory team has been formed (led by David Cunliffe), and some contributors have been identified; additional authors need to be identified; the Secretariat will be asked to support identification of additional expertise/authors; Rhodes Trussell may be asked to join the drafting group.
The WG suggests a two-tiered document structure: (i) scientific background on water quality in distribution systems, including microbial and chemical stability (based on Ainsworth 2004); (ii) support to WSP development and implementation, including case-studies.
Case-studies need to be regionally balanced, if possible (Guy Howard’s work in Uganda to be considered); case-studies to be complemented by a worked example;..
Minor impact on chapter 4 of 5th edition of GDWQ.
### Protection and Control Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting) Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>12-1/32 [13]</td>
<td>Updating Volume 3 of GDWQ</td>
<td>Han Heijnen has prepared a concept note to reinitiate efforts to update Volume 3. Little progress has been made, since this publication will need to follow the WHO guideline review process. Needed to better understand the process first. May need to re-evaluate the sanitary inspection forms or the recommendations around use of these forms as guideline revised per Barry Lloyd publications (Barthiban et al., 2012, <em>Journal of Water Resource and Protection</em>, 4, 899–912; Barthiban et al., 2012, <em>JWRP</em>, 4, 474–486, etc.). WSP Manual for Small Community Water Supplies was published in 2012. Refer to concept note.</td>
<td>Phil Callan to update WGs</td>
</tr>
</tbody>
</table>

#### Priority for 5th edition: High
#### Focal point/lead: Kah Cheong Lai
#### Implications for other guidelines: No
#### Expected output: Free-standing monograph
#### Target audience: Regulators and utilities
#### Time frame: Draft ready for peer review by end 2013

**March 2013 discussions**

**Summary of discussion:**
WDG confirms that update of Volume 3 is in high demand.

Jan Willem Rosenboom and Han Heijnen reviewed the scope and content of current Volume 3; the main conclusions of the review are:

- **Mixed target audience:** primary audience for volume is planners, managers and regulators; on the other hand, lots of (useful) technical information is presented that addresses field workers;
- **Approach of Volume 3 needs to be brought in line with 4th edition GDWQ framework approach**;
- **Update in technical detail - page by page detailed review of Volume 3 is available.**

A separation of the material of current Volume 3 into two documents is being suggested: (i) material relevant to district/middle-level planners and managers who work in communities (“Volume 3”); and (ii) material relevant to field workers (“field guide”); a draft of the field guide had been prepared previously but was put on hold.

The WG recommends to address the following issues in further developing the two documents:

- **Responsibilities of institutions;**
### Protection and Control Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>

- Need for holistic approach to be taken at local level, which addresses and integrates recreational contact, wastewater disposal and drinking-water abstraction (to become an additional chapter);
- Need for prioritization of most effective interventions of competitive risks at community level;
- Section on health-based targets needs to be packaged in simple way and particularly address specified technology targets;
- Guidance on technology selection, including performance validation;
- Address different levels of sophistication in WSP development, i.e. encouraging start with simplest things, like sanitary inspection;
- New testing methods need to be addressed;
- More pictorial packaging of information.

Minor impact on 5th edition of GDWQ.

**Priority for 5th edition:** High

**Focal point/lead:**

Focal point: Jan Willem Rosenboom

Contributors to update: Phil Callan, Mark Sobsey, Oliver Schmoll, Han Heijnen

Potential peer reviewers: Guy Howard, Steve Pedley, Rick Johnston, Ana Maria de Roda Husman

**Implications for other guidelines:** All

**Expected output:** Revised Volume 3; Field guide

**Target audience:** Planners and managers at intermediate level; field workers in communities

**Time frame:** As per briefing note: review by WG by December 2013

Draft by March 2014 for review by WG
ANNEX 5: Annotated agenda from the Chemical Aspects Working Group for the WHO Guidelines for Drinking-water Quality

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>158 [50]</td>
<td>Disinfectants and disinfection by-products (moved DBPs to BDCM section)</td>
<td>Proceed on a small number of alternative disinfectants (e.g. silver, iodine, bromine, hydrogen peroxide, etc.). Task force to review evidence; take it forward similarly to pharmaceuticals, rapid review of state of science, small meeting group, clarify types of products; try to classify disinfectants by information availability, need to ensure dealing with information gaps identified in existing EHC document or important new data since its publication; Australia has established set of principles to be used in assessing efficacy of disinfectants; some combinations, e.g. copper/silver/zinc, in point-of-use household water treatment.</td>
<td>Lorna Fewtrell preparing fact sheets on silver- and copper-containing compounds. UNICEF is interested in guidance on silver- and copper-containing HWT devices and WHO regulators’ network. Refer to alternative disinfectants concept note (prepared by Michèle Giddings) and evidence review for silver- and copper-containing compounds.</td>
<td>Lorna Fewtrell to present evidence review on silver and copper compounds Joe Cotruvo to lead discussions on iodine, bromine and hydrogen peroxide WGs confirms next set of disinfectants to be reviewed in Phase 2 of this work.</td>
</tr>
<tr>
<td>15</td>
<td>[40]</td>
<td>Iodine</td>
<td>There is now sufficient basis to establish a GV with the 2009 WHO CICAD 72 (Cotruvo). Roll into alternative disinfectants.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

March 2013 discussions
Summary:
Do we proceed? If so, which ones do we choose? What’s to go in fact sheet?

---

18 Agenda items that were not discussed at this meeting but for which follow-up action is required are listed in Annex 6.
**Chemicals Aspects Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>1 [1]</td>
<td>Policies and Procedures Manual</td>
<td>Needs to address wider management of chemicals, when exposure not just in water – e.g. essential elements and lead</td>
<td>Policies and Procedures Manual being updated by Phil Callan. Should WHO prepare short background documents (e.g. 1 pagers) that summarize other sources of information, particularly for pesticides, rather than full background documents? Refer to draft P&amp;P manual</td>
<td>Phil Callan to update WG P&amp;P to review and approve text for P&amp;P.</td>
</tr>
</tbody>
</table>

Need to evaluate 1) efficacy and 2) safety of a range of alternative disinfectants, 3) issues for use (may be handling issues, e.g. with bromine; cost issues), 4) quantity of material available (format of fact sheets to follow these four headings). Start with efficacy, if it doesn’t work, may not need to look at the toxicity, particularly if there are limited resources. Micro WG needs to review efficacy data. Would be easiest to start with NaDCC.

May need to speak to researchers involved in silver. Database is limited. Need to add other types/treatments involving silver (colloidal silver, nanosilver, silver coatings) and toxicity outside of water.

Need to agree on content, length of fact sheets. John Fawell to develop a model potentially for NaDCC.

Iodine literature fairly comprehensive.

Have referenced background documents to back up fact sheets.

**Priority (high/medium/low):** High

**Focal point (lead):** John Fawell (NaDCC); Lorna Fewtrell (silver)

**Implication for wastewater:** Yes for peroxides

**Implication for recreational water:** Yes for NaDCC

**Output:** Fact sheets on NaDCC and silver to start (later iodine, bromine, peroxides maybe) (start with drinking-water)

**Target audience:** Regulators

**Time frame:** NaDCC fact sheet: when John can find time; silver background document: end of April

---

**March 2013 discussions**

**Time frame:** Look at draft and respond with comments to Phil within next 4 weeks

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>58-1, 58-2 [19, 21]</td>
<td>Essential elements Infant formula</td>
<td>Issues around how to deal with essential elements (e.g. selenium, fluoride, molybdenum, manganese). It is important to ensure that a reasonable balance is maintained between consideration of potential toxicity</td>
<td>Nutrition programme convened a meeting in 2005 to look at how to establish upper levels of nutrients and related substance intakes. Report published, A Model for Establishing Upper Levels of Intake for Nutrients and Related Substances (2006).</td>
<td>John Fawell to lead discussions (lump with sodium, manganese,</td>
</tr>
</tbody>
</table>
**Chemicals Aspects Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>142 [38]</td>
<td>Sodium</td>
<td>Sodium in drinking-water and blood pressure; minor route of exposure. John Fawell to prepare short document post-4th Ed.</td>
<td><strong>John Fawell</strong> to develop outline for background document. WHO nutrition group has developed guidance on sodium intake in adults and children, 2012 (<a href="http://www.who.int/nutrition/publications/guidelines/sodium_intake/en/index.html">http://www.who.int/nutrition/publications/guidelines/sodium_intake/en/index.html</a>). Health effects are summarized, but it does not address sodium in drinking-water. In 2010, Health Canada published a report from a multi-stakeholder WG regarding sodium reduction (<a href="http://www.hc-sc.gc.ca/fn-an/nutrition/sodium/related-info-connexe/strateg/reduct-strat-eng.php">http://www.hc-sc.gc.ca/fn-an/nutrition/sodium/related-info-connexe/strateg/reduct-strat-eng.php</a>). In addition, Health Canada is developing a sodium information sheet, mostly dealing with water treatment devices that use sodium and the concerns (similar to the one Health Canada has on potassium). Refer to background document.</td>
<td>selenium) WG agrees on way forward Michèle Giddings to give an update on Health Canada work on managanese</td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:** Essential nutrient text to be included in P&P manual (see handout) and will be taken into consideration in all future evaluations of essential elements (e.g. may have to take into consideration levels in water if used to mix infant formula)

**March 2013 discussions**

**Summary:** Need to develop a note to address blood pressure for high-risk populations

**Focal point:** Michèle Giddings will look at Health Canada (and Institute of Medicine) reports on sodium and draft a note (need to show that contribution is not relevant)
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>157 [44]</td>
<td>Manganese</td>
<td>Keep watching brief for new data, including new epidemiology studies and studies on bioavailability and speciation.</td>
<td>Studies have come out, indicating manganese is a problem in drinking-water. Confusion on GV versus health-based value. Health Canada is funding a 3 year epidemiological study, starting April 2013, which follows up on the 2010–11 study of manganese in groundwater in Quebec, which showed cognitive issues.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:** Health-based value being misused. Need to have clearer explanation as to how to interpret health-based value (which is not based on toxicity, but upper range of intake, in case of manganese) and aesthetic value, make it clearer that it’s not a guideline value.

**Output:** Work with Jennifer on text to go in document that John and David are working on for adapting guidelines to local situations.

**Priority:** High

---

### Ref. No. 21

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>
| 21       | 77 [28]                             | Molybdenum  | United Kingdom data show presence in very low concentrations; may want to withdraw GV.  
**[If not occurring at concentrations close to GV, not appropriate to include formal GV, change to health-based value (essential element)]** | GV withdrawn in 4th edition and changed to a health-based value due to occurrence information.  
**John Fawell** to follow up on occurrence data. |                                             |
|          |                                     |             |                                               |                                                               |                               |

**March 2013 discussions**

**Summary:** Data being generated showing that low concentrations, but seems to be concentrated in rice (they could use health-based value as GV in such a situation). United Kingdom, USA and Japan, data show low concentrations. Need to do more studies to find out source of molybdenum in rice (soil? Grown in water)

**Focal point:** Mari Asami and Akihiko Hirose

---

### Ref. No. 22

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>New item</td>
<td>Iron</td>
<td></td>
<td>May occur more readily at higher concentrations than previously thought. If so, this may need to be addressed in the GDWQ.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:** Some evidence that iron levels may be higher in some places (Denmark anaerobic groundwaters, iron stays in water in solution longer than expected); need someone to look at chemistry and occurrence
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Needs to be re-evaluated per comments received 28/11/12 (background document missed review of the few epidemiological papers on human health effects of selenium ingestion via drinking-water and toxicological differences between inorganic and organic forms). Health Canada is revising/updating its selenium guideline and expects to have the document posted to web site for public consultation later this summer.</td>
<td></td>
</tr>
<tr>
<td>Priority: Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>New item</td>
<td>Selenium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>[11]</td>
<td>Hardness factsheet</td>
<td>Need to approve new text in light of comments from industry (reference document). Background document and summary statement in chapter 12 revised for 4th edition of GDWQ.</td>
<td>This issue continues to be important to Member States. As additional data become available, may need to revise background document and GDWQ. John Fawell to propose a way forward.</td>
<td></td>
</tr>
<tr>
<td>Priority: High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>John Fawell to update WG.</td>
</tr>
<tr>
<td>March 2013 discussions</td>
<td>Action: John Fawell to send Michèle Giddings comments received, Health Canada will evaluate them</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary: Member States concerned that you need minimum hardness</td>
<td>Wait until data become available. High hardness is already covered in fact sheet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priority: Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>131 [17]</td>
<td>Nitrate/nitrite</td>
<td>Need to consider potential benefits; provide better management advice if GV exceeded; need to consider lack of evidence on methaemoglobinemia. To be added to rolling revision when Health Canada revisits its GV.</td>
<td>Health Canada evaluation completed, with no change in GV. Although there is no change in the GV, Health Canada’s consultation document (draft, currently at public consultation stage) also discusses the carcinogenicity of nitrate via endogenous formation of NDMA as well as the issue of thyroid effects. Health Canada has also linked the discussion of these parameters with ammonia because of the nitrification issue in distribution systems. Nitrate: <a href="http://hc-sc.gc.ca/ewh-">http://hc-sc.gc.ca/ewh-</a>.</td>
<td></td>
</tr>
<tr>
<td>Priority: Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>John Fawell to update WG.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

111
### March 2013 discussions

**Summary:** Health Canada guideline to be approved in May; nitrate number stays same, although basis for value will be different (based on NOAEL and not methaemoglobinemia); protective of thyroid effects as well as methaemoglobinemia

Nitrite GV still based on methaemoglobinemia (studies in infants with diarrhoea, not adequate data)

Cancer from endogenous formation of nitrosamines

Benefits: part of endogenous nitrate cycle

There is a need for more epidemiology studies because people are exposed to nitrite, bromate, etc., but people are not necessarily getting cancer as a result of this.

**Output:** Michèle Giddings to submit Health Canada document to WHO (once approved) to use to revise GV; or Michèle to see if Health Canada can redraft the WHO background document according to its new document, then submit it to WHO for review/revision

**Priority:** High

**Implication for P&C WG:** Needs to be discussed with P&C group also (for management advice – nitrification in distribution systems, use of tap water with nitrite in infant formulas, wastewater management, etc. – need to review Health Canada study).

### Actions for March 2013 meeting

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ref. No.</td>
<td>Agenda No. + Ref. No. in 2010 report</td>
<td>Agenda item</td>
<td>Issue and plan of work decided at 2010 meeting</td>
<td>Progress, new issues, developments (before March 2013 meeting)</td>
<td>Actions for March 2013 meeting</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------</td>
<td>-------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>27</td>
<td>60 [23]</td>
<td>Arsenic and fluoride (new item)</td>
<td>JECFA has reviewed arsenic (see meeting report summary); need to determine whether GV needs to be revised. Need to discuss long-term plan for management document, mechanisms for mobilizing resources</td>
<td>4th edition reflects JECFA evaluation (JECFA Monograph FAS 63: <a href="http://whqlibdoc.who.int/publications/2011/9789241660631_eng.pdf">http://whqlibdoc.who.int/publications/2011/9789241660631_eng.pdf</a>). Acknowledges withdrawal of PTWI and retains GV based on treatment performance and analytical achievability. Is there value for WHO to produce a document on arsenic management (monitoring, sampling and analysis, technical options [treatment technologies, use of alternative sources, blending], how to select technical options, communication strategies, policy and regulatory implications, etc.)? Many other organizations have produced arsenic-related publications. Need to identify existing resources and identify Member States’ needs first Health Canada’s guideline document from 2006 does discuss some of the issues and could be used as a starting point: <a href="http://hc-sc.gc.ca/ewh-semt/pubs/water-eau/arsenic/index-eng.php">http://hc-sc.gc.ca/ewh-semt/pubs/water-eau/arsenic/index-eng.php</a></td>
<td>Rick Johnston to present on Eawag’s work on arsenic and fluoride and propose a way forward (15 min) WG agrees on way forward</td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:** Already changed our Guideline text to take account of JECFA evaluation; on agenda to acknowledge this.

Member States need to focus on highest sources of exposure, drinking-water minor source of exposure.

Galvanized pipe source of lead (and cadmium), particularly in older buildings.

No action needed at this time; keep a watching brief.

**Priority:** Low
# Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rick Johnston’s March 2013 presentation on arsenic and fluoride at Eawag**

One water resource quality project involving mitigation: case-studies on fluoride in Ethiopia (test defluoridation options) and arsenic in Bangladesh (study existing mitigation options); also geostatistical risk modelling

Global risk map for arsenic >10 μg/l generated using risk modelling (good tool for predicting where no exposure data available)

Also household surveys on levels of various contaminants, including arsenic, in water; linked with health impacts in Bangladesh; predicted number of annual deaths, 23,000 deaths above 50 μg/l. Forty per cent of arsenic-contaminated samples also have high manganese concentrations.

Arsenic mitigation: Geogenic contamination handbook coming out this summer

Gaps in arsenic: health impacts at low doses and effective behaviour change interventions. In Rick’s opinion, there is no need for WHO to produce guidance documents on arsenic, as several have been produced by other organizations. As there is lack of political will, WHO can provide support in this area.

Gaps in fluoride: field test kit, effect of diet on fluorosis, non-skeletal fluorosis, effective behaviour change interventions and more political will. There is also a need for simpler, shorter documents.

Michèile Giddings to send Rick Canadian arsenic map

**Output:** No need to produce more guidance documents on arsenic

### March 2013 discussions

**Summary:** GV considered to be excessively conservative because studies were not available and epidemiological study on which it was based was not up to modern standards; so higher uncertainty factor of 10 used, even though human study; USEPA and IRIS evaluations of clinical (blood pressure) studies (USEPA uncertainty factor of 3 rather than 10), makes significant difference to GV; IRIS based on animal study, reference dose 0.2 mg/kg bw per day, would give GV of 1.2 mg/l using 20%; other route would give approximately 2 mg/l using uncertainty factor of 3 based on epidemiological study

Need to revise background document, decide which one to use: preferable to use epidemiological data and use animal study to support value: add justification of changing uncertainty factor from 10 to 3 using USEPA arguments

**Priority:** High

**Focal point:** Ed Ohanian

**Time frame:** Ed to revise background document incorporating USEPA arguments for uncertainty factor of 3 [Marla Sheffer to send background document; Ed to update literature and GV]
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>66 [27]</td>
<td>Chromium</td>
<td>CICAD on chromium(VI) still not done. Health Canada also reviewing chromium. If CICAD group decides not to include certain studies, we may have to look at them ourselves; NTP study critical; VI broken down to III, which is essential element; USEPA will be publishing a value</td>
<td>Draft CICAD document ready for review, comments can be sent directly to Richard Brown who is lead from WHO PCS. Does not consider data from 2009 onwards. Likely to be available 2nd quarter of 2013. The most recent publicly available USEPA assessment (draft, 2010) that went to peer review can be accessed at <a href="http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433">http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433</a>. Peer reviewers recommended incorporating new research into the draft assessment and obtaining more stakeholder input. Peer reviewer comments can also be accessed at this site. Schedule for update has not been determined yet. Health Canada is expecting to have a draft document approved for consultation late 2013 or early 2014. Refer to IPCS key issues sheet, published papers and submission schedule document and speciation data.</td>
<td>John Fawell to update WG</td>
</tr>
</tbody>
</table>

#### March 2013 discussions

**Summary:** Still waiting for documents on mode of action etc. CICAD so far out of date can’t be used as basis to revise guideline (Health Canada standard will be total chromium based on chromium(VI)) (see Joe Cotruvo’s list of anticipated studies in handout)

**Output:** No action needed until data become available, reviewed, published; revised background document will probably be based on USEPA or Health Canada document, not CICAD

**Priority:** Low (until new studies become available, then will move up in priority)

**Implications for P&C WG:** The Protection and Control working group will also need to be involved, as they need to look at speciation.

| 30       | 86 [31]                           | Dichlorvos  | Extensive revision needed based on review comments. Wait on JMPR evaluation; on JMPR agenda for 2011, periodic review | JMPR tox evaluation included in Pesticide residues in food — 2011 evaluation ([http://extranet.who.int/iris/bitstream/10665/75147/1/9789241665278_eng.pdf](http://extranet.who.int/iris/bitstream/10665/75147/1/9789241665278_eng.pdf)). Per John Fawell, there are new data but not evaluated by JMPR yet, and it is likely JMPR will not re-evaluate because it is not widely used. John Fawell is checking to | John Fawell to update WG |

---

115
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>see if anyone else has evaluated dichlorvos recently, including EFSA and USA. Note that not included in GDWQ, although there is a draft background document on this. May drop and not establish a GV because it is not widely used. However, there is an issue with spills – so is there a need for WHO to provide brief guidance on this?</td>
<td></td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** John had prepared background document, but it was based on the old JMPR evaluation. It would need to be updated to incorporate the more recent JMPR evaluation if a background document is needed. Dichlorvos hydrolyses quickly in water and is unlikely to be found in water, so is there a need to develop a background document?

In Japan, not widely detected, and probably wouldn’t be detected in developing countries because they can’t measure it.

**Output:** Add dichlorvos to list of fact sheets to be prepared based on JMPR [see #33] (rather than full background documents)

| 31 | 87 [32] | Dicofol | Extensive revision needed based on review comments Wait on JMPR evaluation; on JMPR agenda for 2011, periodic review | JMPR toxicological evaluation included in Pesticide residues in food — 2011 evaluations (item 49, [http://extranet.who.int/iris/bitstream/10665/75147/1/9789241665278_eng.pdf](http://extranet.who.int/iris/bitstream/10665/75147/1/9789241665278_eng.pdf)). Same issues as dichlorvos. | John Fawell to update WG |

### March 2013 discussions

**Output:** Add dicofol to list of fact sheets to be prepared based on JMPR [see #33]

**Sidebar:** Suggestion is to take out guideline values for all pesticides, replace with a summary table in chapter 12; discuss in plenary

### March 2013 discussions

**Summary:** MCPA background document revised by Health Canada, but then JMPR evaluation after that; if plenary agrees, it will be added to list of JMPR pesticides for which summary fact sheets will be provided [see #33]

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>98/117 [34]</td>
<td>Pesticides assessed by JMPR/various pesticides with requests for GVs</td>
<td>One background document almost ready, two more started, three more to go (from comparative list prepared to match up with JMPR studies) [source management is key, rather than developing more and more GVs; John Fawell could produce formal white paper that will allow us to look at alternatives]</td>
<td>Toxicological evaluations conducted by JMPR since 2010 need to be evaluated for the GDWQ. In 2010, 2011 and 2012, JMPR conducted toxicological evaluations for 11, 12 and 12 pesticides, respectively. In 2013, toxicological data for 13 compounds will be assessed. Pesticides for which we already have guidelines and therefore which need to be updated (in addition to dichlorvos, dicofol and MCPA) are: bentazone (2012), diquat (for fall 2013), diflubenzuron (for fall 2013) Should pesticides applied in rice paddies be considered, and if so, which ones? Refer to JMPR toxicological evaluations list and presentation on occurrence of rice-farming pesticides prepared by Yoshihiko Matsui.</td>
<td>John Fawell to update WG on background paper Yoshihiko Matsui to propose a way forward</td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:**

The usual process of preparing large background documents is becoming an onerous task. As JMPR evaluations are used for preparing background documents, there is little point in duplicating that process. It makes sense to take all pesticides out of the list of guideline values and make it clear that they are health-based values. Member States would then only need to select those pesticides of relevance to them.

Rather than preparing full background document and evaluation, a short fact sheet could be developed instead, which includes health-based values (not formal GVs); pesticides could be dealt with more quickly, we can add to the list when needed, using existing documents (JMPR), which have already been peer reviewed, or something akin to JMPR. At the top of fact sheets, highlight the need to consider source control for pesticides and seasonal variations.

Pesticides in rice paddies: see handout, 500 pesticides used on rice paddies in Japan. USEPA has published list of 353 pesticides with detailed numerical values. The capability of testing for pesticides in developing countries is limited. There is a need to ask Member States what pesticides are used (along with field data on concentrations in water sources) and if there is a need for GVs for certain pesticides. It would be useful to develop an occurrence database for pesticides.

**Focal point:** Yoshihiko Matsui in collaboration with John Fawell and Joe Cotruvo
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1)</td>
<td>Start with rice paddies pesticides (prioritized in terms of amounts used, information that is not available for all developing countries); short one-page fact sheets with health-based (guidance) values; start by matching list of top 100 pesticides used on rice paddies against list of JMPR evaluations; collaborate to develop fact sheet format (similar to summary statements in chapter 12 so can be incorporated into GDWQ next edition … or all pesticides may be removed from chapter 12, except those used for vector control purposes, to be replaced by guidance table only). Remove background documents from web, replacing them with one-page fact sheet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>Aldrin, dieldrin, DDT need to be removed from list since very low solubility, used for other purposes and significant decline in use. GVs have 1% allocation to drinking-water, seems quite excessive due to falling exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3)</td>
<td>Current summary statements for bentazone, diquat, diflubenzuron need to be updated (and changed to new fact sheet format) according to new JMPR evaluations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Priority:</strong></td>
<td>High (start with current WHO pesticides/pesticides evaluated by JMPR then add Japanese list of rice paddy pesticides as well as other pesticides that are known to be used in water sources.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time frame:</strong></td>
<td>Format of fact sheet and a couple of examples within a month … end of year for all of them.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 2013 discussions</td>
<td>Summary:</td>
<td>Field data are needed to see whether assumptions were correct regarding concentrations in water; need further liaison with WHO and others.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Focal point:</strong></td>
<td>Jennifer to pursue with WHO and others. If practical guidance needs to be developed on use of pesticides in drinking-water containers, this should be led by WHOPES.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>52 [33]</td>
<td>WHOYPES pesticides</td>
<td>Confusion around a GV and a recommended dose (ref pyriproxyfen). Recommendation to withdraw GV for pyriproxyfen as it is unlikely to occur in drinking-water. GV withdrawn in 4th edition since not considered appropriate to set guideline values for pesticides used for vector control in drinking-water</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No new compounds evaluated by WHO in check of WHOYPES evaluations from 2010–2012. No new compounds scheduled for evaluation in 2013. Should WHO develop practical guidance on using pesticides in drinking-water containers for end users? WHOYPES welcomes this. Also would be useful to develop materials for regulators (e.g. emphasize importance of regulators to consider co-formulants, how does WHO come up with the recommendations, how WHO guidance can be used at national level, what products have been approved, limits, toxicity).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>John Fawell to propose a way forward on developing guidance on using pesticides in drinking-water containers.</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>[46]</td>
<td>Chlorine dioxide (and hypochlorite)</td>
<td>Need to clarify if this rapidly decomposes and decays and residual (also brings in chlorite).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The current chlorate text in chapter 12 of the GDWQ already highlights the decomposition issue, but perhaps it could be strengthened in the post–4th edition. For this issue, also need to consider hypochlorite, which may be a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Michèle Giddings to update WG</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

- Ref. No.: Reference number
- Agenda No. + Ref. No. in 2010 report: Agenda number and reference number in the 2010 report
- Issue and plan of work decided at 2010 meeting: Issue and plan decided at the 2010 meeting
- Progress, new issues, developments (before March 2013 meeting): Progress and new issues developed before the March 2013 meeting
- Actions for March 2013 meeting: Actions planned for the March 2013 meeting
### March 2013 discussions

**Summary:** Need to add text to GDWQ (chapter 12? wherever it fits best) to highlight decomposition issue

**Output:** Revised paragraph of chapter 12, p. 336, sources of chlorite/chlorate; revise taste and odour threshold statement too / Update background document too.

**Focal point:** Joe Cotruvo

**Timeline:** 2 months

**Priority:** Low but will get done anyway

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>113 [35]</td>
<td>Chlorate</td>
<td>greater source of chlorate from storing hypochlorite too long at warmer temperatures. This is probably a particular issue for developing countries where they probably do not have access to higher-quality hypochlorite and keep it too long. Taste and odour threshold needs to be updated to reflect temperature dependence. Page 336 of GDWQ.</td>
<td>Refer to briefing note</td>
</tr>
</tbody>
</table>

**March 2013 discussions**

**Summary:** Briefing note prepared

**Focal point:** Ed Ohanian

**Output:** Revised toxicological assessment that uses NTP study, applies appropriate uncertainty factors (justify use of uncertainty factor different from that used in JECFA assessment) … unlikely that GV will change

**Timeline:** By end of 2013

**Implications for recreational water:** Not significant (need to manage hypochlorite properly)

**Priority:** High
## Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>141 [37]</td>
<td>Perchlorate</td>
<td>JECFA has reviewed perchlorate (JECFA Monograph FAS 63: <a href="http://whqlibdoc.who.int/publications/2011/9789241660631_eng.pdf">http://whqlibdoc.who.int/publications/2011/9789241660631_eng.pdf</a>; see meeting report summary), so no need to wait for USEPA anymore. JECFA (2010): PMTDI of 0.01 mg/kg bw was established for perchlorate. The estimated dietary exposures of 0.7 µg/kg bw per day (highest) and 0.1 µg/kg bw per day (mean), including both food and drinking-water, are well below the PMTDI. The Committee considered that these estimated dietary exposures were not of health concern.</td>
<td>Occurrence data (e.g. from Japan and USA) need to be evaluated. In the USA, occurrence data are being collected from water suppliers under the data collection rule. The USA’s Unregulated Contaminant Monitoring Regulation 1 (UCMR 1) perchlorate data are available at <a href="http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/data.cfm#ucmr2010">http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/data.cfm#ucmr2010</a>. These data are primarily treated drinking-water data from over 3800 public water systems from 2001 to 2005. A number of systems submitted source water data where the state had approved source water sampling for compliance purposes. Refer to perchlorate origin and occurrence in drinking-water article and abstract on contribution of tap water to chlorate and perchlorate</td>
<td>John Fawell to update WG</td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** JECFA evaluation done

**Focal point:** Ed Ohanian (Akihiko Hirose, Mari Asami will send Japanese occurrence data, etc., John Fawell to supply United Kingdom data)

**Output:** New background document to be prepared based on JECFA evaluation

**Timeline:** End of 2013 first draft to be circulated to Committee for review

**Priority:** Medium

| 38       | 64 [26]                           | Bromate     | Studies still ongoing, should be able to revise value soon. [Joe’s study published, bromate broken down in stomach, metabolism data to be published by end of 2011; relatively high threshold before exposure in kidney results in toxic effects] Needs to be re-evaluated since additional data available | Report on bromate disposition and mechanisms of toxicology produced by Water Research Foundation (2012). Health Canada currently revising its drinking-water guideline and expects to have a document for public consultation in the spring of 2014. It incorporates PBPK modelling information Refer to summary outline | Joe Cotruvo to update WG |

---

120
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>

### March 2013 discussions

**Summary:** See bromate handout in binder: research been carried out, conclusions: need to take decomposition mechanisms into consideration at various doses; PBPK modelling; what’s shape of dose–response curve at low end? Japanese study showed no genotoxicity until very high doses

Rapidly decomposed; genotoxic versus threshold models; not ready to choose yet

Health Canada revising guideline by next year

**Priority:** Medium (waiting for results)

**Focal points:** Michèle Giddings and Joe Cotruvo

**Timeline:** 2–3 years

---

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>152 [41] PFOS/PFOA</td>
<td>Keep an eye open for international assessment, as can be found at high concentrations in water (there are several assessments now: OECD, United Kingdom, Canada, PUB-NTU, and we have agreed that good</td>
<td>Health Canada has hired a consultant to obtain and review all of the toxicology, human health and environmental data on PFOS/PFOA. Health Canada is looking at possibly developing some guidance on these,</td>
<td>Michèle Giddings to update WG</td>
<td></td>
</tr>
</tbody>
</table>

---

**Implications for recreational water:** Yes

---
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>national assessments are appropriate to use, so we could proceed on this one). Discussed under Stockholm Convention as “second generation POPs” – also there are extensive documents available. “can be found at high concentrations in water” – needs to be checked if generally true or only in effluent water. Defer until database more comprehensive, but needs to be evaluated sooner rather than later.</td>
<td>as they get many requests for advice, as these are being found in groundwater in areas where fire-fighting foams have been used (airports/military installations, contaminated sites). Consultant’s report due late fall 2013.</td>
<td></td>
</tr>
</tbody>
</table>

March 2013 discussions

Summary: Health Canada has hired consultant to write risk evaluation with which to derive guidance value (2014); USEPA is monitoring these compounds, so in 2–3 years there will be occurrence data; concentrations low in most locations; United Kingdom has risk assessment

Priority: Medium

Focal point: Derrick Crump/John Fawell?

Output: New background document

Timeline: 2–3 years


March 2013 discussions

Summary: Dialkyltins document may need to be updated based on EU (EFSA) assessment (or may just need to mention that assessment has been done and supports current value)

Focal points: Akihiko Hirose and Mari Asami

Timeline: End of 2013

Priority: Low but will get done

| 42 | Treatment tables | Need to update, perhaps made less detailed, move to annex along with analytical tables and treatment descriptions in chapter 8 (not chapter 7) – need cross- | Annex has been added to 4th edition on treatment methods and performance. Chapter 8 includes a section on treatment performance and refers to annex. Chapter 7 | John Fawell to propose a way forward |

John Fawell to update WG
### March 2013 discussions

**Summary:** Treatment tables are out of date and need to be updated

**Priority:** Medium

**Timeline:** By first addendum

**Focal points:** Potentially PhD students (Cranfield)/Kah Cheong Lai (Joe Cotruvo?)

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>[67]</td>
<td>Emerging issues</td>
<td>referencing – just informative, not all inclusive</td>
<td>also includes a treatment section with a table summarizing treatment processes that are commonly used to reduce microbes and also refers to annex. Needs to be re-reviewed, and a way forward needs to be proposed.</td>
<td></td>
</tr>
</tbody>
</table>

#### March 2013 discussions

**Potential issues include nanoparticles, personal care products (including triclosan), total organic halogens, bisphenol A, and risk assessment and management of mixtures. The latter is being discussed at a half-day scoping session on 22 March.**


**Nanoparticles – Choon Nam Ong**

**Actinomycetes – Kah Cheong Lai and John Fawell**

**PCPs (excluding triclosan) – Peter Marsden**

**BPA and triclosan – Michèle Giddings**
## March 2013 discussions

### Nanoparticles:
**Summary:** Nanoparticle compounds can be useful in water treatment. However, there are ecosystem concerns, and they are difficult to detect. Need to coordinate with other agencies on this work, including food safety. Need to write a one-page description of nanoparticles in water for section 8.5.5 (after pharmaceuticals)

**Focal point:** Choon Nam Ong

**Priority:** Medium

**Timeline:** For next addendum/edition

### BPA and triclosan:
- Drinking-water not significant route of exposure; toxicological number for triclosan indicates not health problem in drinking-water

### PCPs:
Peter Marsden, starting project to look at personal care products; will keep group updated on progress on project (probably not a drinking-water problem)

### Implications for wastewater reuse:
- Yes

### Actinomycetes:
- Taste and odour issue, already covered in chapter 10 on acceptability

### Pharmaceuticals:
Switzerland is coming out with regulations that will require regulating eight pharmaceuticals. A few pharmaceuticals are also being proposed to be included in the EU directive. Need to keep a watching brief on this.

### DDT and triclosan:
- DDT in Indoor Residual Spraying: Human Health Aspects (EHC 241, 2011, [link](http://www.who.int/ipcs/publications/ehc/ehc_numerical/en/index.html)). PCS is scanning the literature on an annual basis to see if there is a need to reassess (due to high profile of this issue under Stockholm Convention). Report is expected the first week in March.

### New item Other chemicals

**WG members propose additional chemicals that should be considered in post–4th edition workplan of GDWQ. wastewater and recreational water workplans.**

- DDT was assessed by PCS in publication, DDT in Indoor Residual Spraying: Human Health Aspects (EHC 241, 2011, [link](http://www.who.int/ipcs/publications/ehc/ehc_numerical/en/index.html)). PCS is scanning the literature on an annual basis to see if there is a need to reassess (due to high profile of this issue under Stockholm Convention). Report is expected the first week in March.

**John Fawell to update WG**

### DDT
- DDT is part of #33 on new pesticide fact sheets; no further action required
### Chemicals Aspects Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues, developments (before March 2013 meeting)</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Nickel:**

**Summary:** Japanese have lower TDI for food, nickel released from faucets etc.; may need to reconsider allocation factor

**Focal point:** Akihiko Hirose

**Output:** Discussion paper for next meeting re possible change in allocation factor based on exposure patterns

**Timeline:** For next meeting (or earlier)

**Priority:** High

#### Nickel

**March 2013 discussions**

**Summary of discussion with Ingrid Chorus:**

Australian position was that data are not adequate/sufficient to derive GV

USEPA laboratory prepared to do trial, need toxin, cost is 200,000 euros, but work is free

Easier to get funding if WHO gives message that interested in preparing GV on cylindrospermopsin

A lot of people using 1 μg/l from Humpage & Falconer publication

OncoLogic predicts carcinogenicity?

WHO would consider deriving GV if properly conducted study available. Good 90-day study (in mice or rats or both?) done to GLP might be sufficient.

Researcher to write up proposal for study, circulate it to WG members, then will search for funding

---

<table>
<thead>
<tr>
<th>10</th>
<th>Cylindrospermopsis</th>
<th>March 2013 discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Summary of discussion with Ingrid Chorus:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Australian position was that data are not adequate/sufficient to derive GV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>USEPA laboratory prepared to do trial, need toxin, cost is 200,000 euros, but work is free</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Easier to get funding if WHO gives message that interested in preparing GV on cylindrospermopsis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A lot of people using 1 μg/l from Humpage &amp; Falconer publication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OncoLogic predicts carcinogenicity?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WHO would consider deriving GV if properly conducted study available. Good 90-day study (in mice or rats or both?) done to GLP might be sufficient.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Researcher to write up proposal for study, circulate it to WG members, then will search for funding</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>11</th>
<th>Toxic Cyanobacteria in Water</th>
<th>March 2013 discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Summary of discussion with Ingrid Chorus:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acute, seasonal and chronic exposure for recreational swimming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maybe take acute row out of table, just discuss within text</td>
<td></td>
</tr>
<tr>
<td></td>
<td>New toxicological reviews with different end-points; there might be a new GV for microcystin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biovolumes versus cell number (or chlorophyll or visual scum)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use toxicological rather than epidemiological studies for recreational guideline numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ingrid to finish chapter 4.0 and send it to WG members for review, including the above issues. If needed, a technical meeting could be convened on this later this year.</td>
<td></td>
</tr>
</tbody>
</table>
# ANNEX 6: Annotated agenda for WHO Guidelines for Drinking-water Quality items not discussed but with follow-up required

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Working Groups</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 [6]</td>
<td>Desalination + water scarcity package</td>
<td>Safe drinking-water from desalination published in 2011. Chee Keong Chew presented on potential activities, but it has not been taken any further; agenda item was closed with the publication</td>
<td>As a follow-up, could develop case-studies on WSPs being implemented at desalination plants in different geographical locations, e.g. Oman, United Kingdom, Singapore, Australia, etc. This would be a practical guide to complement the technical report. Kah Cheong to follow up.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[6]</td>
<td>Bottled water fact sheet</td>
<td>Revise fact sheet in light of new Codex standards for natural mineral waters (reference Codex standard and hygiene documents) [bottled water guidelines based on GDWQ, but natural mineral water guidelines differ slightly (no treatment allowed for natural mineral waters, has to be good to start with); fact sheet out of date]</td>
<td>John Fawell has quickly reviewed the fact sheet and has proposed a number of changes. It is proposed that the WHO secondee from NSF International (WHO Collaborating Centre on bottled water), Nikki Beetsch, finalize the fact sheet. Needs follow-up post-meeting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 [14]</td>
<td>Certification of compliance with GDWQ</td>
<td>Compliance with GDWQ to be discussed post-Fourth Edition. Note issue of potentially encouraging respected third-party certification/validation of water treatment test kits and treatment (e.g. NSF International) based on WHO Guidelines. [quality assurance tool has been published; need procurement guidelines re Aquatab, PUR, etc.; is this part of our purview?; qualified trainers for certifying WSPs?] Incorporate with water in emergency situations, bulk water, alternative disinfectants, etc. Guidance or principles targeting one specific area, things one should consider when buying products to produce safe drinking-water in these situations; need to</td>
<td>WSP Quality Assurance Tool has been developed, and WHO is pursuing development of guidance on auditing/certification of WSPs. Specifically, it will list items that should be considered in developing national WSP schemes, based on best practices identified. HWT evaluation scheme being set up by WHO based on the recommendations in the Evaluating Household Water Treatment Options publication (2011, [<a href="http://www.who.int/water_sanitation_health/publications/2011/household_water/en/">http://www.who.int/water_sanitation_health/publications/2011/household_water/en/</a>]). Maggie Montgomery following up on procurement guidelines and links to evaluation scheme. Yves Chartier started a publication on WASH in health-care settings and emergencies, but for various reasons, this is not being published (needs to be significantly updated, lack of resources, etc.). WHO has published technical notes on WSH in emergencies in 2011, which are currently being revised. There is the 2002 document, Environmental Health in Emergencies and Disasters, published by WHO, the International Strategy for Disaster Reduction, the Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ref. No.</td>
<td>Agenda No. + Ref. No. in 2010 report</td>
<td>Issue and plan of work decided at 2010 meeting</td>
<td>Progress, new issues developments Supporting resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>consult with UN sister agencies, Red Cross, etc., see what their needs are first.</td>
<td>Cross and the United Nations High Commissioner for Refugees. Consider if GDWQ could be updated to include items that should be considered when buying products to produce safe drinking-water in emergency situations.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Microbial Aspects and Protection and Control Working Groups**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments Supporting resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>129 [64]</td>
<td>Boil water instructions</td>
<td>Fact sheet has been prepared but not published. [corrected WHO travellers’ guide; inconsistent instructions on boiling, confusing, numbers range from rolling boil to 20 or 30 minutes; bringing to rolling boil works; draft document (fact sheet) has been prepared]</td>
<td>Jennifer De France or Maggie Montgomery to finalize.</td>
</tr>
</tbody>
</table>

**Chemicals Aspects Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda No. + Ref. No. in 2010 report</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments Supporting resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>135 [2]</td>
<td>PPCPs</td>
<td>Does text in GDWQ need to be expanded or amended following publication of PPCPs document? No new text is needed unless current text needs to be changed.</td>
<td>Pharmaceuticals in drinking-water + information sheet published in 2011. The professionally designed version of this technical document was published in 2012. <em>Misprint in 4th edition of GDWQ. Typically, 50% of these compounds can be removed by conventional treatment processes (coagulation, filtration and chloramination). Chloramination should be chlorination, and it should be “conventional treatment, particularly chlorination; however, more advanced treatment processes have a much higher rate of removal.”</em> Wait to update text until further information is published or with next addendum. Studies are being carried out on the occurrence in drinking-water, removal rates by wastewater and drinking-water treatment processes. Needs follow-up post-meeting.</td>
</tr>
</tbody>
</table>
ANNEX 7: Annotated agenda for all aspects of wastewater

Water Quality and Health Meeting March 2013 – Draft Wastewater Workplan

Prior to the 2012 meeting, there has been no formal workplan for the revision of the WHO Guidelines for Safe Use of Wastewater, Excreta and Greywater in Agriculture and Aquaculture Volumes 1–4.

The items listed below were initiated from small groups of experts and regional office staff familiar with the guidelines. During the meeting, participants had the opportunity to comment on the workplan items and add new items in plenary and during working group sessions.

### All Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>
| 1        | Guidelines structure, presentation and target audience | The main criticism of the current Guidelines is that they are too complicated and difficult to read. Currently they are presented in four separate volumes.  
- Volume 1: Policy and regulatory aspects  
- Volume 2: Wastewater use in agriculture  
- Volume 3: Wastewater and excreta use in aquaculture  
- Volume 4: Excreta and greywater use in agriculture  
► Do we wish to continue this, or have a single volume with supplementary information in separately downloadable online reports? Currently there is some repetition in Vols 2–4.  
► One hundred pages maximum if supported by supplementary information in separately downloadable online reports? | WHO Guidelines for Safe Use of Wastewater, Excreta and Greywater in Agriculture and Aquaculture Volumes 1–4.  
1989 WHO Health Guidelines for the Use of Wastewater in Agriculture and Aquaculture. | Can we develop a revised scope and chapter summary for the 4 volumes? |

**March 2013 discussions**

Summary: Agreement that the next edition should be a simplified single volume guideline. Evidence separated or annexed from recommendations.  
Output: Revised structure harmonized with the drinking-water and recreational water guidelines  
Priority: High  
Implication for drinking-water? Yes  
Implication for recreational water? Yes  
Focal point: Kate Medlicott
# All Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Target audience:</strong> To be defined in revised structure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Time frame:</strong> By end of 2013 (or earlier)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Guideline scope</td>
<td><strong>Countries are interested in developing comprehensive reuse strategies — incorporating reuse in agriculture, aquaculture, industrial use, horticulture, public parks, biosolids use, etc.</strong></td>
<td>Results of the capacity needs assessment of 59 countries 2012–13 (UN-Water, WHO, FAO, UNEP, UNU-INWEH, IWMI, ICID) <a href="http://www.ais.unwater.org/wastewater/ws5">http://www.ais.unwater.org/wastewater/ws5</a></td>
<td>Could/should other kinds of reuse be included in the next edition? What implications would that have on size and harmonization?</td>
</tr>
</tbody>
</table>

## March 2013 discussions

**Summary:** Scope will not be expanded to include other reuse types or biosolids. These should be addressed in separate publications.

**Priority:** Low

**Implication for drinking-water?** No

**Implication for recreational water?** No

**Focal point:** None

**Time frames:** Potential new reuse publications to be discussed at the next meeting.

| 3        | Health-based targets | **Harmonization of health-based targets — the 2006 guidelines need strengthened guidance on linking the 10^{-6} HBT with various barrier options and especially expressing HBTs in the 4 categories (outcome, performance, water quality, specified technology). Also the guidelines say 10^{-5} or 10^{-4} may be adopted as an interim target, but no detail is given on how to apply a lower HBT. Clarity is also needed on how HBTs apply to consumers versus workers and surrounding communities.** | Duncan Mara (2011). Water- and wastewater-related disease and infection risks: What is an appropriate value for the maximum tolerable additional burden of disease? Journal of Water and Health 9 (2), 217–224 Options for Updating the 2006 WHO Guidelines; WHO, Geneva, 2010 | How should HBT be clarified and simplified? |

## March 2013 discussions

**Summary:** A tabular form showing HBT as outcome, performance, water quality, specified technology for 10^{-6}, 10^{-5} or 10^{-4} DALY.

**Priority:** Medium

**Implication for drinking-water?** Yes

**Implication for recreational water?** Yes
## All Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supporting resources</td>
<td></td>
</tr>
<tr>
<td>Focal point: David Cunliffe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** Development of a roadmap document targeted at policy-makers to complement the SSP manual, which is targeted at system operators.

**Priority:** Medium

**Implication for drinking-water?** No

**Implication for recreational water?** No

**Focal point:** Kate Medlicott – expert technical support to be identified.

**Time frames:** Draft to be available for review at the next meeting.

| 5 | Evidence retrieval and review | Literature review for all volumes: |
|   |                             | - Volume 2: Wastewater use in agriculture |
|   |                             | - Volume 3: Wastewater and excreta use in aquaculture |
|   |                             | - Volume 4: Excreta and greywater use |
|   |                             | No thorough literature review has been conducted by WHO since the publication of the 2006 guidelines. One key study: Critical review of epidemiological evidence of the health effects of wastewater and excreta use in agriculture. London School of Hygiene and Tropical Medicine, London, 2003 (Blumenthal and Peasey). |
|   |                             | Establish a process for evidence retrieval and review. |

## March 2013 discussions

**Summary:** WHO needs to develop terms of reference and select experts to conduct the evidence retrieval and systematic review for wastewater, greywater and excreta reuse and identify funding to support the process. Review should include information in the first (2008) and second (2010) WHO information kits and on the guidelines.

**Priority:** Medium

**Implication for drinking-water?** No

**Implication for recreational water?** No

**Focal point:** Kate Medlicott to initiate. Technical experts to be identified.
### All Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Time frame: Review initiated before next meeting.

**March 2013 discussions**

Summary: Review of recommendations and metrics is needed across 3 volumes.

Priority: Low

Implication for drinking-water? No

Implication for recreational water? No

Focal point: Thor-Axel Stenström (TBC)

Time frame: During drafting

### Chemicals Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**March 2013 discussions**

Summary: Current chemical working group members do not have specific expertise on chemical risks to health from wastewater use. Specific expertise needs to be sought on this topic through the WQTAG call for experts and establishment of a working group within the wastewater Guideline Development Group to cover chemical aspects.


Implication for drinking-water? Yes
### Chemicals Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Implication for recreational water? Yes (potentially some experts will be common to chemical WGs for all three guidelines)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focal point: WHO Secretariat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time frame: Experts identified and Guideline Development Group working group established by next meeting.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Risks to plant health</td>
<td>The 1985 FAO report by Ayers and Westcot on chemical risks to plants used as the primary reference for the guidelines is now very old. There is a need for review and to go beyond the level of detail provided in this publication.</td>
<td>Ayers, R.S. and Westcot, D.W. (1985). Water quality for agriculture (Irrigation and Drainage Paper No. 29, Rev. 1). Food and Agriculture Organization of the United Nations, Rome</td>
<td>Actions for updating chemical risks to plant health.</td>
<td></td>
</tr>
</tbody>
</table>

#### March 2013 discussions

Summary: Check USEPA guidelines; check FAO re any update of 1985 report; develop approach for inclusion of chemical risks to plants.

Priority: Medium

Focal point: Duncan Mara (TBC)

### Microbial Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Exposure models</td>
<td>The exposure models that underpin the guidelines are based on a small number of studies and include assumptions that may not be valid in many countries—for example, the choice of lettuces and onions and the assumed amount of daily ingestion.</td>
<td>Critical review of epidemiological evidence of the health effects of wastewater and excreta use in agriculture. London School of Hygiene and Tropical Medicine, London, 2003 (Blumenthal and Peasey)</td>
<td>Are the exposure models still valid – what kind of review is needed?</td>
<td></td>
</tr>
</tbody>
</table>

#### March 2013 discussions

Summary: Review of all exposure models needed and recommendations for a revised approach or validation of the existing guidelines.

Priority: Medium

Focal point: Raphael Bastos (TBC)

Implication for drinking-water? No

Implication for recreational water? No

Time frame: Detailed approach for review to be tabled and discussed at the next meeting.
### Microbial Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>

#### March 2013 discussions
Summary: Refer to Norovirus notes in the drinking-water workplan


#### March 2013 discussions
Summary: Refer to *Ascaris* notes in the drinking-water workplan

| 12 | QMRA | Many, if not most, of the readers of the 2006 Guidelines are “frightened” by QMRA. Should online learning kits and tutorials be developed to encourage its wider use? | | |

#### March 2013 discussions
Summary: Refer to QMRA toolkit notes in the drinking-water workplan

| 13 | *E. coli* to pathogen ratios | Additional work is needed to clarify the *E. coli* to pathogen ratios in wastewater that underpin the recommended verification monitoring limit for *E. coli* in the wastewater guidelines. | | |

#### March 2013 discussions
Summary: See drinking-water workplan summary on *E. coli* to pathogen ratios

| 14 | Anti- | There is emerging evidence of antimicrobial resistance, resistant genes | Reference publications needed. | Can this issue be |
## Microbial Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>microbial resistance associated with wastewater use.</td>
<td></td>
<td></td>
<td>addressed in the guidelines?</td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** Antimicrobial resistance should be included as part of the Evidence retrieval and review under item 5.

**Priority:** Medium

**Implication for drinking-water?** No

**Implication for recreational water?** Yes (refer to microbial aspects WG Ref. no. 56)

**Focal point:** Technical experts to be identified.

**Time frames:** Review initiated before next meeting.

## Protection and Control Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Sanitation Safety Planning</td>
<td>The sanitation safety plan concept and manual are currently being developed. However, SSPs are currently not specifically mentioned or embedded in the 2006 guidelines.</td>
<td>Draft SSP manual under development. Review from expert review meeting soon to be available.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** Sanitation Safety Planning should become a key chapter for the revised guidelines, building on the Water Safety Framework presented in the drinking-water guidelines. The approach should be harmonized across the 3 guidelines.

**Priority:** Medium

**Implication for drinking-water?** Yes

**Implication for recreational water?** Yes (relevant for harmonization)

**Focal point:** TBD
ANNEX 8: Annotated agenda for all aspects of recreational water

**Water Quality and Health Meeting March 2013 – Draft Recreational Water Workplan**

Prior to the 2012 meeting, there has been no formal workplan for the revision of the WHO Guidelines for Safe Recreational Water Environments Volume 1: Coastal and Fresh Waters and Volume 2: Swimming Pools and Similar Environments.

The items listed below were initiated from small groups of experts and regional office staff familiar with the guidelines. During the meeting, participants had the opportunity to comment on the workplan items and add new items in plenary and during working group sessions.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
</table>
| 1        | Harmonization of the recreational water guidelines | Swimming pools and spas revised chapter outline proposed by Expert Group Meeting on Guidelines for Safe Pools and Spas (Bonn, 8 July 2011).  
1. Health benefits of recreational water environment  
   (Health benefits of aquatic treatment and benefits of swimming in health facilities, led by Johan Lambeck, assisted by Katherine Pond)  
2. Public health aspects of recreational water use  
   (Led by David Cunliffe, Australia)  
3. Accidents, drowning and injury prevention  
4. Chemical risks  
5. Microbiological risks  
6. Managing users and pool environment  
7. Improving performance  
8. Occupational health  
   (Led by Jan Bakker, the Netherlands) | Supporting resources | Does this outline fit with the harmonization agenda? What recommendation should this group make back to the Bonn group? |
### All Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supporting resources</td>
<td></td>
</tr>
</tbody>
</table>

#### March 2013 discussions

**Summary:** Agreement that the Bonn outline presented would need to be revisited in light of the harmonization exercise with wastewater and recreational water and the process for evidence retrieval, review and drafting revisited in light of more stringent Guideline Review Committee requirements.

The group agreed that health benefits, social aspects are likely to fall outside the scope of the harmonized structure. The public health chapter is more likely to be of direct relevance to the revised structure.

WHO has extremely limited time and resources to devote to recreational water guidelines development until the completion of task 2 below. In the interim, Bonn experts may continue with drafting and seek alternative avenues for publication and/or await the outcome of task 2 below.

**Priority:** Medium

**Implication for wastewater?** No

**Implication for drinking-water?** No

**Focal point:** WHO Secretariat in coordination with WHO Regional Office for Europe

<table>
<thead>
<tr>
<th>2</th>
<th>Harmonization</th>
<th>Harmonized chapter outlines for Vol. 1 and Vol. 2 are needed to shape appropriate responsibilities for the technical inputs to the revised guidelines.</th>
<th>Refer to the Bonn 2011 meeting revised outline for Vol. 2.</th>
</tr>
</thead>
</table>

#### March 2013 discussions

**Summary:** Harmonized chapter outlines to be developed, including detailed consideration of how the chapter groups in the Bonn meeting will contribute to the revised harmonized outline. Outline will be accompanied by a project justification and budget that can be shared with donors.

The harmonized structure will include a common framework of 1) Health-based targets, 2) Safety plans and 3) Surveillance.

**Priority:** High

**Implication for wastewater?** Yes

**Implication for drinking-water?** Yes

**Focal point:** Phil Callan for harmonized outline; Kate Medlicott / Oliver Schmoll for concept development and budget.

**Time frame:** By end of 2013

<table>
<thead>
<tr>
<th>3</th>
<th>Harmonization of HBTs</th>
<th>Through the harmonization agenda, is it necessary to reconsider the HBT for recreational water of $10^{-2}$ for an event versus $10^{-6}$ for drinking-water and wastewater?</th>
<th></th>
</tr>
</thead>
</table>

#### March 2013 discussions

**Summary:** The meeting agreed that we are aiming for harmonization of the approach – e.g. using same types of HBTs etc., but we do not need to aim for equivalency. However, a justification for the performance target should be included.
### All Working Groups

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priority: Moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implication for wastewater? No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focal point: David Cunliffe (TBC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sanitary profiles</td>
<td>WHO guidance needed on how to interpret tools in terms of health implications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>March 2013 discussions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary: No action identified. Deferred to next meeting.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priority: Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implication for wastewater? No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implication for drinking-water? No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focal point: Marta Varga (TBC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Indoor air in pools</td>
<td>Risks from indoor air quality, especially for pools workers, is not adequately covered in the currently guidelines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>March 2013 discussions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary: Need to connect with the indoor air group at WHO on inhalation for potential inclusion in recreational water guidelines.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priority: Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Protection and Control Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Japan (2010)</td>
<td>(Volume 1) The epidemiological data and risk assessment framework used to underpin the 2003 Guidelines are limited to temperate seawaters. Also a set of assumptions built into the criteria relate to the statistical distribution parameters of seawaters in this region. It is timely to consider whether other data are now available to extend this evidence base both regionally and particularly to fresh recreational waters.</td>
<td>Significant work has been completed in the EU and USA since the 2009 review of the 2003 Guidelines, and this should be evaluated for incorporation. Specifically, the epidemiological basis of freshwater standards is unacceptable.</td>
<td></td>
<td>Formulate a team and timetable for delivery of revised or reviewed criteria</td>
</tr>
</tbody>
</table>
### Protection and Control Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supporting resources</td>
<td></td>
</tr>
</tbody>
</table>

#### March 2013 discussions

**Summary:** The group agreed on moving forward as suggested to review data and recommend if there are sufficient data to extend to other regions and to fresh water.

- **Priority:** Medium
- **Implication for wastewater?** No
- **Implication for drinking-water?** No
- **Focal point:** David Kay and Tim Wade

| 7 | GSRWE Vol. 1, Ch. 4 (2003) Annapolis (1999) Japan (2010) | Real-time management, prediction and discounting. This innovative option has been costed and in some cases implemented with varying levels of success. It has proven challenging for some Member countries, and clear guidance on its implementation could be a useful addition to the Guidelines. It results in significant public health benefits and reduced cost (in Britain alone, valued by government at US$ 2–6 billion). There are also implementation issues arising, such as the allowable % rate of discounting (in the EU this is 15%, whereas the WHO Guidelines did not place a limit on this aspect). | Predictive model calibration and parameterization are rudimentary or non-existent, specifically: (i) it often assumes a uniform and predictable “bathing day” water quality; (ii) fixed decay coefficients either derived from literature or, inappropriately, “adjusted” to ensure model fit to compliance data; and (iii) some administrations are suggesting simplistic rainfall triggers, which will produce significant misclassification. | Design a work programme to deliver clear guidance on prediction and sample discounting |

#### March 2013 discussions

**Summary:** Develop a guidance on prediction and sample discounting. Consider to include risk management and communication issues.

- **Priority:** Medium
- **Implication for wastewater?** No
- **Implication for drinking-water?** No
- **Focal point:** David Kay

| 8 | GSRWE Vol. 1, Ch. 4 (2003) | Sanitary profiling and HACCP principles are built into the Guidelines as a formal risk assessment phase. Tools of quantitative and semiquantitative risk assessment through catchment investigations (QMSA, MST and phage tracer work) are maturing in the science literature, and consideration should be given to building guidance on their use and relative utility within sanitary profiling of | MST protocols are increasingly focused on library-independent molecular markers in carrier bacteria and viruses. The extent to which they can deliver “quantitative data” to inform sanitary | A WHO guidance report on the utility of QMSA, MST and emerging phage tracking would |
## Protection and Control Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments Supporting resources</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>bathing waters – this may resonate with WSP implementation and sanitary profiles for shellfish harvesting waters. The USEPA web site reports of TMDL impairment parameters provides an interesting perspective on the importance of microbial management at the catchment scale (see <a href="http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T">http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T</a>)</td>
<td>profiling using compliance point sampling has been questioned. At the same time, they are being incorporated into site assessments often without clarity on their credibility and utility.</td>
<td>provide useful guidance for the operational community</td>
</tr>
</tbody>
</table>

### March 2013 discussions

**Summary:** Provide guidance on the utility of QMSA  
**Priority:** Medium  
**Implication for wastewater?** No  
**Implication for drinking-water?** No  
**Focal point:** David Kay and Lorna Fewtrell

<table>
<thead>
<tr>
<th>9</th>
<th>Pool Safety Plans</th>
<th>Since safety plan is the key management approach for drinking-water and wastewater, should Pool Safety Plans be developed also based on HACCP?</th>
<th></th>
</tr>
</thead>
</table>

### March 2013 discussions

**Summary:** Incorporate pool safety plans in revision of Volume 2 of the Recreational Guidelines. Concept text on the pool safety plans to be developed.  
**Priority:** Medium  
**Implication for wastewater?** Yes  
**Implication for drinking-water?** Yes (harmonization only)  
**Focal point:** Marta Vargha and Christiane Hoeller

<table>
<thead>
<tr>
<th>10</th>
<th>Swimming pools checklist</th>
<th>A draft general checklist for assessment of swimming pools and a short checklist for swimming pool operators have been developed by group from WHO Regional Office for Europe.</th>
<th>How should such a tool be published/promoted?</th>
</tr>
</thead>
</table>

### March 2013 discussions

**Summary:** Workgroup agreed that the checklist should be included in the Pool Safety Plans concept in coordination with the Bonn experts and Marta Vargha.  
**Priority:** Medium  
**Implication for wastewater?** No  
**Implication for drinking-water?** No  
**Focal point:** Marta Vargha


**Protection and Control Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Informal or special new recreational water settings</td>
<td>Guidance is needed on informal or special new recreational water settings, e.g. small clubs and spas, high-performance events (Olympics), natural swimming pools, therapeutic pools, holiday hotels. Is clarity on the definition of a public pool needed (e.g. in Hungary, public pool is defined as anything with access by people other than owner)?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**March 2013 discussions**

Summary: Take into consideration different pool types and specified component. For example, many holiday hotels around the world. This is a communication issue that should be in the Public Health chapter. This issue affects particularly vulnerable populations. Because some of these facilities are located in tourist areas, they are subject to standards of performance and regulations, so a surveillance section should be included. Guidance to be drafted.

Priority: Low

Implication for wastewater? No

Implication for drinking-water? Yes

Focal point: Martha Vargha and Christiane Hoeller

| 12       | Sanitary profiles | More guidance is needed on how to prepare sanitary profiles. Although it is a routine exercise, it is not actually providing the protection for which it was intended. | | |

**Microbial Working Group**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Molecular microbiological methods GSRWE Vol. 1, Ch. 4 (2003)</td>
<td>There is a move to consideration of molecular microbiological methods for regulatory compliance of bathing waters, which will likely spread to other areas, such as shellfish waters and possibly drinking-waters. WHO needs to take an early look at the growing evidence base in this area to determine its potential utility in Guideline development and revision.</td>
<td>Molecular methods can be rapid and offer viral pathogen quantification not possible with traditional culture methods (e.g. for Norovirus). Some administrations and science communities are examining this possibility.</td>
<td>A strategy group comprising regulators, stakeholders and experts to consider the potential utility of the new</td>
</tr>
</tbody>
</table>
### Microbial Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>approaches as regulatory tools</td>
</tr>
</tbody>
</table>

#### March 2013 discussions

**Summary:** Evaluate new molecular methods. Refer to #57 of the drinking-water annotated agenda.

**Priority:** Medium

**Implication for wastewater?** Yes

**Implication for drinking-water?** Yes

**Focal point:** David Kay

| 14 | Linkage with shellfish | WHO has put significant resources into defining the issues and science of shellfish regulation and published a book in 2009 on this issue. Many of the key factors mirror bathing water. | The 2009 review and status report is dated, and decisions on whether to take this area forward incorporated within or in parallel with bathing waters would be prudent and may produce significant efficiencies. | A recommendation on whether to progress the Shellfish topic in the next phase of activity |

#### March 2013 discussions

**Summary:** Harmonize the recreational guidance and shellfish guidance. There are many guidelines published by FAO and others, and the working group recommended to determine the linkages between the different guidelines. Review guidelines and identify linkages. Also, consult with WHO Food Safety.

**Priority:** Low

**Implication for wastewater?** No

**Implication for drinking-water?** No

**Focal point:** Kate Medlicott

| 15 | Secondary contact and cyanobacterial numbers | Lack of guidance on secondary contact and cyanobacterial numbers (Cylindrospermopsis, Anabaena and saxitoxins) (Cunliffe) | Should/can this be included? |  |

#### March 2013 discussions

**Summary:** This is an issue in Australia, and an outbreak related to secondary contact (use of jet skis) was suspected in the USA. Agreed to gather information on secondary contact to develop text to be included in the recreational guidelines, Volume 1.

**Priority:** High: gathering information; Moderate: evaluation and inclusion of text in the guideline
### Microbial Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Implication for wastewater? No**  
**Implication for drinking-water? Yes**  
**Focal point: David Cunliffe and Lesley Vazquez**

| 16 | Natural pools | Increasing trend of natural pools with natural treatment. | How can / should this issue be addressed in the next edition? |

**March 2013 discussions**  
Summary: Include the risk from exposure in natural pools and management guidance.  
**Priority: Low**  
**Implication for wastewater? No**  
**Implication for drinking-water? No**  
**Focal point: Christiane Hoeller**

### Chemicals Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reference No. 17**  
**Antimicrobial resistance**  
Is it possible to quantify health risks associated with antimicrobial resistance for recreational water? What simple guidance can be given?

**March 2013 discussions**  
Summary: Can be incorporated with antimicrobial resistance activities on wastewater (Ref. No. 14 of wastewater workplan)

| 18 | DBPs | Harmonization of DBPs and disinfectants between groups (Giddings)  
Range of disinfectants used in pools that are not used in drinking-water (Sobsey)  
Bromine, hydrogen peroxide with UV, copper/silver controversial, broad range, green disinfectants that don’t make you smell like | Conclusion and action needed on the plenary discussion |

---

142
## Chemicals Working Group

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Agenda item</th>
<th>Issue and plan of work decided at 2010 meeting</th>
<th>Progress, new issues developments</th>
<th>Actions for March 2013 meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>chlorine, not efficacious (Cunliffe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exposure routes in recreational water: Major exposure is inhalation from swimming near surface, heavy dermal exposure, some ingestion (Cotruvo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is special advice needed on vulnerable groups for DBPs and disinfectants? (Sobsey)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>John: need to be careful about epidemiology that has been done; proper mechanism of action linking DBPs and causal effect is not there (Fawell)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inclusion of chlorine not in technology requirements of volume 2 (Hoeller)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### March 2013 discussions

Summary: No action agreed. Items for further discussion at the next meeting.

Priority: Low

Implication for wastewater? No

Implication for drinking-water? Yes

Focal point: Mark Sobsey