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Development of a Strategy on Water Quality and Health

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organized in coordination with
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ACRONYMS

AusAID  Australian Agency for International Development
BOD    biological oxygen demand
BoD    burden of disease
DALY   disability-adjusted life year
DHS    Demographic and Health Survey
EU     European Union
FAO    Food and Agriculture Organization of the United Nations
FSP    food safety plan
GDWQ   Guidelines for Drinking-water Quality (WHO)
HACCP  hazard analysis and critical control point
HBT    health-based target
HQ     headquarters
HWTS   household water treatment and safe storage
IHE    Institute for Water Education (UNESCO)
IWA    International Water Association
JMP    Joint WHO/UNICEF Monitoring Programme for Water Supply and Sanitation
MDG    Millennium Development Goal
MHLW   Ministry of Health, Labour and Welfare (Japan)
MICS   Multiple Indicator Cluster Survey
MPN    most probable number
O&M    operations and maintenance
PCR    polymerase chain reaction
PUB    Public Utilities Board (Singapore)
QC     quality control
QMRA   quantitative microbial risk assessment
qPCR   quantitative polymerase chain reaction
RADWQ  rapid assessment of drinking-water quality
RegNet International Network of Drinking-water Regulators
SSP    sanitation safety plan
TC     total coliforms
TTC    total thermotolerant coliforms
UNC    University of North Carolina
UNEP   United Nations Environment Programme
UNESCO United Nations Educational, Scientific and Cultural Organization
UN-Habitat United Nations Human Settlements Programme
UNICEF United Nations Children’s Fund
USA    United States of America
USEPA  United States Environmental Protection Agency
UV     ultraviolet
WHO    World Health Organization
WSH    Water, Sanitation, Health & Hygiene Programme (WHO HQ, Geneva)
WSP    water safety plan
1. INTRODUCTION

The Water, Sanitation, Hygiene and Health Programme (WSH) of the World Health Organization (WHO) organized a Consultation on the Development of a Strategy on Water Quality and Health in Tokyo on 8, 9 and 10 December 2010. The Consultation was organized in coordination with the Ministry of Health, Labour and Welfare and the National Institute of Public Health of Japan.

1.1 Objectives

The objectives of the meeting were to explore options to strengthen WHO’s work in water quality by:

1) formulating a comprehensive water quality and health strategy;
2) agreeing on the modalities for the establishment of an Expert Group bringing together experts in drinking-water quality, safe use of wastewater and management of recreational water safety;
3) designing the structure and functions of the Expert Group, through working groups and task forces, to address specific technical issues; and
4) better integrating the networks hosted by WHO into water quality work.

1.2 Participants

A total of 27 participants attended the meeting, including members of the WHO Drinking-water Quality Committee, representatives of the expert groups responsible for preparing the WHO recreational water quality and safe use of wastewater guidelines; in addition four staff from WHO headquarters and regional offices were in attendance, as well as 26 observers, the large majority from Japan. A list of participants is presented in Annex 1.

1.3 Organization of the meeting

The meeting consisted of a series of presentations on 1) the three sets of WHO water quality guidelines, 2) the Japanese experience and initiatives in water quality, 3) opportunities for harmonizing the normative water quality functions of WHO, 4) putting the various guidelines into operation in a coordinated approach and 5) optimizing the role of networks. The final session consisted of discussions towards finalization of a roadmap towards the formulation of a water quality and health strategy and its deliverables. The approved agenda is presented in Annex 2.

The elected officers of the meeting were Duncan Mara (United Kingdom) and David Cunliffe (Australia) as co-Chairs and Marla Sheffer (Canada) as rapporteur.

1.4 Opening session

Kimio Matsumoto, Chief of the Ministry of Health, Labour and Welfare, welcomed participants to the water quality and health strategy meeting. He emphasized the need to make a concrete effort to develop a comprehensive water quality strategy for WHO. The Guidelines for Drinking-water Quality (GDWQ) had significantly contributed to improving the management of drinking-water quality internationally, and a global approach to developing a water quality strategy was essential. He expressed his pleasure at having the
opportunity to introduce Japan’s situation related to water quality, and he expected the meeting to promote cooperation between experts and meaningful discussions as a starting point for the formulation of a water quality and health strategy.

Robert Bos, Coordinator of the WSH programme, thanked the Japanese hosts for their hospitality and for the meeting arrangements and noted that WHO receives a constant flow of support from the Japanese government, both financial and in terms of expertise. He welcomed participants from the normative areas of drinking-water, recreational water and wastewater and informed new arrivals that the earlier meeting of the Drinking-water Quality Committee had been productive and that the fourth edition of the GDWQ would be finalized in the coming months and launched next year (2011)∗.

2. JAPAN: EXPERIENCES AND INITIATIVES ON WATER QUALITY

What follows is a summary of the presentations on Japanese water quality experiences and initiatives made by the Japanese experts and observers in attendance.

2.1 Strategy for managing water safety in the water cycle

Professor Magara addressed four issues related to the Japanese strategy for managing water safety in the water cycle: water-related diseases, drinking-water quality standards, water resources management and emerging issues in water quality management.

The first epidemiological study ever showing a relationship between cholera and water and sanitation (specifically wells and ditches polluted by human excreta) had been carried out in 1870. Between 1960 and 1975, the incidence of waterborne disease in Japan, particularly dysentery and polio, but also typhoid and paratyphoid, decreased substantially. In more recent years, water-related disease outbreaks had been caused by Campylobacter, E. coli and Cryptosporidium.

Water pollution in Japan resulted from industrial and domestic wastewater, nitrogen, phosphate (from fertilizers) and hazardous chemicals. Drinking-water quality standards in Japan were compulsory regulatory standards to ensure safe and acceptable water quality for consumers. Currently, there were 51 Japanese standards, as compared to 127 guideline values in the GDWQ. Ambient water quality standards were covered by the Basic Law for Environmental Management, whereas effluent quality standards (ten times the concentration of the ambient water quality standards) were under the Law for Water Pollution Control.

The average consumption of water in Japan was 250 litres per person per day, or about 90 m³ per person per year. The used water, when treated by biological wastewater treatment processes, had a biological oxygen demand (BOD) of 20 mg/l. To reduce the BOD to about 4 mg/l required about four times more water for dilution, or 360 m³ per person per year. Therefore, the total demand is 450 m³ per person per year. In dry years, most water in Japan is used for irrigation, with an equal proportion devoted to both industrial uses and public water supply.

∗ The fourth edition of the WHO Guidelines for Drinking-water Quality was launched during Singapore International Water Week in July 2011.
Focusing on the city of Sapporo, Professor Magara pointed out that high concentrations of arsenic and boron were found in the river water that is the source the city’s water supply. Boron intake from food accounted for about half of the acceptable daily intake of boron of 4.4 mg/day and must also be taken into consideration. A risk analysis resulted in an acceptable concentration of boron in water of 0.86–1.36 mg/l.

Professor Magara expressed the hope that Japan will move from a “vicious cycle” of lack of investment in water and sanitation, poor service and low coverage, and very low cash flows, to a “virtuous cycle” of service expansion, better water quality and increasing water investment.

2.2 New strategy for protecting the aquatic environment

Mr Seki, Director-General for Water Environment, Ministry of the Environment, outlined a new strategy for protecting the aquatic environment, focusing on what Japan had done to overcome serious pollution problems and what Japan was planning to do to create better water quality.

The Ministry of the Environment had been established in 2000 following years of intensive water pollution abatement and improvement. Aquatic environment–related legislation in Japan included the Water Pollution Control Law, which aims to protect human health and the living environment from the adverse effects of water pollution and provides a variety of approaches to reduce pollutants in water, such as effluent limits on industrial wastewater and groundwater protection. Ambient water quality standards included 27–28 toxic substances in surface water and groundwater for the protection of human health and ten items, such as BOD, chemical oxygen demand, total nitrogen and total phosphorus, in surface water for protection of the living environment. Currently, the water quality standards for health were met in most of Japan. While water quality for the living environment had been gradually improved, the quality of closed water bodies such as lakes and bays remained unsatisfactory.

Mr Seki stated that issues that needed to be tackled in future included managing the impacts of climate change, accidents affecting water quality, marine pollution, trace chemical pollution and groundwater and soil pollution. Approaches to be considered included measures against non-compliant establishments, improved responses to accidents, new standards, new effluent control methods, preventive measures, water environment monitoring and data accumulation.

With strict regulations against industrial effluent and intensive domestic wastewater treatment works, serious water pollution had been overcome to a considerable degree. Given the diverse water-related problems, an integrated approach is required to achieve the desired improvements in the aquatic environment. A new strategy for the aquatic environment was under preparation to address emerging issues, taking into consideration four aspects: local, global, biodiversity and partnership.

2.3 Wastewater control and water reuse

Dr Ogoshi, Chief of the Department of Water Quality Control, Wastewater and Sludge Management Division, National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport, discussed standards of treated municipal wastewater use in Japan for non-potable urban uses. He outlined the background and the current status of
wastewater use in Japan, described changes in standards for treated municipal wastewater for non-potable uses and provided an update on recent progress in water reuse.

Water reuse and recycling in Japan had come about as a result of water shortages due to industrial, urban and agricultural requirements as well as severe droughts. Japan used reclaimed water mainly for urban amenities. Currently, most municipal wastewater was used for stream flow augmentation, landscape streams and ponds and snow melting, with lesser amounts used for industrial water supply, agricultural irrigation and toilet flushing.

The reclaimed water quality standard had been revised twice since the first draft was published in 1981. The newest standard (2005) included *E. coli*, residual chlorine, colour and turbidity, as well as additional facilities for sand filtration with or without coagulation, to protect against *Cryptosporidium* infection.

Recently, the actual incidence of norovirus in municipal wastewater treatment plants and in reclaimed water had been investigated, and it was found that norovirus was properly removed.

### 2.4 Managing microbial contamination: monitoring and source control

**Dr Katayama**, Associate Professor at the University of Tokyo, discussed monitoring and source control for managing microbial contamination, with a focus on *Cryptosporidium* and norovirus.

*Cryptosporidium* outbreaks had occurred in Japan in 1991 and 1996. Special countermeasures were needed, because water safety was highly dependent on chlorine. Guidelines for *Cryptosporidium* treatment in the water supply had been issued by the Ministry of Health, Labour and Welfare in 1996 and revised in 2007. The guidelines suggested that water utilities should assess the risk level of potential contamination for each water treatment plant. Upon finding *Cryptosporidium*, the water supply must be interrupted. Plants classified as Level 4 (high possibility of contamination), should install a filtration process to maintain the turbidity below 0.1 nephelometric turbidity units after filtration. Such a turbidity level can be maintained by adding polyaluminium chloride after sedimentation or by pH control. Ultraviolet (UV) treatment had been initiated in 2007. The *Cryptosporidium* concentration had been determined only for source water and had been shown to increase with rainfall. The source of the *Cryptosporidium* had been identified by species.

Waterborne outbreaks of noroviruses have occurred in many countries. In Japan, a norovirus outbreak occurred as a result of untreated shallow well water, possibly due to insufficient chlorination, affecting 29 people. Norovirus had also been detected in tap water in Japan in a survey conducted between January 2002 and February 2003, with the virus genome detected by real-time polymerase chain reaction (PCR). The infectious risk had been calculated to be one infection per 200 people-years in the worst-case scenario, although it had been acknowledged that there were a lot of unknown factors. Methods for the removal of noroviruses in the water purification process were being utilized by the Tokyo Metropolitan Water Works.
2.5 Contribution to world water issues and domestic water issues, Water Security Council of Japan

Mr Inoue, Director of the Japan Water Forum, talked about water quality and the water environment from the viewpoint of sanitation. Access to safe drinking-water and to improved sanitation, as established by the Millennium Development Goals (MDGs), remained seriously inadequate in the Asia-Pacific region. Over 50% of the 884 million people who still use unimproved sources for drinking-water live in the Asia-Pacific region, as do 70% of the 2.6 billion people who do not use improved sanitation facilities. Enhanced efforts, especially for sanitation, are needed in the Asia-Pacific region.

Seventeen Asia-Pacific Water Forum knowledge hubs had been established. Each hub was a centre of excellence committed to improving water security in the Asia-Pacific region by promoting knowledge sharing and championing feasible solutions.

Leadership at the highest government levels was urgently needed in order to secure the governance of water security under global changes (the “Ministers for Water Security” initiative). The Collaborative Action Team for Sanitation, with representation from private companies, national and local governments, nongovernmental organizations, academia, citizens and the media, interacted with the Water Security Council of Japan, which provided support, coordination and evaluation, as well as with international networks and developing countries (for assistance, project implementation and information).

In the session coordinated by the Japan Water Forum in the follow-up meeting on the International Year of Sanitation in Tokyo in 2010, discussion points had included: 1) the need for sanitation issues to be addressed as part of integrated water resources management; 2) the importance of extending the benefits of sanitation to people at all levels; 3) the need to break down sanitation-related taboos, and 4) the desirability of having sanitation facilities sustainably and locally managed.

Key discussion points
- As boron is difficult to remove by treatment, when source waters contain boron at a level higher than 1 mg/l, it is better to change the water source. For desalination plants, a two-step reverse osmosis process can remove boron.
- In Sapporo city, the water is mixed with waters with low boron content to reduce boron intake.
- There is not enough experience in Japanese water utilities in using virus surrogates such as bacteriophages, which are more abundant and easier and faster to measure, so it is not practical to use these at the moment.
- One lesson learnt from the Milwaukee incident was that turbidity had not been monitored closely enough. Continuous operational monitoring allows one to react immediately to a filter malfunction. If one filter has a problem, it can be taken offline. The addition of UV is also useful to ensure adequate reductions in Cryptosporidium.
- A Legionella guideline value has been set for swimming pools and spas in Japan, but not for households (as in Germany).
- Some water bodies in Japan do not meet ambient water quality standards.
3. OPPORTUNITIES FOR INTEGRATING THE NORMATIVE WATER QUALITY FUNCTIONS

3.1 Review of the WHO Guidelines for Recreational Water Quality

Lorna Fewtrell (United Kingdom) explained that the *WHO Guidelines for Recreational Water Quality* consist of two volumes; volume one covers coastal and fresh recreational waters and volume two swimming pools and similar environments. In volume one, the possible adverse impacts are weighed against the substantial benefits to health and well-being associated with the use of recreational water environments. Hazards include drowning, injury, sun, heat, cold, microbial and chemical contaminants, and dangerous aquatic organisms. The degree of water contact (no contact, incidental contact, or whole-body contact) influences the degree of exposure to toxic agents as well as physical hazards. Only for two hazards health-based targets are set, with associated guideline values: faecal pollution (intestinal enterococci associated with gastrointestinal illness) and cyanobacteria in fresh water (three levels and typical actions). For the remaining hazards guidance focuses on control measures. The faecal pollution approach combines sanitary inspection with microbial water quality assessment (in a matrix classification scheme), incorporating both the Stockholm framework † and the Annapolis protocol ‡. The guidelines are based on marine water quality but are applied in marine, estuarine and fresh water (and are likely to be conservative for fresh water). There are no guidelines for chemical and physical agents, but for these the WHO Guidelines for Drinking-water Quality can be used as a starting point. As a screening approach, for example, if a contaminant were to be present in recreational waters at ten times the WHO GDWQ level, this might suggest the need for a closer look.

In volume 2, on swimming pools, the hazards include drowning, injury, sun, heat, cold and microbial and chemical issues. There are different types of pools, such as indoor and outdoor pools, supervised pools and pools without supervision, pools with different types of water, and heated and unheated pools. The guidelines apply to all pools. Chemical hazards can originate from the source water or from the bathers themselves, or may be management-derived. Chemicals for which guideline values are provided include free chlorine, total bromine, chloramines, bromamines, isocyanurates, ozone and various disinfection by-products. The guideline values for disinfection by-products are derived from those in the WHO GDWQ. Ingestion exposure should be less than for drinking-water, but non-ingestion exposure will be higher. There are also guidelines for pH and turbidity (important in terms of seeing the pool bottom as well as disinfection) as well as microbial operational guidelines.

The recreational water quality guidelines were updated at a meeting in 2009.

3.2 Review of the WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater

Blanca Jimenez (Mexico) explained that the WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater in Agriculture and Aquaculture consist of four volumes: policy and regulatory aspects, wastewater use in agriculture, wastewater and excreta use in

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There are different perspectives on global water scarcity, as reviewed by Rijsberman, but whatever indicators is selected, it is clear that water scarcity will be an increasingly important issue for a expanding part of the world population. Urbanization is an on-going process, and since 2010 over half of the world’s population lives in urban areas, with as one of the consequences an ever-increasing production of wastewater. Wastewater use is important in the light of these trends, especially in regions where water is scarce. In some countries, wastewater is treated before use on crops, but in others it is not. At least 10% of countries consume crops irrigated with wastewater. Wastewater use not only reuses water but also recycles nutrients. For wastewater use criteria to be useful, they have to be flexible, locally adaptable and accepted worldwide.

Each of the three operational guideline volumes follows a similar structure, with a focus on assessment of the health risk to consumers, workers and their families, and communities; health-based targets (HBTs); health protection measures; system assessment and monitoring; sociocultural, environmental and economic aspects; policy aspects; and planning and implementation. No guideline values are established, but reasonable minimum requirements of good practice to protect health are described, and information is provided to derive HBTs. The preferred approaches towards implementation of the Guidelines may vary depending on local social, cultural, environmental and economic conditions. The desired level of protection may be achieved through a combination of wastewater treatment, crop restriction, choice of irrigation method and food preparation method. This is referred to as the multi-barrier approach. Within each of these approaches, different techniques can be used to achieve the same reduction of pathogens in order to achieve the HBT.

There are several issues and concerns that need to be resolved. For example, quantitative microbial risk assessment (QMRA) remains a complex methodology; most policy-makers read only the verification values and interpret them as guideline values; although helminth eggs are a relevant indicator, no standardized technique for their measurement is available; and numerous chemical substances, including endocrine disruptors, were not considered in the Guidelines’ third edition. It is also not known how many countries have used the guidelines to develop their own standards.

3.3 Review of the WHO Guidelines for Drinking-water Quality

Ingrid Chorus (Germany) noted that, since July 2010, access to safe drinking-water and sanitation is a human right. The human rights resolutions refer to the GDWQ as the key normative document for “safe drinking-water”. Safe drinking-water is relevant to lives lost, time lost and health-care costs. The GDWQ are a flagship normative publication of WHO, and there is a high demand for the document, as reflected in download statistics. The drinking-water guidelines were first published as International Standards in 1958. In 1984, the first edition of the Guidelines was published, with a significant change to non-prescriptive guidelines rather than standards. In 1993, the second edition was published in three volumes.

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In 2004, the third edition was published, with a new approach involving the water safety plan (WSP) framework, together with numerous supporting documents††.

Key features of the GDWQ include a strict focus on public health protection and a rigorous assessment of microbiological, chemical and radiological hazards in drinking-water. The Guidelines are based on the best available evidence and on international expert consensus. They are the scientific point of departure for standard setting, which involves a risk–benefit philosophy, adaptation to local circumstances and the recognition that incremental improvement is better than no improvement. Incremental improvement is now also linked to the concept of progressive realization, which underpins the human rights-based approach. The Guidelines are a point of reference for norms worldwide. In some developing countries, they are directly transposed into national standards. In others, they are adapted for use or used in the absence of national standards.

Established pro-active and holistic approaches include the multiple-barrier approach, the recognition that disinfection should not be compromised and the faecal indicator approach. Waterborne diseases are still a major public health problem worldwide. Reliance on end-point testing is too little, too late and sole reliance on indicators is insufficient.

The framework for safe drinking-water, as introduced in the Third Edition, includes health-based targets, water safety plans and independent surveillance. WSPs involve system assessment to identify hazards and control measures, controlling hazards, verification and auditing, documentation and review. They are the instrument of choice for implementing the GDWQ.

There are various stand-alone documents in support of the GDWQ, and several networks support their implementation (the WHO (co-)hosted household water treatment and storage, small community water supplies, operation and maintenance, and international drinking-water regulators networks, as well as the WSPortal of the International Water Association [IWA]).

**Key discussion points**

- There has been limited effort in the area of surrogates or indicators for helminths, rather than monitoring helminths directly. The analytical technique is quite simple and affordable, but it needs to be standardized, and there is a need for training.
- The catchment end of the WSP approach needs to be strengthened.
- In terms of wastewater guidelines, it is better to focus on all end-points of toxicity rather than on endocrine disruptors specifically.
- There is common ground between the three areas of work: public health protection, the Stockholm framework, methodological issues (e.g. QMRA and its challenges), similar procedures (e.g. multiple barrier approach). Although the GDWQ have a continuous expert group, that is not true for the other two guidelines. The three presenters (Lorna Fewtrell, Blanca Jimenez and Ingrid Chorus) were asked to get together and provide an overview of the similarities, differences and gaps in the three sets of guidelines as a starting point for later discussion.

†† At the time of the Consultation, publication of the fourth edition was foreseen for mid-2011. Effectively, this edition, which further elaborates the WSP approach and contains many updates from the rolling revision since 2004, was launched at the Singapore International Water Week on 4 July 2011.
3.4 Commonalities, differences, gaps and challenges

As reported by Lorna Fewtrell, discussions between the presenters of the WHO drinking-water, recreational water and wastewater guidelines revealed the commonalities between the three WHO water quality guidelines to include:

- human health protection and promotion (maximizing benefits while minimizing risks)
- health-based targets
- faecal and chemical pollution
- the concept of safety planning, as embodied in water safety plans, the instrument to implement the GDWQ
- “use” of quantitative microbial risk assessment (the concept is ahead of its implementation)
- big gaps in research and data availability
- importance of the multiple-barrier approach and promotion of incremental improvements
- local adaptation encouraged
- all politically high-profile areas in their own right

The three sets of guidelines differ in:

- level of health protection (less for recreational water)
- degrees of exposure
- levels of international recognition/acceptance
- impacts on local economies
- development of operational instruments (moist advanced for drinking-water)
- research at different levels (“data envy”)  
- definition of target audiences (less well-defined for wastewater)
- permanent expert group only for drinking-water quality
- levels of intersectoral arrangements

Gaps include:

- guidance for local adaption (e.g. not using $10^{-6}$ disability-adjusted life year [DALY])
- effective links and division of responsibilities between expert groups and WHO-hosted international networks
- coverage of broader wastewater issues
- coverage of agricultural irrigation water quality (only a WHO issue in as far as there is evidence of health impacts)
- economics underlying various norms, standards and best practice options
- incremental approach in reality
- disinfection by-products and recreational water

Challenges include:

- the perceived complexity of QMRA
- the need to update the protocol on policies and procedures to cover the integrated approach
- the need to address water quality issues in the face of climate change and water scarcity
- wastewater as a source of drinking-water
- the adoption of framework methods and procedures at a national level
- meeting the needs of all users
feedback on how well the guidelines work in practice
- tools for implementation at a local level (e.g. methods of analysis)
- intersectoral planning and action

Also noted were the added benefit from setting HBTs for all water-related exposure pathways, the shared conceptual developments (e.g. QMRA), synergies in water management and the added benefits of expanding capacity, for example through this strategic Consultation.

**Key discussion points**
- **There is a need to avoid complexity.** The main barrier to implementing the wastewater guidelines is their complexity. This is also true for the application of the drinking-water guidelines in small communities.
- **The guidelines documents need to embrace concepts at different levels of performance.** They need to embody the concept of incremental improvement in their approach; otherwise, they will be ignored by some stakeholders.
- **Some countries find it difficult to control what is going on in their catchments and need a clear message from WHO on watershed management and source water protection.** They need advice on how to get started and on how to achieve continuous improvement.
- **An important challenge for WHO will be integrating environmental aspects (e.g. ecological concepts, ecosystem services) without this being at the expense of the health focus.**

### 3.5 Cross-cutting issues

#### 3.5.1 Health-based targets

**Duncan Mara** explained that DALYs, or disability-adjusted life years, are a common metric for disease and disability. DALY losses (his preferred term) can be used to compare the burden of different diseases. A DALY loss is the health cost of disease and disability, with death being the ultimate disability. For most diseases and disabilities, the DALY loss per case of disease or disability is known. Now it is almost possible to translate DALYs into tolerable infection risk and tolerable disease risk.

The drinking-water and wastewater guidelines use $10^{-6}$ DALY loss per person per year. It was chosen because it is equal to $10^{-5}$ fatal waterborne cancer risk in the United States of America (USA) per person over a 70-year lifetime—in other words, $4 \times 10^{-7}$ per person per year. This means that a 1 in 10 million chance of dying each year is acceptable. But the incidence of all fatal cancers in the USA was actually $1.8 \times 10^{-3}$ per person per year in 2006. Is a factor of safety of four orders of magnitude justifiable? For waterborne disease, infection risk and disease risk are $10^{-4}$ and $10^{-5}$ per person per year, five orders of magnitude lower than the actual incidence of diarrhoeal disease and three times lower than the current estimate of waterborne disease in the USA. Should we be using a lower DALY loss?

The wastewater guidelines are based on local incidence of diarrhoeal disease, such as $10^{-4}$ or $10^{-5}$ DALY per person per year. Using, for example, a population of 4930 million people, with a 59 million DALY loss in 2006 for diarrhoeal disease, the DALY loss would be 59 million/4930 million = 0.012 per person per year. An additional DALY loss of $10^{-4}$ per person per year would increase this only slightly. Thus, it seems reasonable to accept a $10^{-4}$
DALY loss per person per year attributable to wastewater use, with the log unit reductions two orders of magnitude lower than for a DALY loss of $10^{-6}$. Treatment can be used for restricted irrigation, and post-treatment health protection control measures for unrestricted irrigation. Wastewater treatment to achieve 1–2 unit log reduction is both simple and affordable.

The key to wider adoption of the 2006 guidelines is to start at the beginning, choosing an appropriate value for the maximum tolerable additional burden of disease from working in wastewater-irrigated fields and consuming wastewater-irrigated foods. The value should be $10^{-4}$, not $10^{-6}$.

Other post-2006 developments include an improved method to determine annual risks (Monte Carlo), the use of norovirus as a reference viral pathogen and Ascaris as a reference helminthic pathogen, and an extended list of health protection control measures on the farm. These issues are covered in a paper included in the second information kit on safe use of wastewater.

**Key discussion points**

- It was clarified that the United States Environmental Protection Agency (USEPA) numbers quoted refer to one excess case of cancer, not one excess cancer death. In fact, the $10^{-4}$ value is an index value, not cases. If the risk is less than $10^{-4}$, it will be accepted by the USEPA.
- The proposal to use Monte Carlo simulations should be re-evaluated to ensure that it makes sense statistically.
- It is important to consider whether annual risk, where all of the peaks are smoothed out, is applicable to the discussion, or whether the peaks and frequency of the peaks are equally or more relevant.
- WHO should not set targets for Member States, but should be transparent about what a target of DALY loss averted would mean. National authorities may set their own targets as appropriate and incrementally increase the target as they go along.
- A DALY of $10^{-4}$ might be a more appropriate starting point for many countries of the world. This philosophical discussion will become important if the guidelines become harmonized.
- Whether the standards are set for endemic or other conditions needs to be incorporated into the discussion.
- Incremental improvement in the context of the supporting document on performance evaluation of point of use treatment has already been accepted in concept by the Drinking-water Quality Committee, so perhaps it is not such a stretch to have these in other contexts, such as wastewater irrigation and recreational water.
- It is important to explain what a $10^{-4}$ risk actually means to help countries adapt the guidelines to local circumstances.
- The meeting participants were asked to send in their comments on the paper by Mara et al. on “More appropriate tolerable additional burden of disease...” so that he and his team can incorporate them and the paper can be included in the information kit on safe use of wastewater.

3.5.2 Health risk assessment

Nicholas Ashbolt (USA) predicted that QMRA will play an important role in the harmonization of the water quality guidelines. Development of QMRA is most advanced for
the recreational water guidelines. The WHO risk assessment and management approach was first detailed in the Fewtrell, Bartram and Stenström (2001) publication and later used in the recreational water guidelines (sanitary surveys and QMRA) and the third edition of the GDWQ.

QMRA provides an estimate of risk based on environmental exposure. Its bigger role is in assisting in risk management. WSPs are based on risk matrices, which are qualitative assessments of risk, but relatively poor at resolving differences between pairs of issues. We need to validate that risk matrices are appropriate, and one way to do that is to use QMRA.

There are three different pathogen types: viruses, bacteria and parasitic protozoa. *E. coli* does not represent pathogens, it is merely an indicator of faecal contamination. We need to use appropriate indicators for appropriate systems. Molecular microbiology and quantitative PCR (qPCR) are used to enumerate norovirus, but there are extraction, reliability and performance issues.

Hazardous events in recreational water are identified by a sanitary survey, and each needs to be assessed by QMRA. The sanitary survey, QMRA and risk management all complement each other.

What is QMRA? The first step is problem formulation and hazard identification (reference pathogen selection, identification of hazardous events). The second step is exposure assessment (for each reference pathogen). Step 3 is health effects assessment (using dose–response models for each pathogen and scenario), and step 4 is risk characterization.

The current QMRA paradigm involves the use of index pathogens as representatives of a group. It is useful for assessing and informing risk management and provides a stochastic approach to dealing with inherent variability and model/method uncertainties.

The shedding of pathogens by bathers is not being studied in most epidemiological studies. We are still reliant on the sanitary survey to identify sewage-impacted waters; sanitary surveys may easily identify pathogen risks.

Current guidance sets general goals that can be aided by QMRA. We need to select the appropriate pathogen and identify the hazardous events. QMRA is used to explore scenarios to aid in sanitary survey interpretation, such as estimating gastrointestinal risks for different scenarios, identifying management targets and identifying key research gaps.

**Key discussion points**

- QMRA is much simpler for wastewater than for recreational waters, as inputs for the latter are difficult to control (bathers, animals, etc.). Nevertheless, the challenges are the same, such as identifying appropriate surrogates and behaviour of the barriers.
- We need to move beyond the specific safe use of wastewater in agriculture to wastewater management and human and animal waste management. They need to be part of an integrated approach.
- We need to decide which diseases to include. Do we stick with waterborne diseases or those transmitted through droplets or other waste? *Legionella*, for example, is

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responsible for a large proportion of deaths due to drinking-water, yet we don’t have management systems in place for this organism (or for Mycobacterium).
- We should not forget about simple interventions such as putting up a fence to prevent cattle from defecating in the water.
- Risk matrices are a good start and an essential first step, as they get people to look at their systems. However, WHO should be more aware of their limitations.
- Suggesting different reference pathogens may not be the right way to go. It might be better to look at the local situation and see what is appropriate.

3.5.3 Health risk management: wastewater

Pay Drechsel (Germany) is responsible for implementing the IWMI wastewater irrigation and health programme (based on the WHO wastewater guidelines) in West-Africa. The work involves a shift to HBTs with an emphasis on the multibarrier approach. Ghana has lots of wastewater treatment plants, but most do not work, and, for example in Accra, the largest part of human excreta from septic tanks is dumped directly into the sea. Urban wastewater and fecal sludge are used in their raw form to irrigate vegetables, and many of these are eaten raw.

Individual interventions are most effective at higher levels of contamination, so that when interventions are combined, their individual effectiveness is less than expected. Low-cost interventions at one or more entry points could avert 90% of DALY loss attributable to wastewater-irrigated vegetables, and the cost-effectiveness is reasonable. Cost-effectiveness is only high if interventions are adopted.

In low-income countries, there is low risk awareness in the population. This means that there is no market for safer produce. There is also limited institutional capacity to enforce regulations or control. In this context of poor perception and low capacity, a safety plan is ambitious. To trigger behaviour change, there is a need for financial subsidies, non-financial triggers (prestige, fear), learning from hygiene promotion and social marketing.

IWMI, through its regional office in Accra, is working on interventions in West-Africa: improved vegetable washing, hand washing, cross-contamination, among others. There are so many food safety and hygiene issues that a more holistic approach is needed based on the hazard analysis and critical control point (HACCP) approach, combining WSPs with sanitation safety plans (SSPs) and food safety plans (FSPs). As we move from water quality to HBTs, it is no longer just about water, but also about food. Do we have the right people for this? From a practical perspective, we need to step out of the water box, emphasizing hygiene promotion and food safety and combining WSPs, SSPs and FSPs.

Key discussion points
- Placing the focus on consumer behaviour is one thing that deserves more attention. For household hygiene, it has been found in the case of hand washing with soap that giving people a device that they like to use is a good trigger to change behaviour. We therefore need to give people a more convenient and attractive way of washing vegetables at the household level or at the food producers’ level. The hardware or technology for this needs attention.
- In harmonizing, we can strengthen the message that household actions, including hygiene, are important. With small community water supplies, there are relatively
simple, low-technology, cost-effective solution for safe household water storage and treatment.

- The real issue is the difference between wastewater and drinking-water. Drinking-water addresses formalized, institutionalized subsectors, whereas wastewater addresses an informal sector, such as farmers and street vendors for food. This requires a fundamentally different approach. It is good that we have WSPs as a key instrument to implement the guidelines, but they won’t be enough. We need to develop other tools that focus on behavioural issues.

- Perhaps an incentive for some countries could be the ability to meet quality specifications set by purchasing markets outside the country.

- It needs to be considered that boiling water has its own drawbacks as it creates greenhouse gases, so that we may be transferring the issue from health and hygiene to an indoor air pollution and, cumulatively, to climate change.

3.5.4 Health risk management: chemicals

**John Fawell** (United Kingdom) agrees that with respect to drinking-water chemical issues may be less important from a public health perspective than microbial contaminants, but there are issues of perception that have to be addressed. We cannot separate availability, access, sanitation and (drinking-)water quality. There are different levels of priority for chemicals depending on the nature of the supply and the location of consumers. Increasing demand and increasing scarcity will result in changes in the way in which water is managed. The need for new sources (e.g. reuse) will increase, collection and storage will change and pressures on quantity and quality will increase.

There are many interlinked routes for chemicals and pathogens to reach consumers, starting with the source: natural (drinking, cooking, irrigation) or from wastewater, industrial discharges, agricultural activity, drinking-water treatment and household activities. Advocating for one set of guidelines for all three aspects is not desirable, but it is important to be aware of what is going on in the different areas, as food, drinking-water, wastewater and bathing water are all interlinked.

Chemical hazards and risks need to be placed in the appropriate context. WHO can help Member States to identify priorities (for individual chemicals as well as in terms of overall exposure). This requires common thinking in addressing chemicals and the impact of other aspects (e.g. diarrhoeal disease and nitrate). The different issues and priorities between Member States and between regions need to be recognized.

Overarching management issues include managing at the source wherever possible, multidisciplinary approaches avoiding compartmentalization, recognizing links in the managed water cycle in an integrating approach, and encouraging consumers to make behavioural changes. Managing chemical risks involves assessing priorities and cost-effective interventions, with prevention the preferred strategy. Optimal control may require long-term planning.

Beyond 2010, a more integrated and harmonized approach will be needed, thinking outside of the water box and involving other areas of WHO. In the normative water quality work consideration needs to be given to where interventions can be made most effectively, looking at the long term. One size fits all is not practical in identifying public health priorities; key chemical priorities need to be identified to get the process rolling on a number of initiatives,
such as the WHO/United Nations Children’s Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation (JMP); perception issues need to be addressed; and independent evaluations arranged to avoid diverting resources away from higher priorities.

**Key discussion points**

- We need to keep in mind that health priorities in developing countries (e.g. death from drinking dirty water) are much different from those in the industrialized world.
- We need to identify where the problems lie on a local basis. Not one national authority needs to be monitoring for 125 chemicals.
- The GDWQ were conceived to be universally applicable, which makes it difficult to deal with widely different contexts in terms of level of development. The GDWQ are used as a reference book, but not as a management approach. Even prioritizing the chemicals volume is too complex. This needs fixing.
- In terms of risk perception and communication for chemicals, relating cancer targets to cancer cases we actually see is useful. We need to have more of that type of risk communication, which will indicate that some concerns are quite minor compared to others.
- We need to develop cheap alternatives for testing and control to help developing nations deal with their chemical contamination issues.

3.5.5 The USEPA perspective on integrating water quality issues

The USEPA is looking at two environmental laws: the Clean Water Act and the Safe Drinking Water Act. The Safe Drinking Water Act sets a maximum contaminant level goal and a national primary drinking water regulation for each contaminant. The Clean Water Act develops criteria for water quality to protect aquatic organisms and human health, and it is better resourced than the Safe Drinking Water Act.

**Ed Ohanian** (USA) described the National Water Program’s priorities from 2011 to 2015, which include establishing national and international partnerships and collaboration within and outside the USEPA, healthy watersheds and coastal waters, safe drinking-water, sustainable water infrastructure, new approaches in evaluating groups of contaminants, developing innovative and affordable tools and technologies for public health protection, and using systems approaches to protect ecological systems on a watershed basis.

For healthy watersheds and safe drinking-water, the programme will look at effects, methods development, occurrence/exposure, treatment technologies and their effectiveness.

**Key discussion points**

- The USEPA approach is similar to the European water management directive.
- The guidelines all state that the greatest risk is from pathogens, that only a few chemicals are important and that source protection is important. However, this information is surrounded by pages of detail. This hampers effective prioritization. Guidance is provided just for issues in certain parts of the world. We need to simplify to identify the big ticket items.
- A concise policy document is a good goal, but it risks trivializing the issue.
- This presentation illustrates the consequences of political and public pressure, where the USEPA is instructed to engage in issues simply because of a perception of risk.
- We need to communicate that risk is associated with other things as well as water. Otherwise, water ends up taking the blame for things that are due to other sources, such as food.
- This presentation shows that integration and harmonization are ideas whose time has come, not only within WHO but also within the USEPA, but there are risks associated with this. The guidelines are linked too much with information in books. It is hoped that WHO will make further progress in web-based information. In the rolling revision for the GDWQ, information is posted on the web as it becomes available and the need arises, and the next hard copy edition I provides the final confirmation of the information. In future, perhaps we’ll be able to find information on a local context via hyperlinks. We may want to look at how to improve the formatting of the guidelines information.

3.6 Putting the guidelines into operation in an integrated approach

3.6.1 The concept of sanitation safety plans

Thor-Axel Stenstrom explained that the three components of the sanitation safety plan (SSP) were system and exposure assessment (mapping the system and identifying potential risks along the sanitary chain), operational monitoring (establishing control measures for hazards at critical control points and a mechanism to ensure that failure can be controlled in a timely manner) and management (a plan of action and control measures for normal and incident conditions). An SSP starts with the user interface (e.g. type of toilet), moves to collection and storage (e.g. septic tank) and continues with conveyance, reuse and disposal, and centralized treatment.

There are several similarities between SSPs and WSPs. Both concepts (and the SSP is just a concept at this time) are derived from WHO guidelines. The incremental risk management approach is based on HACCP and the Stockholm framework. Essential actions for both include system assessment, operational monitoring and management. And both are systematic in nature, following the drinking-water/sanitation supply chain.

Differences between the two include the following: the SSP expands to downstream health and environmental effects, whereas the WSP is confined to the drinking-water supply chain. The SSP considers multiple routes of exposure and exposed groups for microbial and chemical risks, whereas the WSP focuses on ingestion of drinking-water containing microbial and chemical contaminants. The SSP involves diversity in the decision-making process, as opposed to a uniform decision-making process for the WSP. The objectives of the SSP are to reduce exposure and negative health and environmental impacts and to prevent wastewater from contaminating fresh water, whereas the objectives of the WSP are to prevent drinking-water from being contaminated. Also, the implementing agencies for WSPs and SSPs are different.

Risk groups to be considered include users, workers, farmers and community members, and consumers. Exposures are broader than those for drinking-water or recreational water, including ingestion from hands, dermal contact, contact with flies, inhalation of aerosols, contaminated surface water or groundwater, contact with leaking contents and consumption of contaminated produce. Exposure considerations include who is exposed, how many are exposed, where in the sanitation system exposure occurs, by which routes, how frequently and at what dose. One needs to consider the types of organisms to which people are exposed
and the barrier efficiency, including the robustness and variability of system performance. The policy and regulatory frameworks are similar to those of other water quality areas. Many of these considerations are common to both WSPs and SSPs.

An integrated approach could be considered that is simple, locally applicable and flexible, and applicable within the QMRA framework.

3.6.2 Water safety plans (for drinking-water supplies)

Mark Sobsey (USA) explained that WSPs are a comprehensive risk assessment / risk management approach, covering all steps from catchment to consumer and based on the principles of the multiple barrier approach and HACCP. The primary objectives of WSPs include minimizing the contamination of source water, removing contamination through treatment processes and preventing contamination during storage, distribution and handling of drinking-water.

WSPs consist of three components: the system assessment (“know your system”), monitoring (“pay attention to your system”), and management and communication (“have a plan, use it and share it”). In system assessment, a team is assembled, the system documented and described, hazards assessed and risks prioritized. In monitoring, control measures are identified, control measures monitored and the effectiveness of the WSP validated — in other words, it aims to verify that the WSP is working effectively and meets predetermined targets (HBTs). In management and communication, supporting programmes are developed, management procedures prepared for normal and incident conditions, and documentation and communication procedures established with others involved in the delivery of drinking-water, including the consumer.

WSPs provide a rational, practical, holistic basis for sound and effective management for delivering safe drinking-water. They are tailored to the local context, adaptable, proactive, scalable to any drinking-water supply, based on sound science, technology and practice, and embrace the basic principles of HACCP.

3.6.3 Recreational water safety plans and recreational water guidelines

David Kay (United Kingdom) noted that volume one of the recreational water guidelines (on coastal and fresh waters) was published in 2003, and that in 2009, WHO held a revision meeting to examine the implications of recent work. The 2003 guidelines represented a revolution in regulation, incorporating a two-part classification system for beaches: sanitary profiles and microbial standards. The 2009 revision meeting examined the European Union (EU) Epibathe results, epidemiological studies from the USA, the application of QMRA, the Virobathe results, percentile compliance, real-time signage and qPCR for compliance assessment.

In Europe, the EU Bathing Waters Directive of 2006 requires sanitary profiles, but they are not used in the classification of beaches. Prediction and discounting are allowed, but with no limits (which was not the intent of the guidelines), and with no distinction between human and animal refuse.

Emerging issues include culture versus qPCR methods for regulation, real-time prediction practicalities, and sanitary profiles and safety plans.
The sanitary profile has been used in guidelines implementation, Blue Flag applications, informing black box real-time modelling, as input to process-based coastal models and to inform empirical data acquisition projects.

**Key discussion points**
- In developing countries, where there is non-compliance across all sectors, the authorities want to know what the biggest hazard is (e.g. open defecation, wastewater irrigation) and how limited public funds can be spent most cost-effectively. QMRA helps them to calculate DALY losses for each hazard and what it costs to avert a DALY loss, to determine which interventions are most cost-effective.
- Sanitary profiling provides a qualitative tool to enable an assessment of the risk of human contamination at a specific site.
- There is a dichotomy between Europe and the USA, with the USA not finding qPCR to be useful.
- SSPs can be viewed as a basic approach, as tier 1 in a tiered or stepwise approach. You can then add more sophistication at the same or the next level and develop an incremental level of sophistication, from the simplest to an extensive risk approach.
- In resource-poor settings, even the simplest tools, other than checklists, are not accessible. The local authorities are unable to do even the simplest microbial analysis of water. We need to encourage the development of new forms of microbial analysis to make them more accessible in the developing world and speed up ways in which we get reliable results from microbial analysis. (There was no consensus on this issue, as some in the group stated that there are very simple techniques for faecal coliforms and E. coli, such as the most probable number [MPN] technique.)
- Perhaps it is better in some settings to consider water and health rather than water quality and health. It has been shown that it is better to wash hands with wastewater than to not wash them at all.
- Perhaps water safety plans would be more appropriately termed water safety programmes, to ensure a greater focus on their implementation.
- At the country level, it is already a struggle that multiple ministries are responsible for drinking-water alone. Once we start linking into recreational water and wastewater, the ability to reach the right audiences in countries or regions will become an even greater challenge. We need to clearly define the audience for this attempt to harmonize among the three areas.
- Intersectoral collaboration appears to be an exercise that we can only benefit from. This is an opportunity to force the ministries to get their act together.
- The commonality in these three sectors is in sanitary profiling. We could produce a document on how to make sanitary profiles work, which would be an important contribution.
- It would be important to prioritize the areas into which you should put your efforts, selecting the top three or five hazards, be they microbial or chemical.
- It is also important to ensure that the “solution” to a problem doesn’t result in more risk than the initial problem (e.g. switch to microbially contaminated surface water because of concerns about arsenic in groundwater).

3.7 Organizing the role of networks

More information on the networks described below can be found on the WHO web site.
3.7.1 Operations and Maintenance Network

Dai Simizaki (Japan) described the historical background of the Operations and Maintenance (O&M) Network, which is a collaborative effort between the National Institute of Public Health of Japan, the International Water Association (IWA) and WHO. Its purpose is to develop and consolidate the networking of service providers and users in order to exchange experiences, knowledge and information through an open dialogue on the O&M of water supply and sanitation systems and to provide a platform for the collection and dissemination of information on O&M.

Current activities include knowledge development, technical advisory services, workshops and events, and communications. In terms of knowledge development, available O&M tools include tools for assessing the O&M status of water supply and sanitation in developing countries and a best practice training manual on leakage management and control. Many of these tools are now out of date. The O&M toolbox can be found in the upgraded O&M Network web portal. In terms of technical advisory services, the network, for example, provides technical guidance and advice to members in countries in response to specific requests; up to one day of remote advisory support is provided per query on a pro bono basis, and expert advice, including face to face advisory support, is considered on an expense basis only.

Network events in 2010–2011 include a joint workshop on WSPs in Lao People’s Democratic Republic, an O&M Preconference Workshop at the Water Safety Conference in Kuching, Malaysia, an O&M workshop at the Chennai Water Convention, and WSP seminars at Stockholm World Water Week, the IWA World Water Congress, the IWA Utility Leaders Forum and Arab Water Week.

The O&M Network engages with IWA specialist groups in areas such as efficient O&M of urban water systems and O&M of drinking-water treatment plants, as well as with external networks and agencies, such as the Rural Water Supply Network and the United Nations Educational, Scientific and Cultural Organization (UNESCO)–IHE (Institute for Water Education, Delft, the Netherlands).

The network currently has 200–300 members from various regions and with various affiliations, about half of which are consultants and service providers.

3.7.2 Household Water Treatment and Safe Storage Network

Bruce Gordon (WHO) emphasized that the need for household water treatment and safe storage (HWTS) is immense. It dramatically improves microbial water quality, significantly reduces diarrhoea, is among the most effective of water, sanitation and hygiene interventions and can be rapidly deployed and taken up by vulnerable populations. Its limitations are that it does not improve access to water (i.e. it is not the same as a piped-in supply), it places the burden of management on the consumer and it demands a lot from householders in terms of behaviour change, and time and financial investments. Its challenges are that it has not achieved a sustainable public health impact and it is a largely small-scale intervention. However, for many vulnerable populations, HWTS remains the only viable approach available to them, and the challenges are significant but not insurmountable. These vulnerable populations do not only include households without access to improved drinking-water sources as defined by JMP, but also those who have access to a well, pump or borehole
but have to store water at home, those who have piped water that is supplied unreliably and those in situations of emergencies and humanitarian crises. It should be stressed that household water treatment and safe storage is not considered under the MDG target.

The GDWQ suggest a significant improvement in water quality and risk reduction through HWTS. The need for an international network was identified in 2003, and the International Network to Promote Household Water Treatment and Safe Storage was established in response to that recommendation. It is unique in its collaboration with the private sector, although the private sector has no voice in terms of guidelines, regulations and other normative functions. Four working groups cover advocacy, communication, research and implementation.

Events in 2010 included a strategic meeting, the South Asia Regional Conference on HWTS, an executive board meeting, a technical consultation on the guidelines for evaluating HWTS options and an HWTS seminar at Stockholm Water Week. Behind the scenes in 2010, the network was involved in strategy development, creation of a position at the University of North Carolina (UNC) and at WHO (network communications and coordination), WHO/UNICEF discussions on co-hosting arrangements, and WHO/UNICEF and UNC discussions on a communication strategy.

The network’s mission statement is To contribute to a significant reduction in waterborne disease, especially among vulnerable populations, by promoting household water treatment and safe storage as a key component of community-targeted environmental health programmes (which represents a change from “as a key component of water, sanitation and hygiene programmes”).

New strategic objectives include strengthening the evidence base of the public health relevance of HWTS, better results in scaling up of HWTS in countries in all regions of the world, development of national policies and institutional frameworks and better monitoring of programmes.

3.7.3 International Drinking-water Regulators Network

Robert Bos (WHO) explained that the goal of the International Network of Drinking-water Regulators (RegNet) is to improve the protection of public health as it relates to drinking-water through the promotion of regulatory excellence and the ongoing strengthening of regulatory systems. It is run by an outposted secondee at Health Canada (who also runs the small community water supply network).

The objectives of RegNet are to advocate for the improvement of regulations in order to better protect public health as it relates to drinking-water, to support the development of internationally recognized guidance on the use of regulations, to provide support and guidance to regulators wishing to establish, update or amend their regulatory frameworks, and to provide a forum for regulators to share experiences, approaches to addressing specific challenges and good practices.

The platform for the regulators includes interactions through the Internet, a virtual forum for discussion and annual RegNet meetings with specific thematic discussions and review programmes. Confidentiality is emphasized throughout.
The network acts as a conduit for advocacy and action in the regulators’ own countries. There is targeted recruitment of members and key messaging in all activities that focuses on how to use drinking-water regulations to best protect public health.

The network offers support and guidance to regulators by compiling and analysing WSP case-studies to inform WSP implementation by other stakeholders, developing a roadmap on how to implement WSPs into policies and regulations and sharing useful tools that support regulatory activities as they are made available. Including the regulatory perspective in water, sanitation and health activities is becoming increasingly important.

The network plans to publish a folder with a number of issue sheets early in 2011.

3.7.4 Small Community Water Supply (Management) Network

David Cunliffe (Australia) explained that the objectives of the Small Community Water Supply Network are to build an evidence base (on health challenges, cost–benefit analysis for improving management), advocate and collaborate (develop strategies), and develop and/or facilitate access to guidance and tools (e.g. communication and promotion strategies, guidance on management of small supplies, guidance on how to apply WSPs for small community supplies, generic risk assessment tools for small community supplies) for managers of small community water supplies. An estimated 3 billion people rely on a small community water supply.

Achievements of the network include publishing guidance on undertaking social cost–benefit analysis, a manual on how to apply WSPs in small supplies and guidance on how to use communication to protect public health. Examples of risk communication tools have been posted on the web. Work has commenced on a generic WSP software tool.

Selected members of the network last met in Kuching, Malaysia in November 2010. Presentations confirmed that WSPs represent common sense, are easy to understand and apply to small supplies, and that simple and relevant communication is a key part of promoting safe water and household hygiene. Strategies include persistence, consistency and thinking big.

Tasks identified include linking activities of the household and small community networks; developing a clear workplan (including objectives, targets, roles, timelines, identifying deliverables and establishing performance indicators); focusing on implementation and evaluation of tools already developed; revising the virtual forum and improving its user friendliness; undertaking more case-studies; and improving engagement with established organizations with practical experience and knowledge.

3.7.5 Asia-Pacific Water Safety Plan Network

Under Phase 1 of the Australian Agency for International Development (AusAID)–funded WHO Water Quality Partnership for accelerating effective water, sanitation and hygiene management for health with emphasis on the Asian region, capacity building initiatives and piloting of WSPs were initiated between 2005 and 2009 in Bangladesh, Bhutan, Nepal, Lao

People’s Democratic Republic, Viet Nam and the Philippines. In Phase 2 of the partnership, full-scale implementation is under way in Bangladesh, Bhutan, Lao PDR, Nepal, Philippines and Viet Nam. Phase 2 runs from July 2010 until December 2011.

A network is needed to improve water quality and safety throughout the region, as existing networks do not focus on water quality. The network will act as a focal point of information and resources. There is a need for a coordinated effort to accelerate the implementation of WSPs. The existing networks in Asia serve as a good reference for this network, which is currently being set up.

The Asia-Pacific Water Safety Plan Network aims to promote the scaling up of the development and implementation of WSPs among water service providers in the region through advocacy, communications, research and capacity building. It serves as a forum for sharing knowledge, experiences and best practices on WSPs. Its mission statement is To contribute to a significant reduction in the waterborne disease burden in the Asia-Pacific region by promoting water safety plans to achieve reliable, consistent and equitable supplies of safe drinking-water, through information dissemination, knowledge sharing and support for capacity building. Its strategic objectives are advocacy, communication, research and implementation. The network has seven founding organizations, including IWA, Public Utility Board (PUB) Singapore, United Nations Human Settlement Programme (UN-Habitat) and WHO. Participation is open to regional and national water associations, water service providers, environmental and health professionals, policy-makers, regulators, academia, community and consumer groups in the region. A stakeholder survey was completed in September 2010.

Financing will come from the network partners. Mien Ling Chong is the interim Network Coordinator, on secondment to the WHO Regional Office for the Western Pacific from PUB, Singapore.

The way forward includes confirmation of the strategic plan and workplan, a participation drive, web site development (case-studies, tools, resources, experts, events, references), a regional training of trainers programme and advocacy of WSPs in regional events.

**Key discussion points**

- Could some of the small community supply network efforts be applied to urban areas? Urban water utilities often struggle to serve customers who can afford to pay their bills, but it is more difficult to serve the poor, who are not connected to a piped supply, so they pay more per cubic metre. It would be better to connect them to an urban piped supply, which would cost them less.

- Why don’t we have networks on periurban supplies and on wastewater and sanitation? The current networks have emerged in response to specific water issues. If a strategy is developed at this meeting, we may bring in new networks (e.g. a wastewater use network) or look at structures that already exist.

- Networks do not see themselves as “industry groups”; they are responding to a need, and they want to share their experiences.

- Diarrhoeal disease may be the wrong end-point for measuring effects on children.

- If we can show that HWTS interventions can save lives or promote child growth and development or other end-points that get the attention of the medical community, if we could do proper epidemiological studies to get evidence to show that there are
protective effects in terms of disease and fatality, this would bring more attention to what we do.
- There is some epidemiological evidence on diarrhoeal disease reductions in Salvador, Brazil, studied by Sandy Cairncross.
- Regulators in RegNet should be contacted regarding application of the GDWQ.

4. REGIONAL CONCERNS AND REPORT ON JMP TASK FORCE MEETING

4.1 Concerns of the WHO Regional Office for Europe

In a teleconference, Roger Aertgeerts of the WHO Regional Office for Europe was updated on progress at the meeting and asked for his views from the European perspective. In terms of drinking-water quality, the European region needs guidance from on two issues. The first is trace chemicals, such as endocrine disruptors and other emerging chemicals, about which there is public concern and for which there is a need for science-based guidance on which to base policy. The second is a critical note on the current GDWQ, which provides treatment achievability for, for example, arsenic, but does not say how that should be achieved.

With respect to the water quality strategy, the main concern is that there is no clear agreement on the best sampling methodology. WHO needs to help countries develop better methods for sampling.

Robert Bos informed Roger that these issues will be taken up in more detail by the group when his written comments are received. He advised him that this group had concluded work on the fourth edition of the GDWQ, to be launched next year. Once a draft strategy had been developed, it will be circulated to all regional offices for their input. It will need to go through several iterations with experts, the regional offices and others.

Key discussion points
- Governments need to understand more about the issue of trace chemicals in drinking-water.
- People want more guidance on treatment, which should be addressed post-fourth edition.
- There is no detailed guidance on how to establish a good sampling programme. For microbial sampling, there is often wide variation in sampling locations, sampling frequency and treatment of the sample after it is collected. A monograph, a chapter in another document or a special guidance document on setting up a statistically robust sampling programme is needed.
- People may be misreading the treatment achievability tables in the GDWQ, and perhaps more work is needed to clarify them.
- How should the resource allocation between the three areas be harmonized, on a DALY basis or otherwise? A unified approach to harmonization of the three water quality areas even across Europe may be difficult, as countries have their own priorities.

4.2 Water quality monitoring: feedback from a recent JMP Task Force meeting

A JMP task force meeting on monitoring drinking-water quality was held in November 2010 in France. The JMP is the institutionalized mechanism for monitoring progress towards
achieving the MDG drinking-water and sanitation target, by tracking the proportion of the population using improved drinking-water sources and improved sanitation through household surveys and censuses.

The Task Force meeting had a remit focusing on four issues:

Within this overall mandate, the Task Force was asked to address four sets of questions:

1. On rationale, scope and focus
   - For what purpose will JMP as a global monitoring mechanism compile information on drinking-water safety and drinking-water quality? What interests do, in particular low- and middle-income, countries share in the compilation of information on drinking-water safety and drinking-water quality at source or at household level?
   - What are the essential components of drinking-water quality monitoring and surveillance, what is the scope of the terms “drinking-water quality” and “drinking-water safety” in the context of the JMP mandate and what are the boundaries for the measurement of drinking-water quality indicators?

2. On what should be measured
   - What are feasible options for the direct measurement of drinking-water quality parameters that will usefully supplement the JMP datasets on access and use of drinking-water sources? What are the feasible options for assessing drinking-water quality through proxy (process) indicators that go beyond the current improved/unimproved categories (e.g. determining the number and coverage of functional water safety plans)? Would such an approach be compatible with the remit of the JMP?
   - What are the practical considerations for possible inclusion of drinking-water quality testing in MICS or DHS? What are the minimum drinking-water quality parameters that should be measured following a household sample survey approach?

3. On the RADWQ *** experience
   - What are the lessons learned from the RADWQ experience? RADWQ collected drinking-water quality samples at the source and at the point of use, in addition to performing sanitary inspections. Should drinking-water samples be taken at the point of use only, at the source only or at both? Should a sample survey approach include sanitary inspections?
   - Is the package of indicators measured by RADWQ adequate? Can the findings of RADWQ be applied to individual survey data for the RADWQ countries and beyond?
   - Are the costs incurred by a RADWQ type of water quality survey approach proportionate to the value of the information it yields? Is a household sample-based approach cost-effective compared to other options? If not, what options are more cost-effective? If it is more cost-effective, then what should be the frequency of a RADWQ type survey for global monitoring purposes and for country-level monitoring purposes?

4. On methods, procedures and tools

*** RADWQ, the Rapid Assessment of Drinking-Water Quality, was a pilot study carried out in five countries to find out whether, on a nationally representative basis, improved sources of drinking-water did or did not meet the guideline values of the WHO GDWQ.
• What are the optimal sampling techniques for the efficient measurement of drinking-water quality indicators? What are the contextual impediments towards a sampling and surveillance approach in different parts of the world, and how could they be overcome or compensated by statistical methods? Is there a role for data-sharing and management tools? Can the results of a limited number of nationally representative water quality surveys be used to extrapolate water quality information for a larger cluster of comparable countries?

• Can the results of routine surveillance and monitoring by national regulatory bodies be adopted and consolidated into global and regional data? What level of harmonization can be achieved between these national processes? Alternatively, can monitoring and surveillance methods applied by national regulatory bodies be adopted and integrated into the JMP monitoring activities and how can experience and lessons learned be incorporated? What are the constraints and what are the opportunities? Is there a role for the WSP quality assurance tool?

• What is the profile of the ideal tool for direct measurement of drinking-water quality? What are the new low cost rapid assessment tools currently under investigation and development? What criteria should they meet to be useful with respect to the JMP objectives?

New sampling methods for *E. coli* were reviewed, including variations on enzymatic tests (cheaper, more robust, specific, selective, broader range of acceptable temperatures), presence/absence or quantitative tests and on-site analysis (to reduce sample deterioration). Are these methods validated for drinking-water?

A roadmap towards globally useful surveillance was illustrated using an inverted pyramid, moving upwards from 0 to improved/unimproved to total coliform (TC)/total thermotolerant coliform (TTC) to *E. coli* to specific chemicals nationally adjusted to RADWQ set to robust independent surveillance of national HBTs. A similar inverted pyramid reflects a roadmap towards providing safe water, moving upwards from 0 to operator training to sanitary inspections to operator certification to management and regulation of urban operations to robust water quality management to providing water meeting national HBTs all year round. The two roadmaps are linked through WSPs.

The recommendations emerging from this meeting were as follows:

• As the principal global monitoring mechanism on drinking-water, the scope of JMP reporting must include all necessary pieces of information about access to water and, in the context of water quality, not only report on a single pass/fail indicator that is designed to monitor a time-bound, temporary policy. WHO and UNICEF should foresee that ’second generation’ indicators will be
developed for all aspects of the Human Right to Water and Sanitation including accessibility, availability and affordability, with compatibility at the global, regional and national levels.

- The location of water sampling for global water quality monitoring should be consistent; a location within the household provides the best estimate of actual exposure to pathogens through drinking-water, bearing in mind the transition of responsibilities and accountability shift from the provider to the user at the point of delivery/collection.

- Surveys should give priority to sampling at the household level, supplemented by samples from the point of collection, using standard protocols regarding the methodology for identifying and collecting household water samples.

- The RADWQ experience should be analyzed and disseminated and further RADWQ surveys should be conducted, in a small number of strategically selected countries.

- RADWQ 2.0 efforts should be linked with national sector initiatives for improving water quality, with the development of a Water Safety Plan framework as a key country selection criterion. National capacity development should be made explicit in future surveys, surveys should collect geo-referenced data for all water sources (unimproved and improved), target households to the same extent as sources with attention for ethical issues and should have a clear economic component.

- New water quality tests should be properly validated prior to widespread application; criteria and a matrix for selection of microbial testing technologies should be developed.

- New modalities of data collection should be explored allowing the incorporation of water quality measurements into the JMP. New systems should be tested for post-2015 deployment. Experience should be gained regarding how data collected through different modalities can be aggregated and compared consistently.

- The options and opportunities to use regulatory data for global monitoring purposes should be explored, including the development of criteria for the acceptance of regulatory data. A sub-group was established to follow up on this.

- The JMP should develop descriptions of the advantages and limitations inherent to each of the three data collection modalities identified, and endeavor to develop guidance on the conditions under which different data collection modalities might be more appropriate.

Key discussion points
- The $H_2S$ test is not included in the inverted pyramid for globally useful surveillance because it is not active enough to be useful in global monitoring. Although the level of agreement between E. coli and $H_2S$ test results is good, $H_2S$ is routinely being applied as a presence/absence test, which is unfortunate.

- Next steps for JMP include testing some of the tools with surveys and writing up a protocol for a further series of RADWQ (the approach consists of household visits and combines sanitary surveys with water quality testing). We could initiate the process of looking at the information RegNet has available, which could feed into JMP. A broad discussion on developing indicators for post-2015 linked to determinants in the protocol for human rights is foreseen for 2011.

- Immediate next steps in terms of water quality monitoring (post-2015) include trying to get a simple E. coli test integrated into the DHS or MICS, trying to get rapid assessment protocols in some countries and analysis of regulatory information.
- Is there any effort to mine data on water quality in the household system or through the distribution system? Is there an attempt to find out what countries have those data available in a public forum? Should measurements be done at the source or at the household level? Household surveys are already being done, and JMP already uses regulatory data for European countries.
- WHO should have a position on non-intentional use of wastewater.
- The first inverted pyramid should appear in a future overarching document, illustrating the tiered approach. It is not in the guidelines at the moment, but perhaps it should be. The official report of the JMP task force meeting will contain both of these pyramids and roadmaps. It will be circulated to this group so that they can debate as to whether it is adequate and appropriate. It could be put on the web site; there is no need to wait until the fifth edition of the GDWQ.

5. A ROADMAP TOWARDS A WATER QUALITY AND HEALTH STRATEGY AND ITS DELIVERABLES

5.1 A strategy outline, the position of the water quality and health strategy in the broader WSH framework

There are three WHO water quality–related guidelines, with three associated approaches to safety planning. There is the supportive infrastructure of an expert group, particularly for drinking-water, and there are a number of issue-specific networks, plus the WHO collaborating centres.

The commonalities among the three sets of guidelines were presented earlier. The consensus is that there is enough common ground for a harmonized approach, that harmonization and integration are desirable, that global complexity should be overcome by simplification in local contexts and that the scope should include a wastewater component to bring environmental sanitation into the equation. Challenges noted included water quality in the face of climate change, diverse target audiences, feedback mechanisms and the complexity of QMRA.

Discussions confirmed the value of bringing experts from the three areas together. Cross-cutting issues include the following:

- HBTs: adhering to the approach of incremental improvement and multiple barriers; the DALY metric as a basic element; the need to include other infections, such as Legionella
- Risk assessment: the value of sanitary surveys as a common starting point; the need to better explain QMRA; reference and surrogate organisms in the local context
- Risk management: providing guidance to decision-makers operating under basic circumstances in terms of priority setting; recognizing institutional differences; introducing a behaviour change component into the risk management package; perception issues tackled through independent evaluations; messaging and communication are critical; think outside the water box; provide instruments to differentiate priorities by the local reality

There is a need to integrate WSPs and SSPs using lessons learnt from recreational water safety planning.
We need a vision and mission for water and health in WHO, including leadership, normative work, evidence, support of Member States, and responses to emergencies. This may be an acceptable starting point for discussions on the strategy. A roadmap on how to proceed to complete the strategy formulation process needs to be developed before the World Health Assembly in May 2011.

5.2 Setting strategic objectives for water quality and health

Suggestions for strategic objectives, structure and formulation were provided to meeting participants as a starting point for discussions. After much deliberation, a final strategy outline was agreed upon; it is presented in Annexes 3 and 4. The ultimate aim of the exercise is a 15-page strategy document with a focus on water quality and health.

Key discussion points

- A logic map or more holistic framework for all water groups is needed as an overriding front end of the strategy; the Stockholm Framework should be revisited.
- The safe use of wastewater as a drinking-water source should be included. Municipal irrigation could also be added.
- There should be a discussion of water cycles to integrate the whole thing. The managed water cycle, which includes sanitation, needs to be clear, as it is not well understood globally. The sanitation decision point must be emphasized.
- Volume 2 of the recreational water guidelines, on swimming pools, does fit in to this strategy, as the risk management approach can be applied, and the biggest risk is people with diarrhoea.
- Some basic principles of management approaches as well as the Stockholm Framework and sanitary surveys etc. could be included.
- The concept of the disposal of used water needs to be included. There are two new concepts: dispersing or reintegrating water into the water cycle, instead of disposal.
- We need to contextualize the guidance we are giving. There are two different overarching concepts: the managed water cycle (including other impacts on water quality and quantity in particular settings) and the contribution to the disease burden of different pathways of exposure to water (in the context of the overall burden of disease).
- Water resources management (water balance, zero footprint) needs to be emphasized up front.
- We need to talk about whether water (e.g. rainwater and greywater use in homes) is fit for purpose.
- Voluntary versus involuntary actions (e.g. recreational water versus drinking-water) need to be taken into account in describing burden of disease.
- It is important to make linkages with other areas, such as food safety, but perhaps only by way of a link to the work of the Food and Agriculture Organization of the United Nations (FAO) (e.g. water quality in agriculture). The danger is that we could move from an introductory background to a mega textbook. WHO’s role is the promotion of human health, and we need to concentrate on that. We can link to other agencies by pointing the reader to an appropriate web page or report.
- We need to recognize the link between foodborne and waterborne illness (e.g. eating contaminated lettuce).
- The concept of an overarching document that sits above specific guidelines and puts them into a common context is a good idea. A good starting point is the Stockholm Framework and HBTs.
- It would be useful to include the International Protocol on Water and Health as a reference within the strategy. It is a legally binding document that brings together water disease surveillance with the different areas discussed here.
- It is important to include water quantity issues. Water reuse is largely a quantity issue as well as reflecting the desire to make better use of nutrients and reduce discharges into water bodies.
- The introduction needs to mention the sustainability paradigm and the “three legs of the sustainability stool”: economics, human health and environmental services.
- QMRA is a tool to help you determine what level of risk reduction you need so that you get your water fit for purpose at the least cost while still meeting your health targets.
- There should be more emphasis on the multiple barrier principle and on source protection, rather than treatment. Distribution systems and what the consumer does with the water also need to be considered.
- Agriculturists in the USA do not seem to appreciate the impact of animal agriculture on water quality.
- Vulnerable populations need to be considered, as they both contribute different pathogens and are more susceptible to different pathogens.
- Other issues of concern noted were pesticides and antibiotic resistance genes.

5.3 Management structure and resource mobilization strategy for the strategy

There are three expert groups, one permanent (drinking-water) and two temporary (recreational water and wastewater). There is little overlap between the three groups in terms of membership. Both temporary groups have been working on updates, but there is no formal mechanism for this. Networks are formally linked to the drinking-water group only. The WHO Secretariat and the collaborating centres can be placed at the top of the management structure. There are temporary task forces that cut across the three groups, such as the QMRA and pharmaceutical task forces. There are also links between the three groups and other agencies, such as FAO and the United Nations Environment Programme (UNEP) for the wastewater group.

The question is, how can this be reshaped to create an overarching management structure? After much discussion, it was agreed that the three areas could be linked as in a Venn diagram under a coordinating body umbrella. The coordinating group, a steering committee or expert group with representation from all three groups as well as stakeholders, could identify gaps, make assignments, etc. The overlapping areas could represent task forces on issues relevant to all three areas or tools common to the three areas (e.g. sanitary surveys, WSP tools). On some issues, the work of the three areas would remain separate.
The following need to be further discussed:
- the advantages and risks of networks and how the networks link with the groups
- the operational part, promoting the safety planning approach
- periodic updates.

**Key discussion points:**

- **The drinking-water expert group and the networks have a life of their own and will continue, but will not necessarily consider the implications of what they do on recreational water and wastewater. To control the “monster”, we need to have something above all three to ensure that each guidelines group adheres to the strategies discussed.**
- **We don’t want to maintain three separate silos; it is preferable to foster interactions. We could have one “water” entity with task forces on specific issues where necessary (this would reduce the level of bureaucracy).**
- **The GDWQ is a flagship publication with a huge bureaucracy. Do we want to keep putting out guidelines? We need to discuss products as well as strategies. Perhaps we want to aim for slimmer documents on the web site.**
- **We need to identify key content common over the different areas, then start to package it in modular format.**
- **The networks now function as a knowledge base, and there is a risk that they will become a lobby group.**
- **A large meeting with all three groups could be held to discuss products that are of interest to all three and to sort out who does what, and smaller groups could still look at specific issues.**
- **We could use a matrix format, where the different areas work together when appropriate on issues of mutual interest:**

<table>
<thead>
<tr>
<th></th>
<th>Task force 1</th>
<th>Task force 2</th>
<th>Task force 3</th>
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<tbody>
<tr>
<td>Drinking-water</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Wastewater</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Recreational water</td>
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</table>

- **We should be leading the charge on a suite of tools—sanitary survey tools, WSP tools, risk assessment tools, core elements that need to be addressed. We could base the structure around delivering those sorts of products.**
- We need continuity to allow evolution. At the moment, there are no expert groups for two of the three areas, so there is no continuity.
- The link into how we manage inputs of contaminants into water is missing. We don’t talk about sewage treatment, but a big intervention is recognition that improving sewage treatment will help reduce inputs of pathogens and chemicals into water sources.
- We need input from WHO on what tools are needed by user groups.
- We need to make sure that we don’t leave countries behind (e.g. publishing the Third Edition of the GDWQ when some countries had just finished implementing the Second Edition).
- We need outreach, as some people are not aware of what we do here.
- The core group would need to determine what stakeholders are looking for.
- A Stockholm Framework coordination group is effectively what we need. We could produce tools and guidance on HBTs or QMRA, for example, among the various guideline groups. The matrix with task forces could be suggested by the coordinating group or the groups under it. It would make the life of each group easier, knowing that their work was compatible with what the other groups are doing.

5.4 Presentation of the roadmap for the completion of strategy formulation

Robert Bos provided an overview of comments made by meeting participants during the discussion on the strategy and added a few of his own:

- there should be more of a focus on products; guidelines are good products, and the process of getting to the guidelines provides the underlying support.
- driving forces, including climate change and water scarcity, need to be transparently reflected in the context of these products.
- in terms of implementation, we need to convince countries to take on board WSPs, and other safety planning procedures.
- in terms of application, we need to find a way to make guidelines more accessible, perhaps using a modular approach instead of a full volume of guidelines.
- socioeconomic development, epidemiological settings, etc. need to be kept in mind.
- sanitation plays a central, pivotal role in this issue.
- producing the strategy is an iterative process.
- there should be an evaluation component, in which it is evaluated whether targets set have been met.
- we are not adding layers of bureaucracy in terms of a top-heavy steering committee.
- the strategy is for people who want to invest in the programme; we need to be able to show that we have a plan, and we need a very light level of bureaucracy.
- we need to get better feedback from countries with respect to their needs.
- we need a group of experts involved in the implementation part as well as writing guidelines (this will get immediate feedback).
- WHO regional offices are overstretched in reality and do not have the capacity to deal with this in detail.
- we need better means of sending messages out to constituencies, such as development corporations.

The minutes of this meeting will be written up and circulated for review. The first full draft of the strategy will be written up by February. The draft will be sent around for review.
comments will be integrated into the next version, and a final draft will be prepared in time for the World Health Assembly meeting in May 2011.

A resource mobilization strategy will be developed in parallel with finalization of the strategy. Environment and health authorities may be tapped on for this strategy. Although UN-Water is trying to mobilize resources, some donors prefer to give money directly to WHO.

By the middle of next year, the strategy will be ready, and it will then be linked to a more detailed workplan. Perhaps the strategy will be ready to formally review in Singapore in July 2011. Work on the other two guidelines needs to be stepped up. Duncan Mara’s paper may be the first step towards periodic updates of the wastewater guidelines. The 2009 meeting updated the recreational water guidelines, and the material has appeared on the WHO website. There is a need to hear from experts whether there’s a need for further updates.

These issues will be brought to the attention of the executive board and representatives of the World Health Assembly.

Key final comments:
- Short application guidance documents are needed. Developing countries need guidance on implementation. It was noted that a 10-page document on implementation was turned into a 120-page monster by WHO.
- If we have three groups only, we might miss sanitation and other issues. The new group should have good guidance on integrated water management.
- It is good to take a systems approach to managing the water cycle.
- A political steering committee would not be useful.
- We need to get WHO collaborating centres into the picture. It would be helpful to get messages to health ministries that we need resources and support. Developmental aid ministries could be approached.
- Communication with decision-makers is important.
- We need user-friendly documents for developing countries.
- Looking to the future, on the strategy side, we need to consider things like water scarcity, maintaining service delivery, better incorporation of economics, better use of resources and resource recovery, and using a transdisciplinary approach.

6. CLOSING OF THE MEETING

Robert Bos thanked the Chairs and rapporteur, the meeting hosts for their hospitality and facilities, including the Ministry of Health, Labour and Welfare, the National Institute of Public Health and the Japan Water Works Association, as well as the group’s financial supporters: USEPA, AusAID, Health Canada, the United Kingdom Drinking Water Inspectorate and the Government of Singapore. He also thanked all participants for their contributions.

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

Tokyo 8–10 December 2010

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ANNEX 2: Strategy session agenda

World Health Organization Consultation on the
Development of a Strategy on Water Quality and Health,
8–10 December 2010

Organized in coordination with the Ministry of Health, Labour and Welfare,
and the National Institute of Public Health, Japan

Venue: 8 December 2010 Mita Kaigisho Hall
9 and 10 December 2010 Japan Water Works Association

Objectives of the meeting

Explore options to strengthen the WHO work in water quality by

(1) the formulation of an integrated water quality and health strategy

(2) the establishment of an Expert Group bringing together experts in drinking-water quality, safe use of wastewater and management of recreational water safety

(3) the establishment, within the Expert Group, of working groups and task forces to address specific technical issues

(4) better integrating the networks hosted by the WHO into water quality work

Co-chairs: David Cunliffe and Duncan Mara
Rapporteur: Marla Sheffer

Proposed agenda and tentative programme of work

Proposed agenda

1. Opening of the meeting
2. Opportunities for integrating the normative water quality functions
3. The Japanese experiences and initiatives on water quality
4. Putting the guidelines into operation in an integrated approach
5. Optimizing the role of networks
6. A roadmap towards a water quality and health strategy and its deliverables
7. Closure of the meeting
Tentative programme of work

**Wednesday 9 December 2010, afternoon session**

**1330** **Agenda item 1**  
Opening of the meeting

- **Welcome**
  
  *Mr. Kimio Matsumoto, Chief, MHLW*
  
  *Robert Bos, WHO*

- **Round of Introductions**
  
  *Robert Bos, WHO*

- **Objectives, Adoption of Proposed Agenda and Programme of Work, and Election of Officers**
  
  *Robert Bos, WHO*

**14:00** **Agenda item 2**  
Opportunities for integrating the normative water quality functions

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<thead>
<tr>
<th>Review of the WHO Guidelines for Recreational Quality</th>
<th>Web pages with Guidelines update</th>
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<td><em>Lorna Fewtrell, Aberystwyth University, United Kingdom</em></td>
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<tr>
<th>Review of the WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater</th>
<th>Information Kit 2 of the Guidelines for the Safe Use of Wastewater, Excreta and Greywater in Agriculture and Aquaculture</th>
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<td><em>Blanca Jimenez, Universidad Nacional Autónoma de México, México</em></td>
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<th>Review of the WHO Guidelines for Drinking-water Quality</th>
<th>World Water Day 2010 Information kit</th>
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<td><em>Ingrid Chorus, Federal Environment Agency (UBA)</em></td>
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<tr>
<th>Q&amp;A, clarifications, first round of discussions about commonalities, differences and gaps.</th>
<th>Guidance document for the discussion</th>
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<td><em>moderated by the co-chairs</em></td>
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**15:00** **Refreshments**
15:30  Agenda item 3  
Japan: experiences and initiatives on water quality  

Co-moderated by Professor Yasumoto Magara and Robert Bos  

Strategy for Managing Water Safety in Water Cycle  
Prof Magara, Hokkaido University  

New Strategy for Protecting Water Environment  
Mr Seki, Director General for Water Environment, Ministry of the Environment  

Waste Water Control and Water Reuse  
Dr Ogoshi, Chief, Water Quality Control Department, Wastewater and Sludge Management Division, National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport  

Managing Microbial Contamination – Monitoring and Source Control  
Dr Katayama, Associate Professor, University of Tokyo  

Contribution to World Water Issues and Domestic Water Issues, Water Security Council of Japan  
Mr Inoue, Director, Japan Water Forum  

Q&A session, Summary  

17:30  end of the afternoon session  
Evening Dinner at Reception Hall (1st floor)  

Thursday 9 December 2010, morning session  

08:30  Brief recapitulation of the previous afternoon’s session  

08:45  Agenda item 2  
Opportunities for integrating the normative water quality functions (continued)  

Further round of discussions about commonalities, differences and gaps; what are the opportunities and constraints; policy and management requirements for integration.  

Guidance document for the discussion  

Moderated by the co-chairs  

Cross-cutting issues  

Health-based targets  

Duncan Mara, University of Leeds, United Kingdom  

Information Kit 2 of the Guidelines for the Safe Use of Wastewater, Excreta and Greywater in Agriculture and Aquaculture
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<tr>
<th>Time</th>
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<th>Details</th>
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<tr>
<td>10:30</td>
<td>Refreshments</td>
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<td>11:00</td>
<td>Agenda item 2</td>
<td>Opportunities for integrating the normative water quality functions (continued)</td>
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<td>Health risk management</td>
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<td><strong>Nicholas Ashbolt, USEPA, USA</strong></td>
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<td><strong>John Fawell, independent Consultant, United Kingdom</strong></td>
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<td><strong>Pay Drechsel, IWMI, Sri Lanka</strong></td>
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<td>The USEPA perspective on integrating water quality issues</td>
<td><strong>Ed Ohanian, USEPA, USA</strong></td>
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<td>Final round of discussions about commonalities, differences and gaps; what are the opportunities and constraints; policy and management requirements for integration.</td>
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<td>12:30</td>
<td>Lunch</td>
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**Thursday 9 December 2010, afternoon session**

| 13:30  | Agenda item 4           | Putting the guidelines into operation in an integrated approach         |
|        | The concept of Sanitation Safety Plans | **Thor-Axel Stenström, IIDC and SEI, Sweden,** |
|        | Information Kit 2 of the Guidelines for the Safe Use of Wastewater, Excreta and Greywater in Agriculture and Aquaculture |
|        | Water Safety Plans      | **Mark Sobsey, University of North Carolina, USA**                      |
|        | Recreational Water Safety Plans and Recreational Water Guidelines | **David Kay, Aberystwyth University, United Kingdom**                   |
|        | Q&A, clarifications and discussions: institutional issues, global regional and country approaches, partnerships, linking goals to targets | **Guidance document for the discussion**                                |
|        | **Moderated by the co-chairs**                                    |                                                                         |
15:00 Refreshments

15:30 Agenda item 5
Optimizing the role of networks

Operations and Maintenance Network

Dai Simazaki, National Institute of Public Health, Japan
Tom Williams, IWA, the Netherlands

Household Water Treatment and Safe Storage Network

Bruce Gordon, WHO, Switzerland

Regulators Network

Robert Bos, WHO, Switzerland

Small Community Water Supply Network

David Cunliffe, Australia

Asia Pacific WSP Network

Mien Ling Chong, WHO, Philippines

Q&A, clarifications and discussions: mechanisms to optimize the role of the networks in evidence generation, awareness creation, the implementation of a communications strategy and capacity building

Moderated by the co-chairs

Water quality monitoring: feedback from a recent JMP Task Force meeting

Robert Bos, WHO, Switzerland

Guidance document for the discussion

PowerPoint handouts

17:30 end of the afternoon session

Friday 10 December 2010, morning session

09:00 Brief recapitulation of the previous day’s sessions

09:15 Agenda item 8
A roadmap towards a water quality and health strategy and its deliverables
A strategy outline, the position of the water quality and health strategy in the broader WSH framework

Robert Bos, WHO, Switzerland

Draft strategy outline; other WSH strategy documents; EB127 paper

Plenary discussion: setting strategic objectives for water quality and health

Moderated by the co-chairs

10:30 Refreshments

11:00 Agenda item 8
A roadmap towards a water quality and health strategy and its deliverables
(continued)

Activities and outputs under the strategic objectives, with a timeline

Group work

12:30 Lunch

13:30 Agenda item 8
A roadmap towards a water quality and health strategy and its deliverables
(continued)

Reporting back from the groups and discussion

Moderated by the co-chairs

Management structure and resource mobilization strategy for the strategy

Moderated by the co-chairs

15:00 Refreshments

15:30 Agenda item 8
A roadmap towards a water quality and health strategy and its deliverables
(continued)

Presentation of the roadmap for the completion of strategy formulation

Robert Bos, WHO, Switzerland

16:30 Agenda item 9
Closure of the meeting
ANNEX 3: Guiding principles and objectives of the strategy

Rationale/Guiding principles: [to be revised and drafted as a narrative]

- As a point of departure, the strategy considers all routes of exposure relevant to water-related disease.
- A fundamental driver of waterborne disease risk is exposure to excreta; thus, hygiene and sanitation interventions are critical.
- Interlinkages of the water cycle
- Use of common conceptual framework, the “Stockholm Framework” (while this was originally developed to address excreta in water, it is understood to include microbial, chemical and radiological hazards)
- Takes into account cost-effectiveness and sustainability

Target audience:

- Decision-makers and their technical advisers in WHO Member States from all relevant ministries concerned with water and public health
- UN-Water and other relevant international organizations
- Donor community
- Practitioners and nongovernmental organizations

Objectives and associated functions:

1. Guidelines and effective practice
To ensure the fulfilment and evolution of WHO’s global normative role, in all its essential functions, to support Member States to:

- Improve public health through provision and dissemination of water quality management guidelines
- Apply and adapt the Stockholm Framework and guidelines to local circumstances
- Maintain and further develop good practice and implement effective regulatory frameworks

2. Adequacy and quality of evidence base
To improve the adequacy and quality of the evidence base to support development of national policy and legal frameworks, institutional arrangements and effective practice for safe and sustainable water systems through:

- Sustained application of integrated risk assessment, management and communication approaches;
- Adaptation of the evidence base to inform decision-making in different settings and context;
- Effective knowledge transfer and management.

3. Capacity building
To assist Member States to build the following water management–related capacities to protect and promote public health:

- Optimizing national policy frameworks and institutional arrangements
- Strengthening financial and human resource bases
- Performing all critical public health–associated water quality functions with maximum efficiency and cost-effectiveness
- Promoting capacity for effective surveillance of locally relevant water-related disease
4. Implementation and partnerships
To assist Member States in implementing actions to:
- develop partnerships with all stakeholders impacting on water quality and health
- apply evidence-based guidelines and good practice
- select and prioritize interventions
- promote tools and processes to verify the effectiveness of selected interventions
- foster intersectoral collaborative actions at international, national and local levels
ANNEX 4: Draft strategy outline

Executive summary

Background

Ongoing activities on:
Drinking-water quality
Safe use of wastewater, excreta and greywater in agriculture and aquaculture
Safe recreational waters
(normative and operational work and outputs)

Burden of waterborne and water-associated diseases
Microbial etiology
Chemical etiology

Economic impacts

International policy framework: MDGs, the Hashimoto Action Plan II, Human Right to Water and Sanitation

Rationale

Burden of disease

Water safety and water security

The economics of water interventions

Upstream approaches versus after-the-fact repair

The strategy

Vision and mission

Strategic objectives

Strategic outcomes

Implementation management

Strategic objective 1 (normative)

Strategic objective 2 (evidence base)
Strategic objective 3 (capacity building)

Strategic objective 4 (partnerships)

**Budget**

**WHO support structure**

Overview of staff requirements at HQ and Regional Office level