

HEALTH RISKS IN ENCLOSED RECREATIONAL WATER ENVIRONMENTS
Summary of the proceedings of the International Conference on Health and Water Quality
Aspects of the Man-made Recreational Water Environment

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The use of pools and spas represents a recreational use of the water environment that is increasingly relevant. Beyond the traditionally monitored events and effects, it has been recognised that the operation of such an environment involves at an ever growing rate new technical approaches, new attractions, new materials and new chemicals to treat the water, all currently not subject to any form of unified regulation.

This is clearly an area where the freedom of the market and the protection of the health and well-being of the consumers need a sound balance. But on the other hand this balance cannot be solely relied upon the traditional control forces, namely those of the demand and offer without the danger of harmful health consequences.

An international assembly overviewing different aspects of the health risks of the pool and spa environment is particularly justified as these issues are only treated disjointedly, on national or even lower level, and neither the European Union nor any major international organisation except for WHO ever tried to reach at a harmonised approach of their treatment.

That's why the Working Group on Water and Health adopted the organisation of a conference dealing with these issues to its programme of work. The International Conference on Health and Water Quality Aspects of the Man-made Recreational Water Environment, as it was named, was held on the 10-11th March 2005 in Budapest.

This conference offered an opportunity to get a closer look on the risks and the ways of their management for the stakeholders and professionals engaged with this environment and invited balanced opinions on the means to achieve progress on this field in national and international settings.

The Conference, attended by approximately 100 participants from sixteen countries, aimed at filling the above-mentioned gaps by laying down the basis for the development of evidence-based guidelines that can be the reference for new and improved regulations. Issues addressed were organised in separate sections and included:

- (a) standards, guidelines and regulations;
- (b) water treatment and distribution;
- (c) microbiological risks, in particular legionella;
- (d) chemical risks in water and air;
- (e) monitoring and assessment; and
- (f) "natural" pools.

The Conference was organized by the Hungarian National Institute for Environmental Health, with the support of the Hungarian Government and of WHO.

Microbiological risks are known to be a central issue for both the supervisory authorities and the pool and spa industry. It was also reflected in this conference as the issues of microbiological water quality requirements and their fulfilment appeared in several presentations over all sections throughout the conference. Papers from Austria, Germany, Greece, Hungary, Portugal, Romania and Slovakia were all at least partly devoting to the methods and/or results of the microbiological assessment of pool waters. There is a considerable difference between the countries in the indicators and additional microbiological parameters used and in the limit values they observe, although a core set of them seems to be rather universally used. These parameters seem to be “inherited” from the past practice of drinking water bacteriology and applied as a safeguard of the effective disinfection but others are aimed at addressing the most sensitive areas of water treatment in a recirculated pool setting. No attempt has been made to assign one or several parameters as universally applicable or best fitting to this environment. However, it would be very beneficial to have sound experience, based on comparative studies on both the health relevance and the usefulness of the microbiological parameters either for regulatory use in compliance monitoring, for the operators’ check-up or both. Also, it would be high time to explore the perspectives in applying easy-to-use poolside bacteriological kits. This latter proposal is also applicable to a number of chemical tests and is justified by the proposed ability of the operator to flexibly adopt in due time any evidence based modifications of the operation practice.

The most prominent issue of the microbiological session was the Legionella. It is one of the emergent pathogens and is associated with the technical developments brought about by the chase of the satisfaction of the public in new pool and spa complexes like theme parks throughout the industrialised world. First of all the forceful circulation and aeration of the warm water, as it happens in whirlpool spas and similar facilities is favourable to the selective growth of this bacterium, and also favours the exposure of the pool users with it. The presentation of a British group has shown the ignorance, bad operation and neglect to be the main cause of the high prevalence of the Legionella growth in whirlpools and recognised the whirlpool use as the third most important cause of legionellosis in the UK. The risk of Legionella infection has also been shown to accompany the use of thermal waters in the Czech Republic. It is particularly dangerous as this type of water is frequently used for the treatment of people with more or less compromised immune systems rendering them especially susceptible to infections. As no quick remedy to the problem could be found, several spa hotels limited the admission of persons judged to be susceptible on the basis of the anamnesis.

It is therefore rather timely to keep a closer look on the issues related to the risks of legionellosis in pool and spa environment and also to the experiences of the different countries with the management of this risk. In this very issue there is an international body under the patronage of the European Union that has some overview and even power and possibly it would be a good idea to contact them. It is the European Working Group on Legionella Infection, that handles an EU reporting system on travel associated legionellosis.

Another not frequently enumerated but possibly serious source of risk can be the growth of the so-called pathogenic free-living amoebae in the pool and spa environment. Although these organisms are ubiquitous in the nature, the infection is fortunately very rare but on the other hand extremely serious even frequently lethal. That’s why it is highly advisable to consider the practical guidance on the management elaborated by the Slovakian experts.

A separate session was devoted to a new development in responding the pursuance of nature-friendly ways of recreation, namely the so-called Kleinbadeteiche. I apostrophed it in German as this object is only known – as far as I know – in German speaking countries. This is in fact a small artificial pond that is explicitly used for bathing with noteworthy characteristics like being insolated

from the groundwater body and running without any chemical addition and disinfection except for some natural processes like plant and possibly gravel filtration in an ecological way. In response to its growing popularity, the German authorities and expert bodies constructed specific regulations for this object with admitting that the traditional approach cannot be pursued primarily as regards the limit values for the indicator microorganisms. Even so, there are frequently serious problems with the bacteriological quality of the water and the authorities face the choice of either further loosening the requirements or posing serious limitations on them. The delicacy of the issue is hidden in the fact that unlike in normal natural bathing sites, the source of the indicators – and in close dependence of the enteric epidemiology of the population, i.e. the prevalence of diseases spreading via ingestion, - is exclusively the bathers themselves, like in a typical pool setting. On the other hand the strict requirements applied for pool water is impossible to comply with. Anyway, a case was also presented, where the Bavarian health authority could not help of closing a facility of this type as the levels of microorganisms of concern exceeded the edge of their tolerance. This was however not the typical case but an example of extreme ignorance, so the procedure seems to be fully justified.

The water treatment and disinfection that was the subject of a separate session is of first order microbiological safety relevance. It looks like emergent pathogens prefer the pool and spa environment as the presentation of one of the two American speakers analysed the chlorine inactivation curves of Cryptosporidia, known to be another frequent challenge to the health of the bathers. The paper showed not only the fact that chlorine is practically useless against the crypto, but also called the attention to the necessity of care with the use of the popular chlorine stabilisators as these tend to further compromise the efficiency of chlorine in case of neglect. Thermal waters present another challenge to the safe disinfection in countries like Austria – but to tell the truth even more in Hungary due to their generally high pH, buffer capacity and the frequently high organic content. This seems to seriously compromise the trust in chlorine based disinfection, and endorse the search for alternative disinfectants. Unfortunately this issue did not receive attention at this very conference, but it is still felt to be actual and worth of investigating. Unfortunately the regulations in the most influential countries on the field of pool and spa development seem to be rather inflexible or at least meticulous that may be justified on one hand by the precautionary principle but can well hinder the progress and applications among differing conditions. This is an issue that the Working Group may wish to promote in a distinguished way.

Several particulars of advanced treatment processes including their feasibility were discussed by excellent German colleagues. Their papers suggested that procedures like ultrafiltration, possibly combined with reverse osmosis are facing a career also on this field. Treatment and disinfection does not only resolve but create problems as we all know also depending on the awareness devoted to avoid them. Activated carbon is a prominent means of getting rid of the byproducts of the disinfection but can also be one of the locations where they are formed. One of the presentations was specially dedicated to the behaviour of activated carbon filters and the dangers possibly accompanying its use. It is not only the failure of removing DBPs but problems like growth of dangerous bacteria like Legionella and Pseudomonas aeruginosa may result of the lack of careful maintenance.

Trihalomethanes were the subject of two consecutive papers that produced some important practical conclusions as the role of some popular cleaning agents, like citric acid as important precursors of the THM formation. It was also clearly shown, among others via heroic self-exposing experiments that the predominant way of THM uptake is the inhalation.

As chlorination by-products are rather volatile this issue is increasingly treated from the viewpoint of air quality. In addition to its prominent role of the unpleasant odour and irritation in covered pools, nitrogen trichloride, one of the common chlorination by-products received lately great attention because of its chronic toxicity and epidemiological studies seem to have proven its role in

the pathogenesis of chronic respiratory diseases like asthma. This particular substance is behaving rather autonomously because of its extreme volatility and this is marked by a peculiar unpredictability of the airborne concentrations from the chloramine content of a pool as demonstrated by one of the excellent German speakers. He also called the attention to a series of relevant facts that call for preventive management measures like those to enhance the bathers awareness to hygiene, the provision of a minimum proportion of fresh air to the atmosphere of any building housing pools and a diversity of water treatment options, like ozone and UV. After a series of monitoring, experimental toxicologic and epidemiologic studies, French experts introduced for the first time a limit value for the NC_3 content of the air in the swimming pool. They elaborated an innovative approach to handle this issue by stripping the pool water through a by-pass, and demonstrated the effectiveness of it in a pilot setting.

Disinfection by-products are known to be a broad group of substances also comprising several mutagenic and carcinogenic ones. A presentation of theoretical significance shed the light on different mechanisms of action possibly evoking cancer with a clear relevance for the practical settings in pool and spa environment. The essence of the treaty based on in vitro and in vivo carcinogeneity studies is that it is not only the classical genotoxic mechanism and the promoter pathway that are involved in the pathogenesis of cancer, but there is also a cytotoxic way that can most probably provoke it during frequent exposures of concentrations above the threshold, bringing about the disease after several decades later than the exposures.

The first session of the conference dealt in detail with the regulatory environment of the pool and spa operation. A comprehensive paper exposed the contribution of the Public Health Service in Hungary to the modernisation of the pool and spa hygiene in the past several decades leading from the era hit by regular outbreaks originated from public pool setting to the present days' internationally recognised spa culture throughout the country. It has also been emphasized in a presentation from Portugal that progress on this field had also been due to the systematic and tolerant way of communicating the public health authorities their aspects like the importance of application of the best hygienic practices to the operators. His presentation gave a good example on how a competent authority can treat the wide complexity of technical, analytical and health and safety issues in the framework of a well designed surveillance programme.

The special American way of influencing the very much health relevant pool and spa technical environment is the indirect motivation by standards and related certification programmes. According to the speaker, the NSF Standard 50 elaborated and developed by NSF International helps to keep under control the pool and spa operation practices not only for those state, county and local authorities that require public facilities to utilize equipment conforming to it, but probably also a lot more consumers of the pool and spa services who draw a profit of it due to the fact that the market rewards the quality guaranteed by the certified products. A representative of a professional association called the attention of the audience of the positive role of the bodies like his representing undertakers of the market of pool and spa design and construction. An association like the Hungarian Association of Pool Technology may constitute a bridge between the profit-related interests of the undertakings and those of the pool and spa user society. It also can act as a central forum in the training and education of its members and due to the possibility to express the members' experiences in a balanced way, it has crucial role in the improvement of the legal and administrative environment of the pool and spa affairs. The German philosophy of regulating the pool and spa environment is based on a double foundation: a set of general legal requirements for the protection of the public health and a highly structured set of very demanding standards that describe the detailed technical and operational rules in order to guarantee the health safety of the users. The presentation read by the representative of a federal health authority in Germany was particularly noteworthy as the German way of managing public matters in general had always have deep influence on that of a number of countries in Central and Western Europe. A perceptible German dominance throughout the conference was also due to this fact and not only to the great

number of the presentations from this country. There was only one speaker to deal with the regulations and the actual practice of preventing the pool and spa related accidents and physical injuries. This very presentation served also with special regard of coaching the lifeguard personnel to this and other related tasks like rescuing from water and resuscitating victims of the accidents once occurred. Finally in this section, a presentation (notably mine), that was based upon a questionnaire survey answered by 31 professionals from 18 countries, tried to provide the audience with a general view of how widely a number of countries approach the most relevant issues of pool and spa safety and hygiene. There are however issues regarded as of central health relevance, like the mandatory authorisation of the pool water disinfection practices or the monitoring, that are regulated on a very similar way in most of the countries of the respondents. It is however worth mentioning that the answers regarding several important technical issues reflect the lack of regulation in several countries. It would be of great interest to obtain more information on the relationship between the water quality and health outcomes and the way of setting regulations on the health relevant aspects pool and spa environment.

The conference seemed to be a success that offered an ample view on a series of highly relevant issues and there arose the issue of follow-up. At the end of the event, the audience agreed to a conclusion suggesting a continued effort to keep and organise the communication and cooperation of the international community of the stakeholders of the pool and spa environment. As the conclusions adopted by the conference contain also messages to this very body, let me read it out in its entirety.

1. Participants to the International Conference on Health and Water Quality Aspects of the Man-made Recreational Water Environment (Budapest, Hungary, 10 – 11 March 2005) recognize that numerous issues related to the design, operation and management of the man-made recreational water environment remain to be addressed if public health is to be safeguarded. Such issues include, but are not limited to: the assessment of microbiological and chemical risks in water and air, the monitoring and assessment of recreational water environment, water treatment and disinfection processes, and new environments such as private pools and natural pools.
2. Conscious of the advantage that could be derived from enhanced international cooperation, participants call for the establishment of a network of stakeholders in a healthy recreational water environment. As a first step towards the creation of such a network, participants undertake to compile a list of potentially interested experts and organizations in their home countries, and to communicate this to the organizer of the Conference.
3. Activities to be supported by the network will include *inter alia*:
 - a. The creation of a web-based mechanism for the exchange of information between all stakeholders.
 - b. Preparation of an inventory of standards, requirements, and regulatory approaches relevant to health and aesthetic aspects of the man-made recreational waters environment.
 - c. Sharing experience on proven technologies and codes of practice for risk management in the pool and spa environment.
 - d. Serving as a basis for international cooperative exercises, including negotiations with national, regional (esp. European), and international organizations
 - e. Promote common fund-raising activities.
 - f. Preparing a second conference on Conference on Health and Water Quality Aspects of the Man-made Recreational Water Environment

4. Conscious of the commitment taken by the Parties to the Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (the Water Convention) to prevent, control and reduce water-related diseases in “enclosed waters generally available for bathing and other recreational purposes”, conference participants request the Chair of the Working Group on Water and Health to bring the proposed activities to the attention of the next meeting of the Working Group on Water and Health (Geneva, 5-7 December 2005).
5. Conscious of the work currently being undertaken by the World Health Organization in the development of guidelines for recreational water quality, participants request the Chair of the Working Group on Water and Health to seek the assistance of the World Health Organization in addressing their concerns as identified during the present conference, and exploring the possibilities to further support the activities of the network.