Editorial

Drinking-water quality and waterborne disease

Waterborne disease remains one of the major health concerns in the world. Diarrhoeal diseases, which are largely derived from microbiologically contaminated water and inadequate sanitation, account for 2.4 million deaths each year and contribute over 73 million Disability Adjusted Life Years (a measure of disease burden, WHO 1999). This health burden is primarily borne by the populations in developing countries and by children, but outbreaks of waterborne disease continue to occur in both developed and developing countries, leading to loss of life, disease and economic burden for individuals and communities. In addition to risks to drinking-water, safety may also be compromised by chemical and radiological constituents. The world’s most important pathogen causing diarrhoeal diseases is the bacterium *Vibrio cholerae*. There are an estimated 3–5 million cholera cases and 100,000–120,000 deaths due to cholera every year of which only a small proportion are reported to WHO [1].

In developed countries like Germany, cholera infections are rare. The last major cholera epidemic in Germany took place in the hot summer of 1892 in Hamburg where 16,956 people became ill and 8,605 died [2]. Robert Koch (*1843 - †1910) determined the causative agent of cholera, isolating *Vibrio cholerae* in 1884. During the Hamburg epidemic, he implemented his insights gained during a cholera epidemic in Egypt for the first time, inducing concrete measures e.g. the sandfiltration of drinking water for the reduction of the number of pathogens [3]. By these measures, cholera incidences could be reduced considerably. These principles for the purification of surface water were reviewed by the Imperial Health Office and communicated to all federal governments in Germany as early as 1899 (W. Schumacher in [4], S. 13).

During routine measurements, the detection of pathogenic bacteria in water was difficult or even impossible, so that the detection of „marker“ bacteria was used to deduce indirectly possible pathogenic bacteria and so determine the water quality. The determination of markers does not only mean a quality control of the final product, but already represents the so-called principle of indication. It was already known that pathogenic bacteria transmittable by water are excreted mainly or exclusively with the feces. Therefore, water contaminated by feces may occasionally be infected with pathogenic bacteria, too [5].

Even nowadays, bacteria like *Salmonella Typhi* and *Salmonella Paratyphi*, *Vibrio cholerae*, *Shigella sonnei*, *E. coli* and their toxin-producing strains may lead to waterborne diseases, if drinking water is contaminated. However, also parasites such as *Cryptosporidium* and *Giardia* or several viruses occurring in polluted water (hepatitis A virus, human polioviruses, hepatitis E virus, norovirus e.g.) have
repeatedly led to outbreaks of disease. Beside microbial contaminations, millions of people are exposed to unsafe levels of chemical, physical and radiological constituents in their drinking-water. This may be linked to a lack of proper management of urban and industrial wastewater or agricultural run-off water – potentially giving rise to long term exposure to pollutants, which can have a range of serious health implications. Or it may be linked to naturally-occurring arsenic and fluoride, which cause cancer and tooth/skeletal damage, respectively.

In 1984 and 1985, the World Health Organization (WHO) published the first edition of Guidelines for Drinking-water quality which is one of the longest-standing normative publications of WHO. Whereas the first and second editions of the Guidelines for Drinking-water Quality were used by developing and developed countries worldwide as the basis for regulation and standard setting to ensure the safety of drinking-water, they have been comprehensively updated during the last decades. The latest, forth edition of the Guidelines provides an evidence-based point of departure for standard setting and regulation as a basis for health protection. The European Commission e.g. uses these Guidelines as the scientific point of departure for their drinking-water directive and drinking-water quality standards [6], and many developing countries use the Guidelines directly or indirectly in setting national standards.

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Water Safety Planning in the European Region

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The WHO Guidelines for drinking-water quality (GDWQ) describe Water Safety Plans (WSP), a holistic risk assessment and risk management approach of drinking-water supplies which is implemented by the water utility and aims at improving drinking-water safety and thereby protecting public health. They encompass comprehensive risk assessment and management of these risks, building on the multiple-barrier principle to prevent or reduce contamination of drinking-water. By carrying out such control of the drinking-water supplies from catchment to consumer, the focus is shifted from relying on end-product testing only which has a limited capability to identify short-term contamination with pathogens, and which may provide results only after people possibly already have been exposed to contamination. In order to support implementation of WSP, several tools have been developed by WHO.
Water Safety Planning in small-scale water supplies

One of these tools gives guidance on implementation of WSP in small supplies: the manual on water safety planning for small community water supplies. Describing the implementation step by step, it supports communities in day-to-day risk management, operation and consistent improvement of the safety of their supplies. The WHO Collaborating Centre for Research on Drinking-Water Hygiene of the Federal Environment Agency (UBA) is involved in several activities to support water safety planning in small supplies in the European Region. It implemented a national pilot project on the added value, feasibility and implementation modes for WSP in small-scale water supplies in Germany. As an outcome of the project, it is planned to publish a handbook to support the application of this approach. The WHO CC was furthermore involved in a project to develop WSP in small supplies in Tajikistan (http://www.euro.who.int/en/where-we-work/member-states/tajikistan/news/news/2012/08/safe-water-in-tajikistan) during which WSP were implemented in rural water supplies, and facilitators were trained for future support of WSP. The Protocol on Water and Health, which aims at protecting human health and well being by better water management, also addresses WSP in small-scale water supplies.

Water Safety Planning in buildings

For application of the WSP approach in buildings, WHO has published a monograph particularly aiming at those involved in design, construction, management, operation, maintenance and regulation of building water systems. It gives guidance on managing these systems in buildings (including for example hospitals, schools, and child and aged care facilities). Information is provided on how to create a supporting environment, and the concept is illustrated through a model WSP in a daycare facility for children. The WHO CC for Research on Drinking-Water Hygiene aided in implementing WSP steps in German legislation for Legionella prevention in water distribution systems in buildings. Building operators are required to provide public health authorities with a system description, hazard identification and risk assessments. This change in national legislation is backed up by a research project on risk assessment and risk communication concerning Legionella issues in buildings. The WHO CC also implemented a national pilot project on the added value, feasibility and implementation modes of WSP in buildings in Germany. The WSP approach was found to particularly support operators of buildings in fulfilling their responsibilities and in knowing about the legal requirements and being in compliance with them.

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Aspects of drinking water hygiene in buildings

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The Drinking Water Directive applies to:

- all distribution systems serving more than 50 people or supplying more than 10 cubic metres per day, but also distribution systems serving less than 50 people/supplying less than 10 cubic metres per day if the water is supplied as part of an economic activity;
- drinking water from tankers; in bottles or containers and water used in food-processing industries.

It doesn't apply to natural mineral water and waters which are medicinal products.

To ensure water quality standard at EU level a total of 48 microbiological, chemical and physical indicator parameters must be monitored and tested regularly. Among others, this comprises microbiological indicators for fecal contamination, plant nutrients, pesticides and metals. Scientific basis for the quality standards are the Guidelines for Drinking water of the World Health Organization and the opinion of the EU Commission's Scientific Advisory Committee. Member States of the EU are allowed to include additional requirements they consider to be relevant for their country, and they can set higher standards. Lower standards, however, are not allowed in order to protect human health on the same basic level within the whole EU.

Additionally, the EU allows Members States to depart from chemical quality standards for a limited time (derogation, Annex I). Derogations can be granted, if it doesn’t constitute a potential health danger and the drinking water supply cannot be maintained by any other reasonable means.

The results of the drinking water quality monitoring are reported to the European Commission every three years and published as a synthesis report, which summarizes the quality of drinking water and its improvement at a European level.

The EU Drinking Water Directive ensures that water for human consumption is wholesome and clean. Member States need to set up monitoring programs that enable to ensure that the water reaches the consumer with a quality that meets the requirements of the Directive. If the water fails to meet the requirements, water consumption needs to be prohibited and consumers need to be informed promptly and to be given the necessary advice to prevent them from health risks. It is also necessary to regulate that no substances, materials from new installations and impurities associated with such materials affect the drinking water quality. In order to be able to react to actual developments, the EU Commission regularly reviews Annex I parameters and parametric values in the light of scientific and technical progress.

**Lead in drinking water**

Lead is a heavy metal that can severely affect the central nervous system. It is a cumulative poison, resulting in health effects even in small doses if they are taken up for a long time. Lead has been shown to affect the IQ by 3 to 4 points for each 10 μg Pb/dL increase in the blood levels of children. Aside from children, pregnant women are one of the main risk groups that should not be exposed to lead.

Human exposure to lead can occur via food, water, air, soil and dust (SCHER, 2009). To date, food, including drinking water, is the major source of exposure to lead for the majority of population (EFSA, 2010). Aside from ingestion of contaminated food, the use of lead in pipes for water supplies remains an important source of lead in some areas. The formerly widespread use of lead-based paint and soil and/or dust ingestion are additional sources of potential exposure (especially indoors), specifically for children (VRAR, 2008).

In 1993, WHO proposed an amended guideline value for lead in drinking water of 10 μg Pb/L, based upon an overall assessment of studies of human populations. In 1994 the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) agreed that, in conformity with the precautionary principle, the maximum level of lead in drinking water should be ultimately reduced to 10 μg/L. In the revised drinking water directive, adopted by the Council in 1998, a maximum concentration of lead of 10 μg/L was laid down, effective 25 December 2013. In 2008, WHO confirmed the guideline value for lead in drinking water (10 μg/L), fully taking into account that the use of lead-containing additives in
petrol is decreasing, that lead concentrations in air are declining, and that lead intake from drinking water constitutes a greater proportion of the total intake.

In Germany, lead can still be found in many drinking water pipes. While lead pipes were forbidden in Southern Germany already at the end of the 19th century, they were used in northern and eastern parts of the country until the 1970s. Water supplied in building as part of commercial (houses for rent) or public activity, has to be monitored by the building owner and they have to proof to the public health authorities that their pipes are free of lead. If lead pipes are found they have to be removed or the taps have to be marked as unsuitable for human consumption.

If the lead origins from parts of the water supply outside the building, e.g. the connection between the building and central drinking water supply system, the water distribution company has to remove the lead pipes from their system. In general, the central drinking water distribution system is free of lead pipes nowadays, but especially in city areas with houses built at the beginning of the 20th century small lead pipe connections can still be found. Large German cities such as Frankfurt have started monitoring and awareness raising campaigns to get rid of lead pipes more than ten years ago and are quite successful. But still many buildings exist, where the water is contaminated with low levels of lead and these buildings will not meet the new guideline value entering into force at the end of 2013.

Low lead levels may also origin from other sources such as lead-containing faucets or soldering material. It could be shown that the lead from these parts of the drinking water supply can provide sufficient lead to exceed the guideline value of 10 µg/L. Also, the lower acceptable lead level affects the choice of building materials, as some pipe materials are containing small amounts of lead and are not suitable for drinking water supplies anymore. Design and construction of drinking water installation have to undergo revisions in order to provide a safe packing for one of our primary food.

**Legionella in water supplies of the built environment**

The bacterium *Legionella pneumophila* and related *Legionella* species cause infections known as legionellosis. The first infections were recognized in the 1970s and associated with contaminated water systems operating at above ambient temperature. Legionellosis range from mild flu-like illness (Pontiac fever) to severe and often fatal forms of pneumonia (Legionaire’s disease). In 2011, 4,897 cases of legionellosis were reported by the EU Member States Iceland and Norway. Six countries (France, Italy, Spain, Germany, the Netherlands and the United Kingdom) accounted for 83% of all notified cases.

The natural habitat of *Legionella* is sweet water and they multiply well in warmer artificial aquatic environments in the built environment, such as cooling towers, water systems in hotels, homes, ships and factories, respiratory therapy equipment, fountains, misting devices; and pools. The infection is caused via inhalation of aerosols, mists or droplets of contaminated water. The optimum growth temperature for Legionellae is usually between 20 and 45 ºC. *L. pneumophila* is thermotolerant, can withstand temperatures of 50 ºC for several hours, and has been isolated from hot-water systems up to 66 ºC. However, it is destroyed above 70 ºC. Warm water systems in the built environment often use water in the temperature range that encourages *Legionella* growth, and many of these systems potentially produce aerosols, i.e. the route of infection.

In the EU Drinking Water Directive, *Legionella* is not mentioned explicitly. Nevertheless, it is stated that drinking water needs to be free of pathogens. On national level, drinking water legislation should consider *Legionella* and associated health risks and provide the legal framework for disease prevention. In the following, the current status for Germany is presented:

With the revision of the German Drinking Water Ordinance (Trinkwasserverordnung, TrinkwV 2001) in November 2011, the requirements for *Legionella* monitoring in warm water systems of the drinking water supply changed. Water supplied in buildings as part of commercial (houses for rent) or public activity, has to be monitored for *Legionella* once per year, if a large device for water heating is in place and if showers or other aerosol-producing devices exist in the building. This doesn’t apply to single or two family homes. Large devices for water heating are defined as devices with a storage volume of more than 400 litres or more than 3 litres pipe volume between the drinking water heating
device and the tap. The house owners are responsible for the monitoring and need to show to the public health authorities that their building complies with the Drinking Water Ordinances. If the water in the building has met the quality values for three years, the local public health authority can decide to expand the monitoring period, so that less than one monitoring per year is necessary. The results from the monitoring are evaluated by the local public health authorities, and they decide if additional action becomes necessary. This evaluation is based on the threshold level of 100 cfu/100mL for *Legionella*, the inspection of the technical installation in place and the risk assessment of the drinking water installation system.

House owners, planners, technicians, hygienists and health authorities need to work together to fulfill the requirements of the Drinking Water Directives. Together, they are able to protect public health and ensure a high water quality from source to consumption.

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Publications and Resources

Healthy water from private wells - German Federal Environment Agency helps owners with new guidebook

Nearly one per cent of the population in Germany relies on a private well for its drinking water. The Drinking Water Ordinance (TrinkwV) also sets quality standards for the drinking water in these very small water supplies, which are typically found in rural areas. A new Federal Environment Agency (UBA) publication on healthy drinking water from private wells has recommendations for operation and use and shows what to do so that water can continue to be safe and healthy. The publication is available in German and free of charge. It provides information about compliance with certain laws regarding the use and operation of private wells and springs, and it names potential risks to drinking water quality. It also gives advice on how to address risks. "Only safe operation of wells or springs results in drinking water that is tasty and healthy", said UBA President Jochen Flasbarth.

More than 700,000 people in Germany draw their drinking water from their own wells and springs. That figure is equal to the population of Frankfurt/Main, or about one per cent of the entire population. Private wells are a vital source of drinking water in many rural regions. Unlike at central water works, however, the drinking water from these systems does not always meet the requirements of the Drinking Water Ordinance for microbiological and chemical quality. Data available to UBA verify this finding. "Each and everybody in Germany has the right to water that is both tasty and healthy", said the UBA president. The guidebook aims to help operators of private wells and springs in achieving this goal. Further information is available on: UBA - Press Releases 2012 - Healthy water from house wells

Study: Better learning in good indoor air

A study conducted by the Danish consulting company Slotsholm A/S in cooperation with the Centre for Indoor Hygiene and Energy at the Technical University of Denmark on behalf of the skylight manufacturer Velux assesses the socio-economic consequences of improved indoor air quality in primary schools. The study compares the situation in Danish and Swedish as well as Norwegian schools and concludes that Danish students could perform better by 10 percent in the PISA tests. One of the causes herefore, so the authors, could be the poorer indoor air quality in Danish schools. In Sweden and Norway, thanks to widespread automatic ventilation in school buildings, indoor air concentrations of CO₂ are much lower there than in Denmark. According to the authors, this may also have positive impact on economic processes. Further Information: Socio-economic consequences of better air quality in primary schools.

WHO international stakeholder seminar on radiofrequency policies

Concern has been growing about the possible adverse health effects resulting from exposure to radiofrequency (RF) electromagnetic fields, such as those emitted by wireless communication devices and networks. In response, WHO is assessing health risks from RF fields in the frequency range of 100 kHz to 300 GHz in an upcoming Environmental Health Criteria Monograph. On 5 June, 2013 more than 110 stakeholders from 40 countries – ranging from policy-makers to campaigners, and industry representatives – participated in a seminar to gather suggestions on technical topics to be covered in the monograph, and exchanged information on national risk management practices related to the use of RF-based devices and technologies. The seminar was hosted by the French Agency for Food, Environmental and Occupational Health and Safety (ANSES) in Paris, France. Further Information: WHO | World Health Organization

From Construction Products Directive to Construction Products Regulation: up to date environmental requirements in sight - Format for the mandatory designation of construction products

From 1st July 2013, the EU Construction Products Regulation requires new complementary data to accompany construction products with CE marking. If the construction product contains substances of very high concern, these must be declared. Alternatively - if available - a safety data sheet must be enclosed. The Federal Environment Agency hands out advice for the format of the mandatory data. Further Information: Building Products - From Construction Products Directive to Construction Products Regulation
Literature

In this section we will provide a collection of recent housing and health publications from a variety of backgrounds. Literature published in German or French, respectively, is indicated with the German flag or the French flag.

If you have suggestions for interesting journals that we should screen for the literature collection, please let us know!

Table of Topics

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergies and Respiratory Diseases</td>
<td>8</td>
</tr>
<tr>
<td>Indoor Air</td>
<td>10</td>
</tr>
<tr>
<td>Mould and Dampness</td>
<td>13</td>
</tr>
<tr>
<td>Light and Radiation</td>
<td>14</td>
</tr>
<tr>
<td>Smoking / Environmental Tabacco Smoke</td>
<td>15</td>
</tr>
<tr>
<td>Home Safety</td>
<td>16</td>
</tr>
<tr>
<td>Housing and Ageing Society</td>
<td>17</td>
</tr>
<tr>
<td>Housing Conditions</td>
<td>17</td>
</tr>
<tr>
<td>Housing and Mental Health</td>
<td>18</td>
</tr>
<tr>
<td>Thermal Comfort / Energy</td>
<td>19</td>
</tr>
<tr>
<td>Urban Planning / Built Environment</td>
<td>19</td>
</tr>
<tr>
<td>Social Inequality</td>
<td>20</td>
</tr>
<tr>
<td>Noise</td>
<td>21</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>22</td>
</tr>
</tbody>
</table>

Allergies and Respiratory Diseases

**The relationship between exposure to microbial volatile organic compound and allergy prevalence in single-family homes.**

**Childhood obesity and asthma control in the GALA II and SAGE II studies.**
Am J Respir Crit Care Med. 2013 Apr 1;187(7):697-702.

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**Exposure to cats: update on risks for sensitization and allergic diseases.**
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Childhood asthma and allergies in urban, semiurban, and rural residential sectors in chile.

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Identity of the fungal species present in the homes of asthmatic children.

Association between latitude and allergic diseases: a longitudinal study from childhood to middle-age.

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Allergens in urban schools and homes of children with asthma.

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Exceptionally high serum concentrations of perfluorohexanesulfonate in a Canadian family are linked to home carpet treatment applications.
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Individual dose and exposure of Italian children to ultrafine particles.
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The Impact of Air-conditioning Usage on Sick Building Syndrome during Summer in China.
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**Events Announcement**

**Environment and Health 2013**
Bridging South, North, East and West
Conference of ISEE, ISES and ISIAQ
Date: August 19-23, 2013
Venue: Basel, Switzerland
Further Information: Environment and Health | Conference of ISEE, ISES and ISIAQ

**VOC Seminar 2013**
Date: September 16, 2013
Venue: Frankfurt/M, Germany
Further Information: www.eurofins.com/voc2013-de

**Der Demografiekongress 2013 - Zukunftsforum langes Leben**
Date: September 4 - 5, 2013
Venue: Berlin, Germany
Further Information: DER DEMOGRAFIKONGRESS 2013

**8. Deutscher Allergiekongress**
Date: September 5-7, 2013
Venue: Bochum, Germany
Further Information: Deutscher Allergiekongress 2013

**20th International Conference on Environmental Indicators ICEI**
Date: September 23-26, 2013
Venue: Trier, Germany
Further Information: ICEI 2013

**45. Jahrestagung Deutsch-Schweizerischer Fachverband für Strahlenschutz e.V.**
**45th Annual meeting of the Association for Radiation Protection**
Date: September 24-26, 2013
Venue: Essen, Germany
Further Information: Jahrestagung Strahlenschutz

**34th AIVC Conference - Air Infiltration and Ventilation**
Date: September 25-26, 2013
Venue: Athens, Greece
Further Information: AIVC Conference

**IAQ 2013 - Environmental Health in Low Energy Buildings**
Date: October 15 - 18, 2013,
Venue: Vancouver, British Columbia, Canada
Further Information: IAQ 2013 | ashrae.org

**10. AGÖF-Fachkongress**
"Umwelt, Gebäude & Gesundheit: Schadstoffe, Gerüche und Sanierung"
Date: October 24-25, 2013
Venue: Nuremberg, Germany
Further Information: 10. AGÖF-Fachkongress

**8th National Housing Conference - Adelaide 2013**
Date: October 30 - November 1, 2013
Venue: Adelaide, Australia
Further Information: National Housing Conference 2013, Adelaide - National Housing Conference
**Message Board**

In this section we will inform you about activities and projects related to housing and health that are being carried out by WHO or the WHO CC. This may relate to ongoing activities and projects, as well as invitations to participate in data collections or case study projects.

**WHO work on indoor and built environments**

**WHO playing an advisory role in European projects on housing, energy, ventilation and urban planning**

WHO/Europe plays an advisory role in a variety of European projects related to housing and urban issues.

- Across Europe, housing insulation is being applied as one of the main mechanisms to reduce energy consumption. As little knowledge is available on the potential health impacts of such action, the INSULATE-project aims to demonstrate how improving energy efficiency in buildings impacts on indoor environmental quality and occupant health. Since the project started in 2010, field studies have been conducted in Finland and Lithuania, targeting apartment buildings undergoing renovations in 2011—2014. The project consortium hopes to find new collaborative partnerships for further testing of the assessment protocol. For more information, see [www.insulateproject.eu](http://www.insulateproject.eu).

- A new project on energy vulnerability and urban transitions in Europe (EValUaTE) has started in mid-2013, looking into the impact of the economic crises and the increase in energy cost in Central and Eastern European cities and assessing the social and spatial dimensions of energy vulnerability and the related effects on health and wellbeing. The project will be managed by the newly established UK Centre on Urban Energy and Resilience and WHO/Europe will be a member of the Advisory Board. See [http://urban-energy.org/evaluate/](http://urban-energy.org/evaluate/) for more information.

- WHO/Europe has also been on the advisory panel of the HealthVent project which aimed at establishing guidelines for health-based ventilation in Europe to protect people in places like schools, nurseries, offices and homes against health problems caused by poor indoor air quality. The HealthVent project acknowledged – and tried to implement – the recommendations provided by WHO through its Indoor Air Quality Guidelines. The final HealthVent report is expected to be published by late 2013. For more information, see [http://www.healthvent.byg.dtu.dk/](http://www.healthvent.byg.dtu.dk/)

**Evidence on health aspects of air pollution**

WHO/Europe is coordinating the international projects REVIHAAP (Review of evidence on health aspects of air pollution) and HRAPIE (Health risks of air pollution in Europe), to provide the European Commission (EC) and its stakeholders with evidence-based advice on the health aspects of air pollution. This advice will be grounded on a review of the latest scientific evidence on the health effects of a wide range of air pollutants. Results from these projects will support the comprehensive revision of European Union (EU) air quality policies taking place in 2013.


**Multiple exposure in indoor built environments**

Strong evidence is available on the health impacts of certain building- and indoor-related risk factors. However, in real life, many of these indoor exposures occur in parallel and much less evidence is available on such multiple exposures, their health effects, and the appropriate countermeasures. WHO/Europe is now supporting Member States in tackling the challenge of multiple exposures to environmental risks by hosting a capacity building workshop on multiple exposures in indoor built environments such as homes, day care centers and schools. In parallel, similar workshops will be held on
subjects related to air quality monitoring, chemical mixtures and asbestos. One of the workshop documents will be a review of evidence on multiple exposures in indoor built environments, which will be published after the October workshop on the WHO/Europe website on housing and health at http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/Housing-and-health

**WHO project towards developing housing and health guidelines**

In April 2013, the Pan-American Health Organization hosted the first meeting of the Housing and Health Guideline Development Group in Washington. The project is coordinated by WHO Headquarters with the support of WHO/Europe. At the meeting, the guideline development group convened experts from across the world and discussed the format and coverage of WHO guidelines on housing and health, reviewing existing evidence and WHO guidelines to identify the most relevant areas for WHO advice on healthy housing. For the selected topics, systematic evidence reviews will then be carried out to establish health-based guidance on housing criteria and interventions. For further information, please see http://www.who.int/hia/housing/en/index.html

**Health effects and guidance on emergencies**

The WHO/Europe programme on climate change has published a range of products addressing health effects and prevention measures related to heat, cold and flooding which are of relevance for urban settlements as well as healthy housing. For further information on heat, please see http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/Climate-change/activities/public-health-responses-to-weather-extremes2/heathealth-action-plans

For evidence and guidance on flooding, see http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/Climate-change/news/news/2013/05/how-flooding-affects-health


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