EXPERT MEETING ON PREVENTION AND CONTROL OF LEGIONELLOSIS IN THE PAN-EUROPEAN REGION

VIRTUAL SESSION, 30.11-2.12.2021

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Expert meeting on prevention and control of legionellosis in the pan-European region

Meeting report
Virtual meeting, 30 November–2 December 2021
ABSTRACT

Expert meeting on prevention and control of legionellosis in the pan-European region was organized under the Protocol on Water and Health from 30 November to 2 December 2021 in a virtual format. The meeting was co-hosted by the European Centre for Environment and Health of the WHO Regional Office for Europe and the National Public Health Centre of Hungary and financially supported by the Norwegian Ministry of Health and Care Services and German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

Over 70 experts from 28 countries attended the meeting, exchanged national experiences, and contributed to technical discussions. The meeting reviewed the burden of legionellosis in the pan-European region, addressed the status of regulatory environment, surveillance and outbreak management capacities in the countries and discussed priorities for action prevention and control of Legionella infections.

Keywords

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**Introduction**

Legionella species are opportunistic pathogens that may proliferate in water environments and systems. If inhaled, they can lead to infections of the respiratory tract. These infections are of significant public health concern globally and regionally, and, although largely preventable, outbreaks of legionellosis result in a high health burden. The provision of safe water, sanitation and hygiene (WASH) is fundamental to preventing disease and promoting the health and well-being of populations. Sustainable Development Goal (SDG) target 6.1 requires countries to ensure safely managed drinking-water services for all in all settings, while SDG targets 3.3 and 3.9 call for combating waterborne diseases and reducing the numbers of deaths and illnesses from water contamination.

In accordance with its Guidelines for drinking-water quality, WHO promotes a risk assessment and risk management approach for the management of drinking-water supplies, including in buildings, to prevent and control Legionella. The approach became mandatory in the revised European Union Drinking Water Directive of 16 December 2020, which now explicitly addresses effective control and management of Legionella.

The Protocol on Water and Health was adopted in 1999 at the Third Ministerial Conference on Environment and Health in London, England, and entered into force in 2005. To date, 26 countries have ratified it, covering about 60% of the population of the WHO European Region. It is also an important platform in the wider pan-European region to promote and advance global and regional commitments on WASH and health, and the programme of work for 2020–2022 includes increasing awareness and national capacity for the prevention and control of legionellosis.

Legionella cause some of the highest numbers of cases and water-related outbreaks in the region. Although many countries have established national regulations and procedures for the prevention and control of Legionella in water systems and for surveillance and management of outbreaks, a considerable number of countries have not, and the true burden of legionellosis is therefore poorly understood.

The objective of the expert meeting was to review the relevance of legionellosis in the pan-European region, exchange national experiences and discuss priorities for the prevention and control of Legionella infections. The expert meeting advances implementation of the Protocol on Water and Health (hereafter Protocol) and is a joint initiative of Belarus and Norway, the co-lead Parties of the programme area on prevention and control of water-related disease. The meeting was hosted jointly by the National Public Health Centre of Hungary and the WHO European Centre for Environment and Health. Financial support was provided by the Norwegian Ministry of Health and Care Services and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

**Meeting proceeding**

The meeting took place in virtual format from 30 November to 2 December 2021. Over 70 experts from 28 countries representing different organizations such as regulatory authorities, epidemiological and environment surveillance agencies, water supply management, research as well as from other organizations, including the European Commission, European centre for
Disease Control (ECDC), UNECE, WHO headquarter participated in the three-day meeting. Silvia Schreiber and Martina Würzburg served as Russian language interpreters and Elisabeth Heseltine as rapporteur. See Annex 1 for a full list of participants and their affiliations.

The meeting consisted of an opening session, four technical sessions and a brief closing session summarised below in relevant parts.

- Session 1 was devoted to reviewing the burden of legionellosis in the pan-European region and status of regulatory environment and surveillance capacities in the countries.
- Session 2 addressed the key principles of prevention and control of Legionella in building water systems and country experiences.
- Session 3 covered the main approaches to clinical surveillance and outbreak management of legionellosis and country experiences.
- Session 4 devoted to strengthening national capacities for prevention and control of Legionella in regulation and practice

The technical sessions were moderated by Márta Vargha, National Public Health Center, Hungary, Susanne Hyllestad, Institute of Public Health of Norway and Enkhtsetseg Shinee, WHO European Centre for Environment and Health. During the meeting, participants were polled on relevant questions and invited to contribute to word clouds using a platform on slido.com. Annex 2 provides programme details, listing all the presentations and interactive elements of the meeting.

Welcome and opening

The meeting was opened by Surjan Orsolya, speaking for Cecilia Müller, Chief Medical Officer, Hungary, started the meeting noting that under normal circumstances she would be welcoming participants in person in Budapest. She emphasised that the COVID-19 epidemic gives us a number of tasks that require immediate decision, it is also important to focus on other public health issues that go beyond the COVID-19 epidemic. She emphasized the importance of controlling Legionella for public health. Hungary has observed colonization of hot water systems by Legionella and, in 2015, issued a decree on the public health requirements for Legionella risk environments and guidance document on the Legionella risk assessment and management to assist the operators of at-risk facilities and the local public health authorities.

Kjetil Tveitan, Ministry of Health and Care Services, Norway welcomed participants on behalf of the co-lead countries of the programme area on prevention and reduction of water-related disease under the Protocol on Water and Health. He recalled that when Norway adopted an Act on communicable diseases 30 years ago, there was an interest in Legionella, however the knowledge and experience to control lacked and an outbreak had occurred a few years later. He noted that the burden of disease due to Legionella in the European Union is the highest of all waterborne pathogens, with an incidence of 0.1–40 per million, which has nearly doubled in last 5 years, perhaps due to increased awareness and surveillance efforts. He emphasized that risk assessment and risk management approach recommended by WHO became mandatory under EU Drinking-water Directive and the Protocol provides an important platform to build national capacities to manage risks in drinking-water supply.

Sonja Koeppel, United Nations Economic Commission for Europe, noted the importance of the Protocol as a legal instrument to protect health and ensure the human right to clean water. It is a
Oliver Schmoll, Programme Manager for Water and Climate Programme at the WHO Centre for Environment and Health, presented the background, scope and objectives of the meeting noting the need for building efficient surveillance and early warning systems, and response capacities for water-related disease and regulatory and institutional capacities of water-related diseases, including the burden of legionellosis in the region and underlined main principle of the Protocol. He described the relative importance and disparate distribution of Legionella in the region and noted that several countries in the pan-European region have set national targets related to Legionella in the context of the Protocol. He said that the objectives of the meeting were to appraise the situation regarding legionellosis in the region and existing legal frameworks and surveillance systems, discuss the principles of Legionella prevention and control in building systems, promote exchange of good practices and approaches and setting targets for Legionella prevention and control under the Protocol on Water and Health and discuss priorities for action at national level and in the context of the Protocol. The outcome would inform revision of the WHO publication on Legionella prevention and control.

Session 1. Situation overview

The first session was devoted to appraisal of the burden of legionellosis and review of the status of regulatory environment and surveillance capacities in the pan-European region which were undertaken in the framework of the Protocol on Water and Health.

Overview on incidents and outbreaks of legionellosis in the pan-European region

The University of Bonn, Germany, and the Scientific and Practical Center for Hygiene, Belarus conducted a literature search in English (from PubMed, Web of Science) and in Russian (from Elibrary.ru and cyberleninka.ru) on notified outbreaks and cases of Legionnaire’s disease. Several outbreaks and cases were reported in scientific literature search) by 34 of the 53 countries in the pan-European region between 2011 and 2021, the majority from France, Germany, Italy, and Spain. The predominant species was L. pneumophila serogroup 1, and the cooling towers, followed by building water supply systems were the main sources of reported outbreaks. The true burden of outbreaks is likely to be higher than those identified through the literature review. The reasons why only few outbreaks have been reported could include lack of capacity for publishing in the scientific literature, low priority of legionellosis in some countries and the scientific interest more on laboratory detection methods, ecology and host-pathogen interaction, but less on outbreak detection. Legislative and regulatory frameworks should be strengthened to improve surveillance, reporting and outbreak management, with targeted capacity-building programmes and cooperation with the water sector. The review showed that 15 countries, including 4 countries of the eastern Europe, Caucasus and Central Asia provided information about legionellosis in the national reports of the Protocol implementation. It indicates that reporting through the Protocol provides complementary information in analysing the burden of legionellosis in the Region.
During the discussion, it was suggested that in order to improve data on incidents of legionellosis, weekly epidemiological reports should also be analysed, and it was confirmed that other relevant sources should be considered in a future comprehensive overview.

**Status quo: regulatory framework, surveillance system capacities and gaps**

The National Public Health Centre (NPHC) of Hungary collated information on national regulations and existing practices in Legionella risk assessment and management. An online survey had been sent to focal points and other experts in all the countries in the pan-European region and 44 responses were received. About 2/3 responded countries have guidelines, legislation or both for Legionella control, although limited information was available from Central Asia and the Caucasus. The scope of the regulations includes risk assessment, risk management, responsibilities of stakeholders, regulatory values, environmental monitoring, clinical surveillance, qualification and training of operators and registration of facilities that pose a risk and regulatory levels. In more than 2/3 respondent countries, the requirement for risk assessment is specified in the legislation or guideline and it is undertaken by the public health authorities and facility operators, but it is audited only in 1/3 countries. The risk management measures specified for health-care facilities, hotels and other accommodation and pools and spas, cooling towers and other settings. The responsibility for risk assessments and management, environmental and clinical surveillance and monitoring differs by country, although legionellosis is a reportable disease in 35 (80%) countries responded. The regulatory requirements for domestic settings should nevertheless be improved. Most countries reported gaps in financing and human capacity for Legionella control and limited awareness among the general public.

**Session 2. Prevention and control of Legionella in building water systems: key principles and country experiences**

This session focused on the main principles and WHO recommendations for risk assessment and risk management of Legionella in building water systems, recent developments related to revision of the European Commission Drinking Water Directive and good practices from countries in the development and implementation of the national regulations and guidelines and requirements for building water systems.

**Key principles and recommendations for Legionella prevention and control in building water systems**

It was noted that much had been learnt about the causes of the disease since it was first recognized in 1976, which are associated primarily with failures in operation and management, inadequate risk assessment and implementation of control measures, lack of residual disinfectant concentrations and the existence of potential for infection by aerosol production or aspiration. The first WHO publication on Legionella and the prevention of legionellosis (2007) advocated a water safety plan (WSP) approach, and subsequent publications stressed the importance of good design and specifications for construction and commissioning of building water systems. Water systems may contain microorganisms even when meet the criteria for drinking-water. Legionella and other waterborne pathogens can colonise and grow in water systems and equipment which are not adequately designed, commissioned, operated and managed. Building-related risk factors of legionellosis and prevention and control of waterborne outbreaks required shift of focus to
preventive management approach and change of culture for safe design and construction of buildings. In the United Kingdom, a British Standard for risk assessment, an asset register, a system map and a control scheme form the basis of the WSP; assessors are encouraged to be accredited and service providers to be registered. Although maintenance is important, the most effective approach is to ensure prevention of Legionella at the start of a building project, and guidance should be provided on commissioning. As most water system failures are due to human error, the human factor should be removed when possible. It is essential to establish multidisciplinary water safety plan development and implementation; ensure water safety through corporate governance, good design, installation, commissioning and regular operation and maintenance; effective supervision, training and education.

Participants then engaged in an interactive Sli.do session, which showed that they considered that the highest risk environments for Legionella are cooling towers and health-care facilities. The closing down of water systems in some buildings for months during the COVID-19 pandemic has added to the risk of Legionella proliferation. Two thirds of the participants reported that their countries had regulatory requirements for risk assessment and risk management, Legionella-specific requirements for building water systems and guidance and tools on measures to reduce Legionella proliferation in drinking-water systems.


The European Commission recalled that the revised Drinking Water Directive had been adopted in December 2020. Member States have 2 years to comply with its provisions, with some flexibility. The revision updates the safety standards, with a “watch list” mechanism, introduces WHO recommended risk-based approach throughout the whole supply chain, obliges Member States to improve or maintain safe water for all, in particular to vulnerable and marginalised groups, ensures greater transparency about the efficiency and effectiveness of water suppliers and includes provisions on substances and material in contact with drinking-water and emerging risks. Definitions are provided for water intended for human consumption, domestic distribution systems and priority premises.

With regard to Legionella, a value of <1000 cfu/L has been set to trigger risk assessment of the domestic distribution system, with specific provisions for priority premises such as hospitals and retirement homes. Risk assessment in domestic distribution systems includes general analysis of the potential risks associated with these systems that affect the tap water quality and monitoring of the Legionella and lead (Pb) in premises where specific risks to water quality and human health have been identified through the general analysis. Countries may decide to focus the monitoring of Legionella on priority premises and ensure that risk reduction measures are taken as soon as risks have been identified and assessed. Remedial action may be taken at even lower values, such as in an outbreak. The measures for domestic distribution systems include informing consumers and building owners about measures to eliminate or reduce risks, encouraging owners to carry out risk assessment and training of plumbers and other professionals.

The discussion then focused on the definitions, according to the Directive, all water used for household purposes is considered drinking-water. There was a suggestion to have a definition on hot water and the need for clarity whether hot water is “potable”. The domestic distribution systems which entail “the pipework, fitting and appliances which are installed between the taps that are normally used for water intended for human consumption in both public and private
premises and the distribution network, but only if they are not the responsibility of the water supplier, in its capacity as a water supplier, under the relevant national law”.

Addressing the priority premises, the representative of WHO informed that the revised water and sanitation health facility improvement tool (WASH FIT) package incorporates elements of the WSP and also sanitation safety plans. A gap had been identified with regard to risks for Legionella in health care facilities, and a factsheet is being prepared in consultation with the World Plumbing Council addressing aspects of plumbing, design and best practice, with a checklist for use by facilities. Design standards for health-care facilities and in outbreak settings should consider requirements to prevent legionellosis.

Good practices and specific approaches to strengthen the national regulations, environmental surveillance and risk assessment and risk management of Legionella in building water systems

Analysis of available information on Legionella in building water systems in Germany

The WHO Collaboration Centre for Health Promoting Water Management & Risk Communication at the University of Bonn, Germany analysed available data from the mandatory routine monitoring for Legionella in public buildings to determine whether domestic hot water temperature is a good indicator of the presence of Legionella spp. in building water systems. Nearly 300 000 datasets were available for 2012–2017, in which Legionella spp. concentrations in the supply flow, return flow and the periphery were analysed. Little exceedance of the German technical action value was seen in the supply and return flows. Generally, Legionella spp. concentrations decreased with increasing temperature, the relation being strong close to the source of heat and weak in the periphery; however, the variance of Legionella spp. concentrations cannot be explained only by water temperatures. It was noted that 56/53°C are the thermal tipping points for standard installation systems.

The subsequent discussion emphasized the responsibilities for preventing legionellosis, noting that the building owners should ensure safety of tap water and the supplier of cold water is responsible for safe operation of the network. The participants noted that multiple factors influence Legionella growth in the periphery of the system, in particular the colonization in thermostatic mixing valves in the periphery being one of the high-risk factors.

National requirements for planning, construction and operation of potable water installations in Germany to reduce the proliferation of Legionella species

The representative of the German Technical and Scientific Association for Gas and Water, Germany outlined EU and national requirements for potable water installations inside buildings and provided examples of such installations in different types of residential buildings. They are subject to a number of regulations, including mandatory sampling and analysis. The Ordinance on the quality of water intended for human consumption sets parameter for potable water installations with target value for Legionella species < 100 CFU/100ml and requires taking technical measures if the value exceeds. The factors that influence the proliferation of Legionella spp. in potable water are temperature, nutrients, flow rate and maintenance, all of which are regulated. Other aspects, such as the dimensions of parts and component, temperature maintenance systems, hydraulic balance, insulation and hygiene requirements for materials, are
also regulated. Considerations to ensure safe potable water are that it must flow; cold potable water must remain cold, and hot potable water must remain hot; and the installation must be planned, commissioned and operated in accordance with its intended use, with maintenance, monitoring and, if necessary, risk assessment. Orientation examination of potable water installations should be conducted to determine potential contamination of the system by Legionella and need for further investigation. The detailed examination should be undertaken to identify the degree of contamination and required control measures.

**Risk assessment tool and inspection of building water systems in Hungary**

In Hungary, the decree on public health requirements for facilities that pose a risk of Legionella infection was adopted in 2015. Before its enforcement, 46% of hot water samples were positive for Legionella, with one in four samples reaching > 1000 cfu/L. The decree requires Legionella risk assessment of all public facilities, monthly control of temperature and annual testing of water for Legionella in high-risk public facilities such as hospitals and care homes for elderly. Subsequently, the guidelines on risk assessment and management were developed, including a detailed questionnaire covering all possible sources, and a matrix for calculating risk. Monitoring of high-risk sources is, however, decided by local authorities and therefore varies.

In answer to a question about effect of the regulations on the number of reported cases of legionellosis, it was noted that the case numbers are the same; however, the regulation has raised awareness, thereby slightly improving the detection rate.

**Recommendations of the Italian guidelines on Legionella prevention and control in building water systems**

The number of cases of Legionnaire’s disease occurring in Italy has been increasing in the past 10 years. In 2008, Italy adopted a law transposing EU Directive (2000) on the protection of workers from risks related to exposure to biological agents at work; and the law on installation of systems conveying water for human consumption in buildings for prevention of Legionella growth in such systems. The national guidelines regulate aspects related to surveillance, epidemiological investigation, Legionella risk assessment and management by applying water safety plan approach, requirements for design, construction and operation of water systems and occupational exposure. Risk assessments are conducted annually in health-care facilities and repeated if a change occurs in the operation of the water system, the type of patients, the epidemiological situation or abnormal presence and repeated detection of Legionella. Sampling frequency set considering the type of the ward, e.g., at least quarterly for wards with immune-compromised patients and every six months for other wards. Alert and action levels are based on the epidemiological situation, the percentage of positive samples and the concentration of bacteria. Action levels have also been set for other buildings and for cooling towers and evaporative condensers. Laboratories that test for Legionella must be accredited by a national body. The guidelines include the checklist for Legionella risk assessment and the questionnaire for outbreak investigation. A chapter on dental units is included in the guidelines considering the literature evidence on high contamination of dental unit water and occurrence of a fatal case a few years ago. The guidelines provide good basis for preventing and controlling the risk of Legionella infection and, are being revised to include penalties for not having a risk assessment and not having notified the presence of a cooling tower and to establish a permanent group of experts for outbreak investigation.

In the follow up discussion it was clarified that quantitative PCR is conducted to screen water samples, mainly in outbreaks. In some analyses, culture results that cannot be interpreted
because of the presence of many other microorganisms, which is sometimes seen in samples from cooling towers and from pools that are not operated properly. Such samples are considered to have “intervention level” contamination. Although the protocol for contaminated samples in ISO 11731 is used to analyse such samples, laboratories are advised to consider “unreadable” samples as “positive”.

**Wastewater treatment plants as sources of legionellosis and possible interventions in the Netherlands**

The representative of the National Institute for Public Health and the Environment, Netherlands, noted that Legionnaire’s disease is clearly associated with warm, wet weather, and the incidence has been increasing since 2015 in the Netherlands. A national programme was conducted between 2002 and 2012 to investigate the sources of infection and came to no definitive conclusion. Investigations were conducted in 2016 and 2017 in two areas with small clusters of legionellosis cases, and a spatial model was used to locate the source. In 2019, a model was designed to identify risk factors in wastewater treatment plants, which identified a temperature of 30–38 ºC, nutrient-rich water and an aerated process as risk factors which are being investigated. Possible interventions to prevent wastewater associated cases include risk assessment of plants to identify those at high risk, monitoring of water and air samples, spatial modelling for source identification and organise control measures to prevent growth in and spread of Legionella from high-risk wastewater treatment plants and assess their effectiveness.

There was a short discussion among participants pointing that according to European Union regulations on wastewater reuse, Legionella should be monitored in effluents, but compliance is probably not yet widespread as the regulation is recent.

**Session 3. Clinical surveillance and outbreak management of legionellosis: main approaches and country experiences**

This session addressed the status and trend of legionellosis, surveillance and outbreak reporting schemes and sharing country experiences and practices and interactive group work on the outbreak management.

**Overview of Legionnaires’ disease epidemiology in EU/EEA, surveillance and outbreak reporting schemes**

The representative of the European Centre for Disease Prevention and Control introduced about the European Legionnaires’ Disease Surveillance Network (ELDSNet), which is responsible for surveillance of Legionnaire’s disease in the European Union, the European Economic Area (EU/EEA). It comprises > 100 epidemiologists and microbiologists who detect, investigate and report cases, clusters and outbreaks of Legionnaires’ disease and conduct training. The EU (2018) common surveillance case definition and the Legionnaires’ disease database were presented. Clinical and laboratory data are collected on cases, outbreaks, cases acquired during travel and other events for monitoring trends, which are reported weekly, in an atlas and in the annual report. An external quality assessment scheme ensures the quality of surveillance. The outbreak reporting scheme covers outbreaks in the EU/EEA and the United Kingdom. Thus, complementary surveillance systems provide an overview of the burden of the disease. In average 30 outbreaks occurred annually in last five years and the notification rate of Legionnaires’ disease was 1.87 per 100 000 population in 2020. An increasing trend in cases was
seen in the region in 2017–2019 and the number of reported cases in 2021 was higher compared to 2020, indicating that Legionnaires’ disease continues to contribute to morbidity, even during the COVID-19 pandemic.

In discussion, clarifications provided on the source of infections, indicating that the vast majority of cases reported to the annual dataset schemes in the European Union are community acquired, although the source of many cases is reported as unknown. In 2020 and 2021, the number of endemic cases of Legionnaires’ disease has increased with the reduction in international travel, which, however, represents only about 10% of the cases reported annually. In some countries (i.e., Denmark and Slovenia), the high notification rate could be related to the increased awareness of Legionnaires’ disease and testing capacity.

**Good practices and specific approaches to strengthen the clinical surveillance and outbreak management of legionellosis**

**France: Experience of setting up and implementing clinical surveillance of legionellosis and use of surveillance data for Legionella risk management strategies and actions**

The national guidelines on Legionella have been implemented in France since 1996, with revisions in 2005 and 2014. The guidelines address the requirements for thermal spa, hospitals, elderly homes and public buildings with collective warm water or water misting systems. The French National Health and Environmental Plan for 2021-2025 includes action to better understand and prevent cases of legionellosis. The National Reference Centre for Legionella, France, reported that there had been 1200–2000 cases of legionellosis in France per year since 2005; 98% of patients are hospitalized and 40% required intensive care. Cases are diagnosed by 400 hospital laboratories, mainly by urinary antigen testing, with PCR of respiratory samples in highly suspected cases and immunocompromised patients. Culture analysis is conducted for isolation of clinical strains, if the urinary antigen test or PCR test of respiratory samples are positive. As of 2005, all strains, environmental samples and respiratory isolates must be sent to the National Reference Centre. The clinical isolates are available for 25% of cases and more than half of these strains are isolated by the reference centre. Legionellosis is mandatory notifiable disease in France. Clinicians and laboratories are required to notify suspected cases to one of the 17 regional health authorities, which conduct investigations and provide feedback and forward the results to the centralized notification centre, which involves the National Reference Centre, where further testing for typing Legionella species is done. Environmental investigations are also carried out in hospitals, elderly homes, thermal spa and other highly suspected areas, with comparison of clinical isolates and interviews with cases to determine the source of infection. Since 2005, the number of cases has been relatively stable; there have been three confirmed outbreaks, but cases are mainly sporadic. Some increases in incidence were associated with meteorological conditions.

**Source attribution of community-acquired cases of Legionnaires’ disease in Berlin, 2016–2020**

Expert from the Robert Koch Institute, Germany presented outcomes of a prospective case–control study of community-acquired Legionnaires’ disease (CALD) reported between 2016-2020. ¹

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¹ Buchholz et al., PLOS ONE, 2020. Source attribution of community-acquired cases of Legionnaires’ disease – results from the German LeTriWa study; Berlin, 2016–2019
The CALD comprise about 70% of all cases in Germany but for most of which the source and the sequence type of the strain are unknown. The aim of the study was to develop a novel integrated microbiological–epidemiological approach for identifying probable sources of CALD cases in Berlin. The patient samples, household water/biofilm samples analysed and where possible, the risk assessment of drinking-water distribution system carried out. A matrix was thus designed to match the type of source (external, residential non-drinking-water and residential drinking-water) to microbiological, clinical and analytical evidence. Except for wearing dentures, there was no hint of a new source of infection. In standard household water and biofilm samples, neither the presence or high concentration (> 1000 cfu/L) of any Legionella, nor the presence of L. pneumophila and L. pneumophila SG1 was associated with the occurrence of cases. A strong statistically significant relation was found, however, with the presence of a Pontiac (MAb 3/1)-positive strain in water. The matrix approach thus allowed attribution of a source to approximately half of the CALD cases, most prominently residential drinking water.

**Overview of national framework for surveillance and management of Legionella infections in Czech Republic**

The surveillance for Legionella is regulated under the Public Health Protection Act and decrees of the Ministry of Health for drinking- and hot water, swimming pools and saunas, in line with European legislation. The epidemiological surveillance for selected infections addresses Legionella infections. The National Institute of Public Health and the National Legionella Reference Laboratory ensure implementation of the national surveillance programme. The legislation covers only hotels and hospitals, while residential houses, industrial water in cooling towers and from the glass and plastics industries are not covered.

The Legionella spp. limit values in hot water, swimming pools, spas and hydrotherapy pools and monitoring frequency have been set in accordance with the EU Drinking Water Directive. Legionellosis is a notifiable disease, and all cases are investigated when possible. Annually, 230–280 cases are reported and the mortality rate is 6–14%. It was however, underlined that Legionnaire’s disease is likely to be underreported. Respiratory secretions are requested and examined by culture and PCR, and a urinary antigen test is conducted; clinical isolates and epidemiologically related environmental isolates are typed for surveillance purposes, with. In 2000–2021, 96% of all 274 clinical isolates were L. pneumophila, of which 79% were subgroup 1, majority being subgroup Pontiac. The national surveillance data provide credible basis for public health use and prevention and remedial measures.

**Capacity development and communicating Legionella risks and safe management requirements to building owners in Switzerland**

Public shower installations are regulated by law, and recommendations for self-regulation of drinking-water installations in buildings are published. There are legal gaps for the regulation of alternative sources of Legionella infection, such as cooling towers and air-conditioning systems, and recommendations from industry associations are considered an interim solution. Regulations concerning hot water production, sanitary technology and drinking-water hygiene should be revised, and lawmakers, enforcement authorities and industry associations must be open to new ideas and innovations. In 2020, the Switzerland launched a 4-year research project to improve the prevention of Legionella in drinking-water installations in buildings. Swiss legislation allows a maximum of 1000 cfu/L Legionella spp. in public shower systems and 100 cfu/L in whirlpools and steam baths. Public showers are those in hospitals, residential homes, schools, sports facilities, barracks, prisons and hotels. They must be operated according to recognized
technology, and the operators are responsible for self-control with appropriate documentation. Switzerland consists of 26 cantons, each of which may interpret Swiss federal law differently, allowing regionally adapted solutions but obviating harmonized application of a law. The rules for building drinking-water installations are defined by industry associations and not by legislation and are available in a guideline, a standard and a recommendation. All stakeholders are responsible for the quality of drinking-water in buildings, from the owner to the architect, planner, manufacturer, installer, operator and consumer. Building owners undertake a situation analysis (hazard analysis and risk assessment) every 1–2 years according to a checklist. Routine self-control and an emergency plan must be in place. The Cantonal Laboratory Zurich undertakes risk-based random sampling and inspections and investigates outbreaks associated with shower and bath water. It also serves as a contact for enquiries and reports from companies and consumers. There is a plan to use PCR for quantitative detection of Legionella, as a supplement to the standard cultivation method.

**Investigation and control of outbreaks of legionellosis in Norway**

In Norway, Legionnaire’s disease has been a mandatory notifiable since 1980, and the number of cases has been increasing over the past 20 years, although two thirds are associated with travel. Three outbreaks have been identified in Norway, in 2001, 2005 and 2008. The local authorities are responsible for investigation of cases, in particular do exposures mapping, environmental investigation and sampling, microbiological analysis and implement control and prevention measures. Travel-associated cases are reported to the ELDSNet. During the large outbreak in 2005 (with 103 cases and 11 deaths), 23 potential environmental sources were investigated, eight of which considered potential sources and further investigated. A cohort study was conducted of all 120 000 residents in the two cities in which cases occurred, and attack rates were calculated by age, city and source, with air dispersion modelling. The microbiological investigation found L. pneumophila serogroup 1 in 10 patients, in a cooling tower and in an air scrubber and aeration pond at the biological treatment plant and a river downstream the site. Genotyping of isolates from patients and the possible sources allowed for the identification of the likely source (the aeration pond or the air scrubber). The outbreak in 2008 had occurred at the same facility and the main source was the scrubber. The results indicate the importance of proper risk assessment of industrial sites and aerosol-generating facilities and proper maintenance and management, including air and wastewater in outbreak investigation. The outbreak investigation also illustrates that Legionella can probably spread over larger areas with different mechanisms and that geographic mapping is useful in identifying the source. The existing standards are for third-party inspection of cooling towers and air scrubbers by a company accredited by Norway or equivalent ISO certification, but the standard value for Legionella in wastewater has not been set in Norway. The Legionella guide includes recommendations for preventive measures for specific systems such as cooling towers, internal water distribution networks and air scrubbers, and there are general requirements to prevent wastewater from endangering health and polluting the environment.

**Surveillance of legionellosis and outbreak detection in the Netherlands**

The incidence of Legionnaires’ disease in the Netherlands was 3.3 cases/100 000 persons in 2019 with more domestic cases than those associated with travel. The number of cases has been increasing since 2021, possibly due to weather conditions. In investigating cases, physicians and laboratories notify to regional health services, which seek the source and interview patients and their families and then notify the national level. The information of the identified sources is included in the national level database that helps to detect if multiple cases have been exposed to the same potential source. Tools are available for continuous geographical analysis in order to
detect clusters and outbreaks, which is followed by environmental sampling of potential sources. A 10-year national outbreak detection programme (2002–2012) found that most of the 1448 possible sources of exposure that were sampled were drinking-water installations. Genotypic matches were found for 41 of 392 patients, mostly matching with sources in hospitals, wellness centres, hotels and spa. The latest analysis in 2013-2020 on genotype matching reveals important shift to wastewater systems due to several outbreaks linked to such systems; and to private spa pools where legislative requirements and operation and maintenance are lacking. There is mismatch between patient isolates and isolates from drinking-water, indicating probability of the environmental sources and influence of weather conditions in Legionella growth. Dutch legislation on drinking-water (2002) requires risk assessment and control plans for priority settings such as hospitals and other health-care settings, retirement homes, travel accommodation, wellness centres and pools. In addition, all buildings should comply with the requirements set by the plumbing standard, including the temperature requirements. In response to a question on the reasons of the higher incidence rate and whether it is due to not chlorinating the water, it was clarified that the higher incidence might be the result of enhanced diagnosis, as all cases of severe pneumonia are tested for Legionella and only a small proportion of cases are attributed to water.

The session continued with the group work to discuss intersectoral collaboration and communication in managing outbreaks of legionellosis.

After a brief reminder of the principles and main steps of outbreak management, three groups of participants discussed the following scenario.

Scenario:
Six cases of legionellosis have been notified in the past 24 h to the municipal public health department of city X by the main hospital. One patient has died, and another is in intensive care. In addition, an unusual increase was seen in the past 3 days in consultations for respiratory infections at one primary care centre in the same district, but no tests were performed. The municipal medical officer organizes an urgent meeting and assembles an outbreak team. Three additional cases are notified that evening. Interviews with the patients and their families show that all the laboratory-confirmed cases had been to a popular shopping centre within 10 days of symptom onset. None had travelled outside the city. No other common exposure was found. The shopping centre had been closed for 2 months due to strict restrictions and lockdown in response to a wave of COVID-19 in the country. It had reopened 2 weeks previously, when the main restrictions had been lifted after a decrease in COVID-19 incidence. The shopping centre comprises three blocks and more than 100 shops and restaurants. Each block has a large rest room, with toilets and sinks, and one has five showers. There is also a gym with two swimming pools and a steam bath. It is not clear yet which areas of the shopping centre the patients visited. The participants met in three groups and focused the discussion on intersectoral collaboration and risk communication during outbreaks of legionellosis. The questions and discussion points are outlined below.

- Which organizations would you engage in investigating the outbreak? What would be their roles? Is there a mechanism for coordination among human, environmental health and other relevant sectors at local level in your country? Are these aspects defined in a
preparedness plan at local level? Are there regular meetings or other types of contact among these sectors in non-outbreak periods?

The response should include both the local and national public health authorities to undertake prompt action to investigate the outbreak, identify the infection source and take necessary response measures. The local preparedness plans are in place in majority countries. Official coordination mechanism for outbreak response should be established and the roles and responsibilities of members in the investigation and management of outbreak should be defined. The outbreak investigation team will include public health experts, epidemiologists, clinicians, environmental hygiene specialists, microbiologists, laboratory personnel and communication experts. The manager of the shopping centre and technicians should also be involved. Some countries indicated that a district operational team should be set up, to organise control and preventive measures, such as disinfecting water distribution systems.

- How should risk communication activities and messages be coordinated and aligned among the various stakeholders? Would a spokesman be appointed? Which channels and mechanisms would be used to develop and distribute the messages to ensure that they reach the right people?

The groups indicated a need to establishing an adequate communication mechanism between involved organizations as well as for engaging with the public. It is important to appoint a spokesperson (i.e. local chief medical officer) and involve professionals from local and national public health institutions and the media representative to effectively coordinate the risk communication measures. Messages to the community and stakeholders should be accurate, carefully considered, clear and understandable.

**Session 4: Strengthening national capacities for prevention and control of Legionella in regulation and practice**

The session focused on the approaches used in the development of the regulations, country experiences in setting up and implementing legislative framework and interactive discussions on the challenges, opportunities and priorities for action for prevention and control of Legionella.

**Considerations in setting up and implementing the national regulations and surveillance framework**

The legislation and standards set mandatory requirements and responsibilities of stakeholders. The guidelines or non-binding standards are advisory of nature and allow voluntary application. Both approaches are used in establishing regulatory framework in countries. Development of the regulation and its scope can be prompted by different factors, including the serious outbreak and disease burden, international advisory and regulatory requirements, protection of vulnerable groups and industrial best practices. The authorities involved include ministries of public health, the environment, labour, housing and infrastructure, standardization bodies and professional or industrial associations. Regulations may address (a) clinical-epidemiological aspects, such as inclusion of legionellosis in the list of notifiable diseases, the requirements related to disease surveillance or outbreak investigation and response; and (b) environmental dimension, such as drinking-water and domestic hot water, pools and spas, cooling towers and air-conditioning and other specific environments (e.g., dental water lines, car-washing). The regulation on legionella may include the following components: health-based regulatory values, roles and responsibilities
It is important to consider several aspects in establishing or improving clinical surveillance of legionellosis, which include: undertaking a national situation analysis to assess the regulatory framework, surveillance system capacity and burden of legionellosis; defining the objectives and scope of surveillance tailored to the national context; design the reporting scheme and database for legionellosis surveillance; use of data to inform regulatory and practical measures to prevent Legionella infections. In setting requirements for environmental surveillance, considerations should be given to the specificity of sampling frame, reliability of testing and identification of Legionella, defining regulatory values, using additional indicators (water temperature, disinfectant levels), and implementing a risk-based approach is used to eliminate conditions that favour the proliferation of Legionella.

In developing regulations, it is essential to consider human resources and institutional and laboratory capacity and consider the financial aspects of enforcing the regulations. A stepwise approach is recommended, according to the available resources, followed by review and revision. A laddered approach was proposed in designing and implementing the regulations, as presented in the figure below.

Belarussian experience and need for strengthening national capacities for prevention and control of legionellosis infection

In Belarus, a database had been started only in the past 8 years, although few cases of legionellosis had been registered. Methods for detecting legionella in the environment and clinical materials as well as methodology for epidemiological surveillance of legionellosis have been developed as basis for setting up a fully functional surveillance system. Surveillance data indicate that health facilities, public buildings, spas, swimming pools, hotels and rooms with air-conditioning are as the risk areas. In a survey for Legionella in 2014–2018, > 2100 wipes and 1300 water samples were taken in healthcare, recreational and sports institutions and in hotels, and 333 isolates of Legionella were found, most of which were L. pneumophila. Risk identification and assessment algorithm was developed and being used in practice, especially in health-care establishments. Capacity building trainings in epidemiology and clinical diagnosis
have been conducted and laboratory capacity has been increased. The laboratory analyses include culture test of respiratory samples, measurement of soluble antigens in urine, antibodies in serum and PCR and ELISA for both clinical and environmental samples. The presence of Legionella in water systems and the occurrence of legionellosis urged establishing a firm legal basis in the country. Newly adopted hygienic norms on drinking-water safety (adopted by the Cabinet in January 2021) include requirements for Legionella in hot and cold-water systems in public buildings and controls will be conducted at least once a year. Furthermore, guidance documents were issued for laboratory diagnosis and analysis of environmental samples and the algorithm was developed for quantitative monitoring of legionella in high-risk settings such as public swimming pools, spa, hotels, health facilities and cooling systems.

**Legionella guidelines in the Russian Federation: harmonization in accordance with international standards**

Prevention and control of legionellosis is a priority issue in the Russian Federation. Experience in a large outbreak of legionellosis near Ekaterinburg in the Urals showed the importance of taking urine samples, especially in intensive care units. In the period 2007-2010, series of methodological guideline, sanitary and epidemiological rules and standards such as for detection of L. pneumophila in the environment; epidemiological surveillance, diagnosis and treatment and prevention of legionellosis were developed in line with international requirements. Preventive monitoring activities conducted in high-risk areas, for which personnel had to be trained and accredited in all parts of country. Laboratory analysis such as urinary antigen tests, use of real time PCR for monitoring potentially dangerous water-systems; typing of clinical and environmental isolates are conducted at the national level. The efficiency of the surveillance system was proven during the 2018 winter Olympic Games, when all the hotels and sports facilities were efficiently tested, with no major problems. International standards are followed for urine antigen testing and risk assessment of water samples. New hygienic standards and norms (SanPins) for ensuring safety of habitat environment for humans and prevention of infectious diseases (2021) also focus on Legionella in specific settings (cooling systems, air conditioners, hot water systems of health facilities and social case settings. Case detection rate for legionellosis is determined by 2 main factors: the level of Legionella contamination in high-risk systems and mandatory use of urine antigen test for clinical isolates from patients with acute severe pneumonia. No major outbreaks have been seen, but the increase in the number of cases is a problem in the country, even if it is lower than in other parts of the world. All pneumonia patients are tested for legionellosis, and standardized surveillance and prevention methods are used. It was noted that the introduction of the guidelines in the last decade was an important step in strengthening the surveillance and prevention of legionellosis in Russia.

In the discussion, participants raised the issue of keeping guidelines and regulations up to date, avoiding or minimizing conflicts with guidance and technical standards issued by other bodies and having a period of public consultation before a change is made, which provides an opportunity for other bodies to update their regulations. However, complex guidance documents can take years to update or new infrastructure may take years to plan, during which time guidance may change but cannot be incorporated, so that a new building is already non-compliant.

Sustainability is a valid aspect to include in planning, revising and enforcing standards and regulatory acts. The problem of conflicts might be exacerbated by moves to zero carbon and “pushes” to lowering warm water temperatures in the context of climate change, energy efficiency and cost saving. Related to this issue, an example was given about a national
children’s hospital that is planning to become carbon neutral. It runs at a lower temperature of 43 °C, uses copper–silver ionization as the primary control on water temperature and have to do extensive sampling to demonstrate control both of Legionella and the metals, the costs of which are significant in terms of both personnel and funds. From a public health perspective, lowering temperatures is not advisable. Lowering temperatures is being discussed in some countries (Germany, Netherlands and United Kingdom). There was general agreement on the need for developing a clear position on this aspect to support national work and having answers to several critical questions: Should water temperatures in domestic installations be lowered (is there evidence that it’s not detrimental to human health)? Should other heat-independent measures of legionella prevention in domestic water installations be studied/promoted? What are the individual and public costs if water temperatures are lowered/not lowered vs. climate-related casualties?

The session then continued with the group work to discuss challenges and countries’ priorities and requirements for support under the Protocol on Water and Health. Participants were asked to address three questions and the main suggestions and discussion points are summarised below.

a. What are the main difficulties in setting up and/or maintaining effective surveillance and response systems for Legionella prevention?

- Existing legislation and regulations do not sufficiently address all the potential sources of Legionella. Climatic conditions affect the safety of water supply; however, the regulations do not also address the aspects related to seasonality and climate change.

- In some countries, legionellosis is not included in the list of mandatory notifiable diseases, or the guidelines lack clear case definitions of legionellosis. Some participants noted that legionellosis is not a popular diagnosis and clinicians do not send patients' biomaterial for testing. These indicate the lack of diagnostic and surveillance capacity, thus the underdiagnosis and underreporting of legionellosis.

- The cases might also be missed because of overemphasis of laboratory analysis of Legionella serogroup 1, therefore, not all species and serogroups are picked up. In addition, overreliance on the use of urinary antigens and limited capacity/or use of PCR may affect the detection of Legionella.

- Timely and efficient coordination and collaboration between the different ministries and/or authorities is not always in place. Communication between hygienists, epidemiologists, clinicians and water operators need to be improved.

- Lowering the water temperatures in water systems to save energy and costs could lead to proliferation of Legionella and associated health risks. It was suggested to explore appropriate solutions addressing both, the prevention of potential risks of legionella in hot water systems and the energy efficiency due to climate change considerations.

b. What are the opportunities and/or actions for successful strengthening of national surveillance systems and management of legionellosis outbreaks?

- The new EU Drinking Water Directive recast requires risk assessment in domestic distribution systems and testing of Legionella in the priority settings such as
hospitals and hotels. It provides a sound regulatory push to transpose these requirements into national legislation and regulations.

- Undertaking national assessments to map and register potential sources, investigate the effects of climate change on colonization of water systems and identify differences in the geographic subregions.
- Strengthen the capacity of laboratories and the accreditation procedures and build capacity for environmental and for epidemiological investigations of outbreaks of legionellosis.
- Develop training programmes for health personnel, water system operators and other relevant professionals and organise capacity building trainings and simulation exercises.
- Improve design, quality and safety of building water systems and materials in contact with water, develop tools/protocols for safe design and installations and conduct training for design engineers and plumbers.

c. What activities would you propose as priorities for the new programme of work of the Protocol on Water and Health for 2023–2025?

- Support awareness-raising activities for all relevant stakeholders, including water supply utilities, wastewater companies and decision makers and organise capacity building workshops and foster networking and experience sharing at the national, subregional and regional context.
- Promote setting targets for prevention and control of Legionella in the context of the Protocol.
- Support the development of guidance and tools for setting up and improving the surveillance system of legionellosis and collate case studies on investigation and response to Legionella outbreaks.

**Session 5: Summary of the consultation and way forward**

The outcomes and conclusions of the meeting and proposed actions are summarised below.

a. Strengthen the national and local capacity for surveillance and outbreak management of legionellosis.

<table>
<thead>
<tr>
<th>Summary points</th>
<th>Proposed actions</th>
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<tbody>
<tr>
<td>Reports of outbreaks in 35 countries have been published in the scientific literature. Outbreaks and cases of legionellosis are likely underreported and the true extent of burden of legionellosis in the pan-European region is unknown.</td>
<td>• Extend regional review of evidence on Legionella by screening epidemiological bulletins and other sources.</td>
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<td>ECDC surveillance systems, which provide up-to-date data on the epidemiology of legionellosis for part</td>
<td>• Undertake national situation analyses of the burden of legionellosis and the associated risks.</td>
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<td>• Include legionellosis on national lists of notifiable diseases.</td>
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**Summary points**

- The region showed an increasing trend in 2017–2019.
  - Case identification and reporting are especially limited in eastern European, Caucasian and central Asian countries.
  - Public health authorities often lack financial, laboratory and/or human capacity for Legionella surveillance and outbreak investigations.

**Proposed actions**

- Develop or update national guidelines and tools for surveillance and epidemiological investigation and response to outbreaks of legionellosis.
- Build capacity for environmental surveillance of wastewater for Legionella as an integral component of public health surveillance.
- Establish targeted capacity-building programmes for professionals in public health, the environment and other relevant disciplines.

**b. Improve regulatory frameworks and promote uptake of risk-based management approach in buildings and other high-risk settings**

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<tr>
<th>Summary points</th>
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<tr>
<td>- Many countries have established regulatory requirements or are developing or revising their regulations in accordance with the WHO guidelines. However, one fourth of countries in the region have no requirements, and measures for prevention and control of Legionella.</td>
<td>- Take country tailored step-by-step actions to build an enabling environment, in particular in countries, considering the resources and institutional capacities.</td>
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<td>- Several countries have developed guidelines and set requirements for Legionella control in building water systems, in line with the WHO concept of a water safety plan.</td>
<td>- Establish or improve guidelines for risk assessment and good management practices for Legionella prevention.</td>
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<td>- The addition of Legionella to the recast European Directive on drinking-water will encourage countries to revise their regulations accordingly.</td>
<td>- Practise risk management of Legionella in high-risk settings such as in hospitals, nurseries, other public buildings and wastewater treatment plants.</td>
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<tr>
<td>- WHO Guidelines, tools (e.g. WASHFIT), ECDC guidelines and country best practices and tools provide useful reference in improving and enforcing the national regulations.</td>
<td>- Set specific requirements for domestic water distribution systems and improve the design, construction and regular maintenance of building water systems.</td>
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<td>- Set criteria for qualification and develop programmes for training public health and environmental professionals and building owners.</td>
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<td>- Raise awareness and communicate risk among physicians, various stakeholders and communities in high-risk settings for the prevention and control of Legionella.</td>
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</table>
c. Enhance national and local implementation of the core provisions of the Protocol on Water Health (Article 8) to establish and maintain surveillance and early warning systems, contingency plans and response capacities for water-related disease and scale up actions on Legionella control and prevention under the Protocol.

<table>
<thead>
<tr>
<th>Summary points</th>
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<tbody>
<tr>
<td>• Target setting in the context of the Protocol is a good policy drive for establishing and implementing priority WASH agenda.</td>
<td>• Publish the pan-European evidence review report on Legionella control and prevention for the pan-European region,</td>
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<tr>
<td>• Reporting to the Protocol includes complementary information for analysing the burden of and monitoring trends of legionellosis in the pan-European region.</td>
<td>• Compile case studies on investigation and response to Legionella outbreaks.</td>
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<td>• Programmatic activities under the Protocol are highly relevant and support national work on prevention and control of legionellosis. These include prevention and reduction of water-related disease, risk-based surveillance, safe management of water supplies and WASH in healthcare facilities and schools.</td>
<td>• Promote establishment of context-specific Legionella targets (e.g., building requirements, national regulations and guidance, disease reduction).</td>
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<td>• Support development and updating of guidance and tools for prevention and control of legionella in building water systems and establishing and improving surveillance systems for legionellosis.</td>
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<td>• Foster networking and experience-sharing at national, subregional and regional levels.</td>
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<td>• Organize capacity-building events in countries as requested.</td>
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**Closure of the meeting**

The meeting was closed by Oliver Schmoll noting that the meeting provided excellent opportunity to exchange experiences across countries and establish networks reminded participants that the Protocol is also an instrument for networking. He thanked all the participants for insightful contributions, Norway and Belarus for advancing the work on prevention and reduction of water-related diseases under the Protocol, Hungary for hosting the meeting.
## Annex 1

### Programme of the Meeting

**Tuesday, 30 November 2021**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>09:30–10:15</td>
<td>Opening and introduction&lt;br&gt;Opening and welcoming by Cecilia Müller, Chief Medical Officer, Hungary&lt;br&gt;Opening remarks by Kjetil Tveitan, Ministry of Health and Care Services, Norway&lt;br&gt;Opening remarks by Sonja Koeppel, United Nations Economic Commission for Europe&lt;br&gt;Introduction to the background, scope and objectives of the expert meeting (Oliver Schmoll, WHO European Centre of Environment and Health)&lt;br&gt;Interactive Sli.do element: getting to know each other</td>
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<tr>
<td>10:15–11:00</td>
<td><strong>Session 1. Situation overview</strong>&lt;br&gt;Overview of incidents and outbreaks of legionellosis in the pan-European region (Andrea Rechenburg, University of Bonn, Germany, and Alena Drazdova, Scientific and Practical Center for Hygiene, Belarus)&lt;br&gt;Status quo: regulatory frameworks and surveillance system capacities (Marta Vargha, National Public Health Center, Hungary)</td>
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<td>11:00–11:15</td>
<td>Health break</td>
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| 11:15–12:45 | **Session 2. Prevention and control of Legionella in building water systems: key principles and country experiences – Part 1**<br>Key principles and recommendations for Legionella prevention and control in building water systems (Susanne Surman-Lee, United Kingdom)<br>

*Good practices and specific approaches to strengthen the national regulations, environmental surveillance and risk assessment and risk management of Legionella in building water systems:*<br>Analysis of available information on Legionella in building water systems in Germany (Thomas Kistemann, University of Bonn, Germany)<br>National requirements for planning, construction and operation of potable water installations to reduce the proliferation of Legionella species in Germany (Christoph Theelen, German Technical and Scientific Association for Gas and Water)<br>Risk assessment tool and inspection of building water systems in Hungary (Zsofia Barna, Semmelweis University, Hungary)<br>Requirements set by the EU Drinking Water Directive on Legionella control and prevention and considerations for implementation (Bert Leemans, Directorate-General Environment, European Commission)<br>Interactive Sli.do element |

**Wednesday, 1 December 2021**
09:30–09:45 | Re-cap of Day 1

09:45–10:10 | **Session 2. Prevention and control of Legionella in building water systems: key principles and country experiences – Part 2**

*Good practices and specific approaches to strengthen the national regulations, environmental surveillance and risk assessment and risk management of Legionella in building water systems (continued):*

- Recommendations on Legionella prevention and control in building water systems established by the national guidelines in Italy (*Maria Luisa Ricci, National Institute of Health, Italy*).
- Environmental surveillance of wastewater for Legionella: experience of the Netherlands (*Ana Maria de Roda Husman, National Institute for Public Health and the Environment, Netherlands*).

10:10–11:20 | **Session 3. Clinical surveillance and outbreak management of legionellosis: main approaches and country experiences – Part 1**

- Overview of the Legionnaire’s disease epidemiology in the EU/EEA countries, surveillance and outbreak reporting schemes (*Lara Hallstrom, European Centre for Disease Control*).
- *Good practices and specific approaches to strengthen the clinical surveillance and outbreak management of legionellosis:*
  - France: Experience of setting up and implementing clinical surveillance of legionellosis and use of surveillance data for Legionella risk management strategies and actions (*Sophie Jarraud, National Reference Centre for Legionella, France*).
  - Germany: Source attribution of community-acquired cases of Legionnaires’ disease (*Udo Buchholz, Robert Koch-Institute, Germany*).
  - Czechia: National framework for surveillance and outbreak management of legionellosis, including in health care facilities (*Helena Sedláčková, Public Health Institute Ostrava, Jaroslav Sasek, National Institute of Public Health, Czechia*).
  - Switzerland: Capacity development and communicating Legionella risks and safe management requirements to building owners (*Hans Peter Füchslin, Cantonal Laboratory Zürich, Switzerland*).

11:20–11:35 | Health break

11:35–12:45 | **Session 3. Clinical surveillance and outbreak management of legionellosis: main approaches and country experiences – Part 2**

- Management of outbreaks (*Bernardo Guzman, Ministry of Health, Spain*).
- Group work: Improving intersectoral collaboration and communication in managing outbreaks of legionellosis and feedback to the plenary.

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**THURSDAY, 2 DECEMBER 2021**

09:30–09:45 | Summary of Day 2

09:45–10:10 | **Session 3. Clinical surveillance and outbreak management of legionellosis: main approaches and country experiences – Part 3**
**Good practices and specific approaches to strengthen the clinical surveillance and outbreak management of legionellosis (continued):**

- Norway: Tools and protocols for investigation and control of outbreaks of legionellosis
- Netherlands: Clinical surveillance and outbreak management of legionellosis: main approaches and experiences (*Petra Brandsema, National Institute for Public Health and the Environment, Netherlands*)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tbody>
<tr>
<td>10:10–11:00</td>
<td><strong>Session 4: Strengthening national capacities for prevention and control of Legionella in regulation and practice – Part 1</strong></td>
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<td>Considerations in setting up and implementing the national regulations and surveillance framework (<em>Marta Vargha</em>)</td>
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<td>Belarussian experience and need for strengthening the national capacities for prevention and control of Legionella (<em>Alena Drazdova</em>)</td>
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<td>Legionella guidelines in the Russian Federation: harmonization with international standards (<em>Igor Tartakovskii, Gamaleya Federal Research Centre for Epidemiology and Microbiology, Ministry of Health, Russian Federation</em>)</td>
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<tr>
<td>11:00–11:15</td>
<td>Health break</td>
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<tr>
<td>11:15–12:15</td>
<td><strong>Session 4: Strengthening national capacities for prevention and control of Legionella in regulation and practice – Part 2</strong></td>
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<td>Group work bottlenecks, country support needs and priority activities under the Protocol on Water and Health</td>
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<td>Feedback to the plenary</td>
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<td>12:15–12:30</td>
<td><strong>Session 5: Summary of the consultation and way forward</strong></td>
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<td>Summary of the meeting and next steps</td>
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<td>Closure of the meeting</td>
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Annex 2

LIST OF PARTICIPANTS

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The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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