indicators are assessed under the same areas; as well as the ways of impact rate classification are different and mostly respect national particularity. It is possible to assume, that the assessment systems sensitivity is different and the indicators independence is not always secured. The proposal of building environmental assessment system requires a complex multidisciplinary and multicriterion approach. The aim of building environmental assessment is a sustainable building design, which demands the cooperation among civil engineers, architects, environmentalists and other experts from different areas of building environmental assessment.

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DIMINISHING OF LEGIONELLA INFECTION RISK IN HOT WATER SUPPLY

The presence of Legionella pneumophila in hot and cold water systems inside any building is to be expected. Hotels and hospitals abroad, particularly those located in old buildings, represent a major source of risk for Legionnaires' disease due to the high frequency of Legionella contamination. The most vulnerable individuals are normally the elderly, or those already weakened by sickness or disease. The subject of the paper is our investigation Legionella contamination of hot water in a cross-sectional survey in Kosice, the second biggest city of the Slovak republic.

Introduction. More than a quarter of a century has passed since more than 200 people became sick from a mysterious disease at a fateful American Legion convention in Philadelphia. Ultimately, 34 people died from that exposure, which has since become known as Legionnaires' disease.

Following an investigation by the Centers for Disease Control in Atlanta, bacteria Legionella pneumophila was isolated in 1977. Since then, federal agencies all over the world have required more stringent cleaning and hygiene provisions for cooling towers and large scale air conditioning systems. Nevertheless, various outbreaks have occurred with recent, well-documented cases [1]. The first evidence of the association between water for human consumption from shower and nosocomial legionellosis was reported more than 20 years ago [2], and the hot water system is thought to be most frequent source of case or outbreaks within a hospital [3], where patients may be at higher risk for a severe infection [4]. Relatively little is known about sporadically occurring cases of community-acquired legionellosis, which accounts for most infection [5], although correlation analyses suggest that a substantial proportion of these cases may be residentially acquired and associated with bacteria in hot water distribution system. Absolute exclusion of these particular bacteria from building water systems may not be possible, nor necessary.

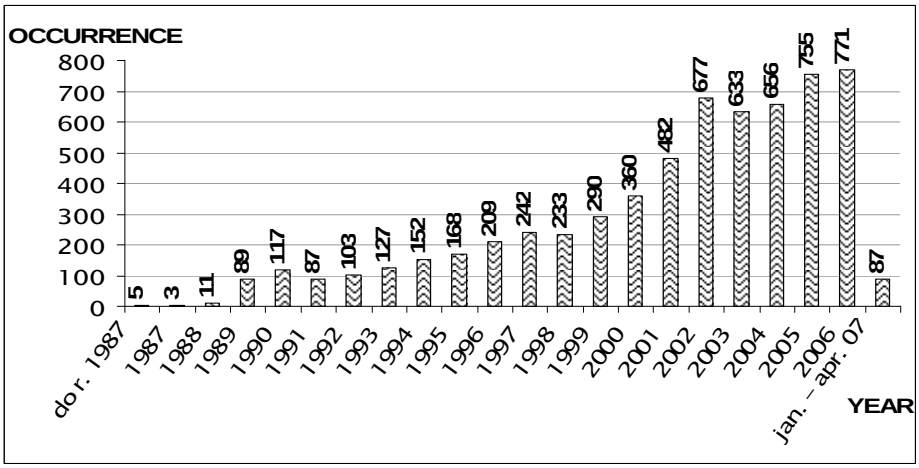

Figure 1 - The outcome of illness for all cases with onset in 2007 on the base of [9]

Outbreaks of disease have generally occurred when the concentrations in water systems have been high and aerosol has been produced. The aim therefore is to minimise the possibility for infectious doses to be produced as a result of operation of water systems. It is important that appropriate measures are taken to guard against conditions which may encourage Legionella multiplication**.**

For example, since mid July, 175 people have been hospitalized due to a pneumonia outbreat in the Urals region of Russia. A total of 150 have been diagnosed with Legionnaires´ disease, 66 of which were confirmed by laboratory tests. At least four have died. The startup of the hot water supply following a lenghty shutdown for maintenance is believed to have caused the outbreak [9]. Most apartment buildings in our regions received hot water from thermal plants rather than from water heaters within the buildings. The hot water supplies are typically shut down for a few weeks each summer for maintenance.

Legionnaires' disease and Pontiac fever. Legionnaires' disease lacks characteristic symptoms or signs: there is no typical syndrome, and not everyone exposed to the organism will develop symptoms of the disease (Yu et al.,1982; Macfarlane et al., 1984; Granados et al., 1989; Roig et al., 1991; Sopena et al., 1998; Ruiz et al., 1999; Gupta, Imperiale & Sarosi, 2001). However, several clinical signs are classically associated with Legionnaires' disease rather than with other causes of pneumonia.Legionnaires' disease is often initially characterized by anorexia, malaise and lethargy; also, patients may develop a mild and unproductive cough. About half of patients develope pus-forming sputum, and about one third develop blood-streaked sputum or cough up blood.(haemoptysis). Almost half of patients suffer from disorders related to the nervous system, such as confusion, delirium, depression, disorientation and hallucinations. These disorders may occur in the first week of the disease [6].

Pontiac fever is an acute, self-limiting, influenza-like illness without pneumonia (that is, it is "non-pneumonic"). Unlike Legionnaires' disease, Pontiac fever has a high attack rate, affecting up to 95% of exposed individuals (Glick et al., 1978).

For main characteristics of Legionnaires' disease and Pontiac fever see Table 1 [6]:

Table I

Main characteristics of Legionnaires' disease and Pontiac fever

Characteristic	Legionnaires' disease	Pontiac fever
Incubation period	2–10 days, rarely up to 20 days	5 hrs–3 days (most
Duration	Weeks	2–5 days
Case–fatality rate	Variable depending on susceptibility;in hospital patients, can reach 40–80%	No deaths
Attack rate	Attack rate 0.1–5% of the general population 0.4–14% in hospitals	Up to 95%

Sources: Woodhead & Macfarlane, 1987; Stout & Yu, 1997; Yu, 2000; Akbas & Yu, 2001; Mülazimoglu & Yu, 2001

1. The chain of causation

Humans are an incidental host to legionella. The following factors, or chains of causation, must be in place:

- A natural reservoir - any aquatic environment;
- Amplifying factors - man made sources or containers of warm water;
- Aerosolization - production of droplets of 5 microns or less;
- A virulent strain;
- Site of inoculation - legionella must reach the alveolar region;
- Suceptibility of the host [7].

2. Risk factors

The risk analysis shall at least take the following risk factors that promote the multiplication of legionella bacteria in tap water systems into account:

- water temperatures between 25°C and 50°C;
- stagnant water;
- long residence time;
- biofilm and sediment.

The risk analysis shall at least take the following risk-limiting factors into account:

- water temperatures below 20°C;
- water temperatures between 20°C and 25°C, in so far as water is standing for no more than one week and there is good flow;
- water temperatures above 50°C;
- water temperatures above 60°C (at which bacteria die off);
- flow;
- short residence time.

In cases in which the risk analysis shows that there are favourable circumstances for legionella growth and the owner chooses to manage this risk by reheating the water or increasing the temperature of the pipe network on a weekly basis (thermal disinfection), the owner shall adhere to one of the following ratios between temperature and time [8]:

Table II

Ratios between temperature and time

Temperature	Reheating time	Standing time for weekly thermal disinfection
60°C	10 minutes	20 minutes
65°C	1 minute	10 minutes
70°C	10 seconds	5 minutes

4. Hot and cold water systems

Hot water systems present the greatest risk in environments that allow the proliferation of Legionella. There are a variety of systems available to supply hot and cold water services: pressurised system and a gravity system.

For example:

- At the base of storage water heaters where the incoming cold water merges with the existing hot water;
- Water held in pipes between a recirculating hot water supply and an outlet (e.g. tap or shower) particularly when not in use as they may not be exposed to

Water systems may occasionally be contaminated with Legionella (usually in small numbers) which enter cold water storage systems from the main supply. This presents little risk under normal circumstances. Legionella will only grow in cold water systems and the distribution pipe-work when there are increased temperatures (e.g. due to heat gain), appropriate nutrients and stagnation.

Some of the features of gravity hot water systems that increase the risk of exposure to Legionella, such as having open tanks and relatively large storage volumes can be eliminated by moving to mains pressure systems. Other problems, such as the maintenance of water temperatures throughout the distribution system and changes in demand, can be simplified by changing to point of use water heaters with minimal or no storage.

Hot and cold water systems should be designed to aid safe operation by preventing or controlling conditions which permit the growth of Legionella and which allow easy cleaning and disinfection. In particular, the following should be considered:

- Materials such as natural rubber, hemp, linseed oil based jointing compounds and fibre washers should not be used in domestic water systems. Materials and fittings for use in water systems should be known not to support microbial growth;
- Water storage tanks should be fitted with covers which comply with the national water regulations and insect screens fitted to any pipework open to the atmosphere, e.g. the overflow pipe and vent;
- Multiple linked storage tanks should be avoided because of operati onal difficulties due to possible unequal flow rates and possible stagnation;
- Accumulator vessels on pressure boosted hot and cold water services should be fitted with diaphragms which are accessible for cleaning;
- The use of point of use hot water generators, with minimal or no storage for remote low use outlets should be considered;
- Thermostatic mixing valves (TMV) if any are fitted should be sited as close as possible to the point of use. Ideally, a single TMV should not serve multiple tap outlets but, if they are used, the mixed water pipe work should be kept as short as possible. Where a single TMV serves multiple showerheads, it is important to ensure that these showers are flushed frequently [9].

5. Legionella detection

Today, improvements in the detection of Legionnaires' disease, or Legionella, continue. Severn Trent Laboratories in Coventry, has recently introduced a new method for the rapid detection of Legionella. With the ability to generate results within 24 hours, the new Legionella PCR (Polymerase Chain Reaction) method is a key tool in establishing risk in emergency or outbreak situations and offers real-time analysis of a water system [1].

6. Legionella contamination of hot water in a cross-sectional survey in Kosice

From February through October 2006, a total of 46 water samples were collected from private homes, hospitals and boiler houses of Kosice, representative of Eastern Slovakia. Selection was made on the basis of the water distribution systems inside the town and buildings and heater types in each area. After we identified each building, we asked a random family, or work collective to participate in the study, i.e. to complete our questionnaire and give informed consensus for water collection. Laboratory

examinations and Legionella analysis were made by Regional health office – referential centre for potable water in Kosice.

Hot water samples were drawn from the bathroom outlets in the case of residential houses (shower heads or bathroom tap) in the sterile 1-L glass battles after a brief flow time (to eliminate cold water inside the tap or flexible shower pipe). To neutralize residual free chlorine, sodium thiuosulphate was added in sterile bottles for bacteriologic analysis, whereas acid-preserved glass bottles were used for chemical determinations. Collection bottles were returned to the laboratory immediately after sampling for bacteriologic examination. We used concentration of samples by membrane filtration. Filters Millipore were used for 10 ml sample volumes. Adjusted samples were inoculated on the medium GVPC surface.

7. Positive Samples

Water and aerosols samples survey to legionella presence according their outcomes is connected with saprophytic and thermotolerant amebas presence monitoring. In waters for human consumption (potable water cold - PWC) volume of legionellas were detected, from sporadic colonies 20 CCU/100ml up to massive colonizationist in the quantity 6700 CCU/100ml of a sample. Legionellas presence was detected in 8 samples of drinking water samples analysis. Positive finding was recorded in 8 samples of PWH (potable water hot). In waters for human consumption (potable water hot - PWH) volume of legionellas were detected, from sporadic colonies 200 CCU/100ml up to massive colonizationist in the quantity 14600 CCU/100ml of a sample. Legionellas presence was detected in 8 samples of PWH samples analysis, i.e. in 17,4 %.

Note: we speak about contamination in the case of > 1 000 CCU and heavy contamination in the case of > 10 000 CCU.

8. Results

We repeat sampling after thermal disinfection in contaminated places. After 12 days the level of legionella colonies was the same as before this measure (see Figure.2).

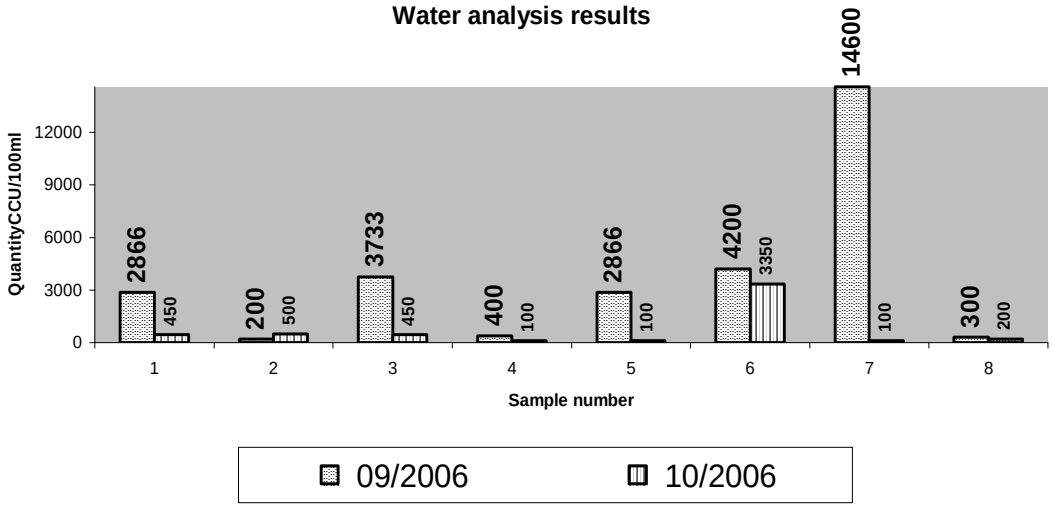

Fig. 2. Legionella results – positive samples

Much worse results were obtained at similar survey in Italy or Germany [6]. In this case 36 - 68 % of samples were positive. In case that thermal disinfection in contaminated places was not done, the concentration of bacterias will have exponential character – will continually increase. By collecting the samples we verify that thermal disinfection is not systemic solution and it is needed to find a new complex solution. A lot of European studies showed that there is evidence that anti-Legionella treatments like chlorination with chlorine dioxide and electrolysis of the water can have an effect on this bacterial contamination.

Conclusion. It is needed to minimize the health risk of Legionella colonization in distribution systems. Our results do not suggest specific new measures to control Legionella contamination except for the protective role of periodical temperatures of >60°C.

Our observations suggest that Legionella species should be considered when examining environmental contamination, which is essential to better evaluate environmental risk factors and select the most appropriate prevention and control measures. We do not believe disinfecting measures at the domestic level are needed, considering that our retrospective study on pneumonia in residents did not show a relevant evidence of risk in colonized buildings.

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OCENA ZGODNOŚCI WŁAŚCIWOŚCI BETONU

The subject of this paper are methods and criteria of conformity for the ready mixed concrete properties. Using the Monte Carlo simulation method sampling plans recommended in codes, based upon the acceptable quality level (AQL) and statistical criteria have been analyzed. The analyses show that in cases of small sample sizes these criteria can produce an undesired effects to the both producer and contractor. An approach based on assessing the risk of producer and contractor is also discussed in the paper.

Wprowadzenie. Najstarszą definicję jakości przypisuje się Platonowi, który określił ją jako pewien stopień doskonałości. Współcześnie, w kategoriach filozoficznych przyjmuje się, że jakość oznacza właściwość, rodzaj, gatunek, wartość danego przedmiotu czy zjawiska, która posiada cechy obiektywne, mierzalne, oraz subiektywne, oceniane indywidualnie. Natomiast w różnych dziedzinach nauki i techniki, w szczególności w naukach ekonomicznych i naukach o zarządzaniu, jakość jest różnie definiowana i oceniana. Na przykład, w normie ISO 9001:2000 przyjęto, że jakość oznacza „stopień, w jakim zbiór inherentnych cech spełnia wymagania". Zawężając zakres rozważań do obiektów budowlanych, w normie