Regulation on Legionella prevention in collective water systems

W.G. van der Schee
w.g.vd.schee@wolterendros.nl (TVVL)

Abstract

This paper focuses on the regulation on Legionella prevention in collective water systems in the Netherlands. After the outbreak of the Legionella epidemic January 1999 the Minister of Housing, Spatial Planning and the Environment sent the Legionella Prevention Action Plan to the lower house of the Dutch parliament. The aim was to have a quick reaction on a serious problem, which could threaten the public health. The technicians of TVVL and ISSO published two guidelines: Publication 55.1 "Legionella prevention in collective water systems" and Publication 55.2 "Legal responsibility for Legionella prevention in collective water systems". Both publications require technicians to make a Risk analysis and control plan.

Keywords

Legionella prevention; Collective water system; Risk analysis; Control plan.

1 Introduction

After the the Legionella epidemic of January 1999 in the Netherlands in Bovenkarspel, sent the Minister of Housing, Spatial Planning and the Environment a Legionella Prevention Action Plan to the Tweede Kamer (the Dutch Lower House) on 17 May 1999. This plan expressed the intention to develop a ministerial regulation as soon as possible, aimed at the prevention of legionnaire's disease, in so far as contamination can be related to the supply of mains water that is designated for drinking, showers, washing or other domestic purposes.

The minister can adopt a regulation, in the event he should deem an immediate provision to be necessary with a view to preventing or limiting a serious public health hazard. The Interim Regulation was made by the Minister of Housing, Spatial Planning and the Environment on October 2000.

The Interim Regulation was mainly directed at collective water systems and collective water distribution systems: an amount of about 600,000 objects.

This interim regulation was in force until October 2002 and had to be followed up by a definitive regulation for Legionella Prevention. In December 2004 new rules for Legionella Prevention were put into force. This Definitive regulation for Legionella Prevention divides the 600,000 objects in two groups:
High and middle risk class. 10,000 objects
Low risk class about 590,000 objects

2 Definitive regulation for Legionella Prevention in high and middle risk classed objects

This definitive regulation for collective water systems is obligatory in the 10,000 objects with a so-called high and middle risk class:

- In a hospital facility
- Hotels
- In a centre for Asylum Seekers
- In a building with a cell function (Jails)
- In a bathing establishment
- On camping-sites
- In a port offering berthing and mooring of pleasure vessels

3 ISSO-publication 55.1: "Legionella prevention in collective water systems"

The manual "ISSO-publication 55.1" gives an elaboration on the risk analysis of collective drinking water systems and gives proposals of adaptation of the system and rules for drawing up the management for such systems. The manual gives information about solutions for large water systems with a small amount of aerosol producing tap points, model working instructions, information about the automation of control measures, alternative control measures and alternative detection methods.

There are two options for the risk analysis of a collective water system, i.e. a) a limited analysis or b) an extensive analysis. Although the new rules only speak of a risk analysis and does not mention the limited and extensive risk analyses, one has chosen to maintain the distinction in the manual. It is namely practical to carry out the limited analysis at first (mainly consisting of an inventory of the aerosol producing tap points) to determine whether simple measures are sufficient.

In both approaches, the results of the risk analysis are recorded. If control measures need to be taken on a regular basis, a management plan to this extent will be drawn up. Its implementation will be recorded in a logbook.

3.1 The risk analysis

A risk analysis shall be performed by performing one or more of the following steps in succession:

1. Inventory of tap outlets for anticipated aerosol formation;
2. Collection of data relating to the collective water supply or the collective pipe network;

3. Subdivision of the collective water supply or the collective pipe network into main functions;
4. Risk analysis from component to system.

3.1.1 Inventory of tap outlets for anticipated aerosol formation

For the execution of the inventory, the extent to which when using tap outlets forming part of, or connected to a collective water supply or collective pipe network, aerosols as well as legionella bacteria carried by them, whether or not in conjunction with other micro-organisms, can be released in quantities which, when inhaled, may have adverse effects on public health (referred to below as relevant quantities of inhalable aerosols) must be assessed.

The following aspects shall be established for each tap outlet:

- location of the tap outlet (description of the room);
- type of tap outlet (e.g. sink, washbasin, bath, shower, fire hose);
- an assessment as to whether relevant quantities of inhalable aerosols may be released on use.

3.1.2 Prevention at tap outlets

If following the execution it is shown that there are one or more tap outlets at which relevant quantities of inhalable aerosols may be released, at least one of the following measures shall be taken:

a. the aerosol-forming tap outlets must be removed;
b. in the supply pipe to the tap outlet concerned, a treatment technique must be applied which eliminates to a sufficient extent the legionella bacteria that have grown in the collective water supply or collective pipe network. At the request of the inspector, it must be demonstrated that this technique is effective and has no unacceptable side-effects on public health or the environment;
c. in accordance with paragraphs 3.1.3 to 3.1.5, a risk analysis must be performed for the section of the pipe between the (central) point of delivery of the collective water supply or the collective pipe network and the tap outlet concerned. A section of pipe that only supplies non-aerosol forming tap outlets may be excluded from the risk analysis provided that a regulatable non-return valve is present at the beginning of this section of pipe and the branch is located directly after the (central) point of delivery. See figure 1.
d. in accordance with paragraphs 3.1.3 to 3.1.5, a risk analysis must be performed for the whole of the collective water supply or collective pipe network.

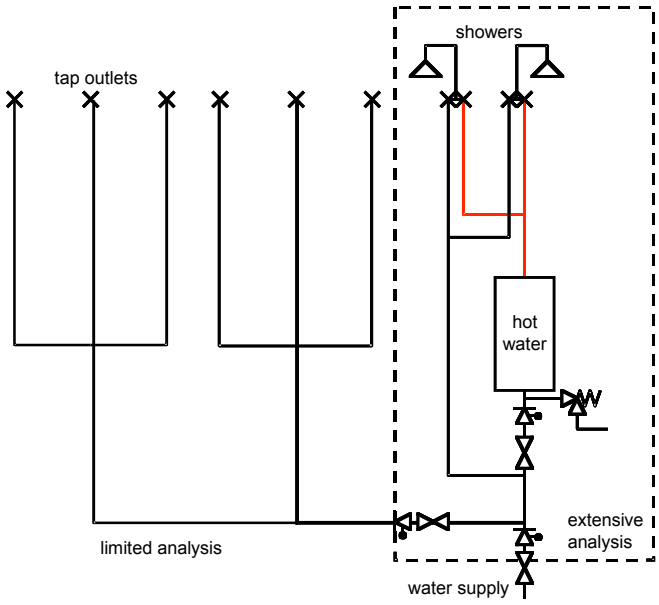

Figure 1 - Water supply separated by a regulatable non-return valve

To the extent that regular measures are required in order to manage the risk of infection from the aerosol-forming tap outlets, a control plan shall be compiled and implemented.

3.1.3 Collection of data relating to the collective water supply or the collective pipe network

For the purpose of the risk analysis, at least the following data shall be collected with regard to the installation:

- installation drawings or equivalent drawings, diagrams or descriptions showing the course of the pipe, the position of devices and relevant fittings (non-return valves) and tap outlets;
- a list of the devices used;
- the method of operation and temperature settings (design and in practice);
- the temperature of the tap water at the tap outlets located at a long distance from the (central) point of delivery or the hot water device, tap outlets with a long draw-off pipe and tap outlets that are used infrequently.

For the purpose of the risk analysis, at least the following data shall be collected with regard to the environment:

- room temperature (design, maximum daily average);
- temperatures above suspended ceilings or in ducts or (technical) rooms in which pipes are located;
- temperatures of walls, floors or ceilings in which other hot pipes are located.

To get an indication in new buildings of hot spots in shafts TNO developed a tool to calculate the temperature. See figure 2.

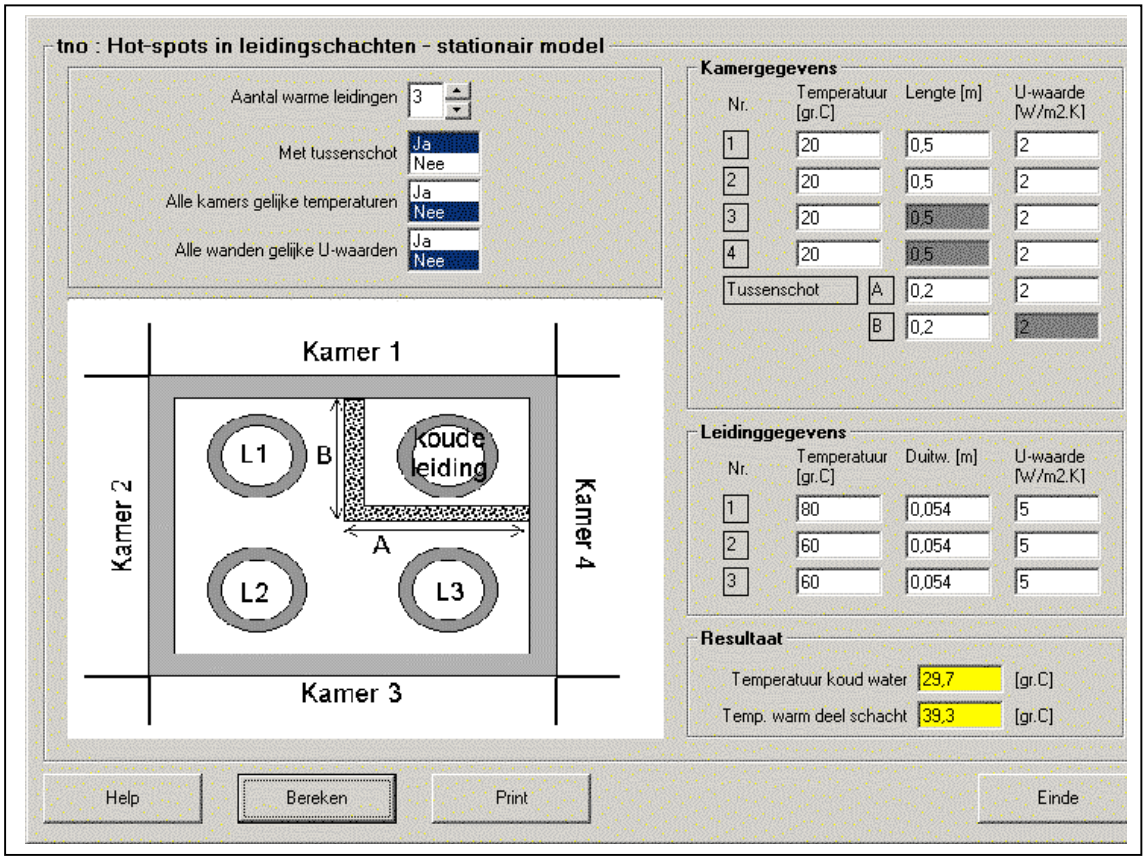

Figure 2 - Results of the calculation for the temperature in shafts

For the purpose of the risk analysis, at least the following data shall be collected with regard to use:

- operating times, including the periods in which the installation is not used on account of, for example, holidays or seasonal closures;
- use functions of the building (or part of the building);
- frequency of use.

The data as mentioned above shall be such that the following data may be derived from it for the purpose of the risk analysis:

- the function of the installation component;
- the material data of the installation component;
- the method of operation of the installation component;
- the temperature of the installation component.

3.1.4 Subdivision of the collective water supply or the collective pipe network into main functions

For the purpose of the risk analysis, the collective water supply or the collective pipe network is subdivided into five main functions:

1. the raw material, being the quality of the water at the point where the installation is connected to the point of delivery;
2. the drinking water or domestic water installation, being the pipe network between the central point of delivery and all tap outlets;
3. the hot tap water preparation system, being all hot water devices and their interconnection by means of pipes;
4. the hot water pipe network, being the pipe network between the outlet of the hot tap water preparation system and all tap outlets, including any circulation systems. If water mixing devices are used, this includes both the water mixing device and the distribution system to the tap outlets behind the water mixing device;
5. the tap outlets, being the points at which water is drawn off by the user and the points at which water is used for other domestic purposes, as a result of which it can come into contact with people.

3.1.5 Risk analysis from component to system

For each main function, as referred to in regulation 3.1, of the collective water supply or collective pipe network, the risk analysis shall specify whether there is a risk of growth of any legionella bacteria present.

The following procedure shall be followed for the risk analysis:

1. the collective water supply or the collective pipe network is subdivided into separate components for each main function as described in regulation 3.1;
2. a risk analysis is then carried out per component;
3. thereafter, a risk analysis per main function is carried out for the entire installation.

In the execution of the regulation, the following factors which may cause a change in the risk factors must be taken into account:

- pipe branch. Whether the function of a pipe and therefore the intensity of use changes is particularly important.
- room. Each room is checked to establish whether it poses an increased risk of hot spots for the drinking water installation pipes and hot water draw-off pipes.

Devices shall be regarded as separate components.

The components shall be numbered, starting at the inlet of the main function and ending at the termination points, and then listed.

The numbering of the components shall be marked on the installation diagram.

The data required for each component shall be entered in a list. The data referred comprises:

- a unique name or description of the component;

- the function, in order to indicate the regularity and intensity of the flow;
- the visibility of the component. If components are completely concealed in the structure of the building, this shall be recorded;
- the water content of storage devices and drinking water tanks;
- nature of the room(s), in order to indicate the anticipated maximum temperatures;
- dead legs:
- hot spots;
- description of series of pipe(s) / tap outlet(s).

The risk analysis for each component in the collective water supply or collective pipe network is based on the component data described in 3.1.3. On the basis of this data, the anticipated (different) operating statuses of the installation component concerned shall be determined. The risk qualification and any actions to be taken shall be determined in combination with the risk factors and risk qualification pertaining thereto as specified in 3.1.7.

In order to determine which operating situations, or combination of operating situations, that can reasonably be expected, may result in a maximum risk of growth of legionella bacteria, the following aspects shall at least be taken into account:
- resident, user and manager behaviour;
- faulty operation of installation components.

Risk analysis per main function and for the entire installation.
1. The risk analysis for the entire installation is based on the risk analysis per main function as referred to in 3.1.3.
2. The risk analysis per main function may be performed as follows:
    - the simple method, which requires that none of the components of the main function may have a negative risk assessment after any actions have been performed;
    - the formal risk analysis, using the symbols specified in regulation 3.1.7. For this purpose, the risk assessment determined previously per component is added up in accordance with the rules provided.

Recording the results of the risk analysis.
The results of the risk analysis, the data used for this purpose and any measures taken are recorded in writing, stating the date, an indication of the tap water installation to which the risk analysis relates, as well as the name and capacity of the person who performed the risk analysis.

3.1.6 Risk factors and risk qualification to be applied in the risk analysis

In the risk analysis, the owner's starting point shall be the risk factors referred to in regulation 3.1.6.1 and the risk qualification referred to in regulation 3.1.7.

3.1.6.1 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:

Table 1 - 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

Installations shall be designed and operated in such a way that temperatures between 25°C and 45°C are avoided as far as possible, particularly in combination with large volumes of water, stagnant water or long residence times.
This means that:
- there must be no dead legs in either cold or hot water systems;
- sections of drinking water or domestic water installations or of non-flowing hot water draw-off pipes must be prevented from heating up to above 25°C;
- if alternative disinfection methods are used, the removal or killing factors shown for that method must be used in the risk analysis to the extent that control measures are implemented that guarantee that the method consistently has this level of effectiveness in practice.

Cold water pipes that are not used for longer than one week shall be flushed through on a weekly basis. When doing so, water shall be drawn off for up to 10 seconds after a stable temperature has been reached.

Hot water pipes that are not used for longer than one week shall be flushed through on a weekly basis. When doing so, water shall be drawn off for up to 10 seconds after a stable temperature has been reached

3.1.7 Risk qualification

In the risk qualification, the symbols + (legionella bacteria dying off), 0 (neutral) and - (growth of legionella bacteria) shall be used. A concentration of less than 100 cfu/l shall be used as the reference. The meaning of multiple minuses and pluses is given below.

Table 2 - Meaning of symbols for risk qualification

Symbol	Meaning
0	No growth
-	Risk of slight growth
--	Risk of moderate growth
---	Risk of extensive growth
+	Limited reduction
++	Moderate reduction
+++	Extensive reduction

If components or clusters of components are connected in series, the following calculation rules apply to the symbols:

1. If multiple components or clusters score minuses or zeroes, the total score is given for the lowest score in the series. The component with the most minuses determines the total score. Multiple components with a negative score are therefore not totalled.
2. If one or more components together have a negative score, this can be compensated for by one or more pluses. If components that are connected in series have pluses, the positive scores may be totalled.
3. A minus can only be compensated for by a plus downstream; pluses cannot be ‘saved’.
4. Every main function must meet the requirement for a zero score.

The risk qualifications for various combinations of risk factors are given below.

Table 3 - Risk qualification as a function of risk factors

Risk factors		Pipe volume > 1 litre
Temperature (°C)	Duration of temperature in component	Risk qualification (+ dying off; - growth)
< 20°C	unlimited	0
20 – 25	unlimited	0[1]
> 25 – 45	< 2 days	0[2]
> 25 – 45	> 2 days < 1 week	0[3]
> 25 – 45	> 1 week	---
> 45 – 50	unlimited	--
> 50 – 55	unlimited	0
> 55 – 60	> 1 hour	+
> 55 – 60	> 2 hours	++
> 55 – 60	> 3 hours	+++
> 60 – 65	> 3 min	+
> 60 – 65	> 5 min	++
> 60 – 65	> 10 min	+++
> 65 – 70	> 20 sec	+
> 65 – 70	> 40 sec	++
> 65 – 70	> 1 min	+++

Notes:

1. At temperatures between 20°C and 25°C in combination with standing times of longer than one week or poor flow, slow development of bacteria may occur up to a level above the detection limit.

2. In this temperature phase, the risk qualification '0' is only given in a situation in which the water is heated up to a temperature above 60°C after the two days in accordance with the standing time specified in table 2. If this requirement is not met, the period with temperatures between 25 and 45°C is longer and the risk qualification must be determined for the whole period.

3. In this temperature phase, the risk qualification '0' is only given in a situation in which the water is heated up to a temperature above 60°C after the seven days in accordance with the standing time specified in table 2. If this requirement is not met, the risk qualification will be '---'. In the case of weekly preventative thermal disinfection, there may occasionally be a situation in which legionella bacteria occur in concentrations above the detection limit. It does not necessarily follow that this will result in high concentrations, so these situations can be regarded as safe. The risk qualification for pipe volumes of less than 1 litre at all temperatures above 25°C is neutral (0) provided there is good flow.

4 Regulation for Legionella Prevention in low risk classed objects

The owners of the other 590.000 low risk classed objects are obliged to care for the quality of the supplied water. They have to deliver drinking water with a high quality. Legionella is one of the parameters.

The new manual "ISSO-publication 55.2" helps the owners of the low risk classed objects to check the collective drinking water system on the risk of Legionella.

5 ISSO-publication 55.2: "Legal responsibility for Legionella prevention in collective water systems"

The manual ISSO-publication 55.2 "Legal responsibility for Legionella prevention in collective water systems" address to managers (owners, consultants and installers) of collective water systems which are not covered by the Water Supply Decree. The aim of the manual is to consult them on a easy, open and surveyable way to ensure the availability of reliable water. This manual focuses on the aspect Legionella.

The owner of a collective water system, which is not covered by the Water Supply Decree, is solely responsible for to ensure the quality of the supply.

The manual propose the next options:

- Inventory of the tap points by a limited analysis. The aim is to assess or and at how much tap points with relevant quantities of inhalable aerosols may be released on use. This inventory can be done by the owner themselves and focuses on the tap points.
- Further there are three possibilities:
  - If there are no tap points with relevant quantities of inhalable aerosols, the analysis is finished.
  - If there are a few tap points with relevant quantities of inhalable aerosols it is possible to take measures on those tap points.
  - If there are a large number of points with relevant quantities of inhalable aerosols, a risk analysis must be performed for the whole collective water supply or collective pipework.
- The results of the risk analysis, the data used for this purpose and any measures taken are recorded in the control plan.

In a water system with a small amount of there are three different approaches:

- Divide the water system just after the flow-meter (segmentation)
- Disinfection on the taps
- Local disinfection in the supply to the aerosol producing tap points

6 References

ISSO Publication 55.1 "Legionella prevention in collective water systems", Rotterdam, February 2005

ISSO Publication 55.2 " Legal responsibility for Legionella prevention in collective water systems", Rotterdam, March 2005

7 Presentation of Author

Walter van der Schee is a representative of the Netherlands Technical Association for Building Installations (TVVL). He is a member of the board of the department Sanitary Technologies (ST). The objective of the association is to promote research and technology in the field of building services. This is done by networking; giving courses; lectures; organizing symposia; subcontracting research and co-financing university-chairs.
For further information see www.tvvl.nl.
Walter van der Schee is working at Wolter & Dros were he is responsible for the engineering of installations in buildings.

8 Annex

The Water Supply Decree

A summary with the most important rules of the Water Supply Decree follows below.

Article 1
Definitions:
- The owner: the owner of a water supply company and the owner of a collective water supply;
- Domestic water: tap water that is exclusively intended for flushing toilets, use in washing machines or watering the garden;
- Domestic water supply: a facility which draws or treats water that is made available to third parties in the form of domestic water by means of a pipeline or distribution network;
- Hot tap water: a heated water supply;
- The Act: the Water Supply Act
- Aerosols: water particles with a diameter of between 1 and 10 micrometres dispersed in the air;
- Legionella bacteria: bacteria belonging to the legionella family;

Tap outlet: the place where tap water is made available for use;

Article 4
1. The tap water that the owner makes available to third parties may contain no micro-organisms, parasites or substances in numbers per volume unit or concentrations which may have adverse consequences for public health.

Article 15
The owner of a water supply company shall monitor the residential installations, collective water supplies and collective pipe networks and other tap water installations

directly or indirectly connected to his company's pipe network for the risk of contamination of his company's pipe network.
The owner of a water supply company shall likewise monitor the collective water supplies and collective pipe networks directly or indirectly connected to his company's pipe network for the risk of contamination of the tap water made available to third parties.

Rules on the prevention of legionella in tap water

A small summary of the Rules on the prevention of legionella in tap water follows below.

§ 1 General provisions

Article 17j

1. Tap water that is made available or used at the tap outlets in such a way that aerosols as well as legionella bacteria carried by them, whether or not in conjunction with other micro-organisms, are released in quantities which, when inhaled, may have adverse effects on public health, must contain less than 100 colony-forming units of legionella bacteria per litre.
2. The owner of a collective water supply or a collective pipe network shall ensure that the tap water made available by him to third parties complies with the provisions of paragraph 1 at the point of delivery.

§ 2 Risk analysis and control plan for collective water supplies and collective pipe networks

Article 17k

2. The owner of a collective pipe network shall perform a risk analysis in respect of the risk of non-compliance with Article 17j, paragraph 1.
3. The risk analysis referred to in paragraph 1 or 2 shall be performed prior to the commissioning of the collective water supply or collective pipe network.
4. The risk analysis referred to in paragraph 1 or paragraph 2 shall be repeated no later than three months after every change to the collective water supply or collective pipe network or the use thereof that is relevant to the risk referred to in paragraph 1 or paragraph 2, or a change in factors that may influence that risk. The first sentence does not relate to changes applied on the basis of Article 17n, paragraph 1 or Article 17o, paragraph 1.
5. The owner of the collective water supply or the collective pipe network shall ensure that the results of the risk analysis performed on the basis of paragraph 1, 2 or 4, together with an overview of the data used in that analysis and the measures taken, are available for inspection by the supervisor at the location of the collective water supply or collective pipe network, and are sent to the supervisor at his request in a form specified by him.
6. If the supervisor is of the opinion that the risk analysis referred to in paragraph 1, 2 or 4 has been performed inaccurately or incompletely or otherwise does not comply with the regulations set out in Annex F, he may require the owner referred to in

paragraph 1 or paragraph 2 to amend, supplement or repeat the risk analysis within a specified period of time.

Article 17l

5. The control plan shall at least comprise the following parts:
   a. drawings or descriptions indicating the location and layout of the collective water supply or collective pipe network;
   b. details of the devices in the collective water supply or collective pipe network with which hot tap water is made available, pipes and other devices;
   c. details of the origin, nature and quality of the water used in the preparation of tap water, including hot tap water;
   d. the results of the risk analysis performed;
   e. the measures that have been or are being taken, the work instructions for the execution of the measures and the regulations applied to the operation, maintenance and monitoring of the collective water supply or the collective pipe network, to the extent that these relate to the management of the risks identified in the risk analysis, along with an indication of who has been charged by the owner with the execution of the measures, what powers exist in this regard and in what way and with what frequency the measures are executed;
   f. the tap outlets at which and the frequency with which the tap water is tested for the presence of legionella bacteria in accordance with Article 17q;
   g. in the case of a collective water supply or a collective pipe network in an institution as referred to in Article 17i, paragraph 1, under a. or b.: a description of the steps taken in order to avoid the risk of scalding by persons who on account of their physical or mental capacity are incapable or insufficiently capable of adjusting the temperature of the tap water used in bodily care or otherwise to a safe level;
   h. the measures taken if there are indications that Article 4, paragraph 7 or Article 17j, paragraph 1, are not being complied with.

Article 17m

1. If the owner of a collective water supply or collective pipe network is required to compile a control plan on the basis of Article 17l, he shall ensure that this control plan is available for inspection by the supervisor at the location of the collective water supply or collective pipe network. At the request of the supervisor, the control plan shall be sent to him in a form specified by him.
2. If the supervisor is of the opinion that the control plan referred to in Article 17l, paragraph 1 or 3, is inaccurate or incomplete or otherwise does not comply with the regulations set out in Article 17l, paragraph 5, he may compel the owner to amend, supplement or redraft the control plan within a specified period of time. Paragraph 1 shall apply *mutatis mutandis*.

Article 17n

1. The owner of a collective water supply or a collective pipe network shall carry out measures and monitoring in accordance with the control plan.
2. The owner referred to in paragraph 1 shall keep records of the measures, monitoring and tests carried out pursuant to this Section as well as the results thereof in a logbook. This information shall be kept for a period of three years.
3. The owner referred to in paragraph 1 shall ensure that the logbook is available for inspection by the supervisor at the location of the collective water supply or the collective pipe network or, with the agreement of the supervisor, at another place to be determined by him. At the request of the supervisor, the logbook shall be sent to him in a form specified by him.

§ 3. Monitoring, reporting and measures

Article 17o

1. In circumstances which the owner of the collective water supply or collective pipe network may reasonably know or suspect may endanger or hinder compliance with Article 4, paragraph 7, or Article 17j, paragraph 1, he shall immediately inform the supervisor thereof and as a precaution shall implement the measures and monitoring specified in the control plan in view of such circumstances or, to the extent that no such measures have been provided for in the control plan or if a control plan is not applicable, the measures and monitoring that he may reasonably be required to implement in such circumstances, unless the supervisor specifies otherwise. In this case, the consumers shall also be informed and advised immediately about the health protection measures they should take, unless the supervisor is of the opinion that the exceedance of the standard will not have adverse effects on the health and welfare of the consumers.
2. If the owner of the collective water supply or collective pipe network establishes that tap water does not comply with Article 17j, paragraph 1, as a result of a circumstance originating in a residential installation, collective water supply or collective pipe network connected to his pipe network, he shall immediately inform the owner thereof and shall advise him as to the remedial action to be undertaken. He shall also inform the supervisor immediately.

Article 17p

1. Sampling and analysis of samples in execution of this Section shall take place in accordance with NEN 6265 or an equivalent method.
2. An equivalent method as referred to in paragraph 1 may only be applied with the prior permission of the inspector. All information relevant to the assessment of the equivalence of the method referred to must be submitted to the inspector in the form specified by him along with the application.

Article 17q

The owner of a collective water supply or collective pipe network shall test the tap water for the presence of legionella bacteria at the tap outlets referred to in Article 17i, paragraph 4, as part of the execution of the risk analysis referred to in Article 17k, paragraph 1 or 2, and thereafter at least every six months. The number of measurement points to be included in this test shall be determined in accordance with table 4. The

supervisor may require the measurement frequency or the number of measurement points to be included in the test to be reduced or increased.

Total number of tap outlets in the collective water supply or collective pipe network	Associated number of measurement points to be tested
Up to 50	2
51-100	4
101-200	6
201-400	8
401-800	10
801-1600	12
More than 1600	14

Table4: Definition of the number of measurement points for testing tap water for the presence of legionella bacteria in accordance with Article 17q