

# Legionella in Drinking Water

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## **From a positive result to a defensible remediation strategy**

Technical guidance for operators, facility managers,  
planners and hygiene professionals.

This report links assessment of findings, understanding  
of the installation, root-cause analysis, protective action  
and verification of effectiveness into a traceable  
decision process.

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**IN THE CONTEXT OF THE TRINKWV**

and the UBA recommendations of 2025

## Remediation starts with understanding the system



Measurement equipment in a real water installation

A positive *Legionella* result is the starting point for a technical and organisational investigation, not an isolated laboratory event. The value describes a sample taken at a particular place and time. It signals a need for action, but does not explain the cause or the extent of contamination. A short-term fall in the count is therefore not enough.

### Read the installation, operation and use together

The structure of the installation, operating data, patterns of use and sampling results show whether an abnormal result is locally confined or points to a systemic risk. The report follows the main steps from the initial assessment to documented stability. It connects regulatory duties with a technical sequence: understand the result, map the system, prioritise causes, justify the measures and verify their effectiveness.

This guidance does not replace an assessment of the individual installation. It helps operators, designers, specialist contractors, laboratories and the health authority work from the same record of responsibilities, findings and evidence.

### The central question

The aim is a defensible remediation strategy. It explains the conditions that create risk, limits exposure, addresses the technical cause and defines how later stability will be assessed. One device, one sample or one operating instruction cannot resolve a positive result on its own. Protection, engineering work and verification belong to one documented process.

### Contents

01 Findings and significance; 02 Operator duties; 03 Installation logic; 04 Investigation design; 05 Remediation priorities; 06 The role of disinfection; 07 Evidence of effectiveness. Each stage provides the basis for the next, with a traceable finding, responsible person, deadline and evidence.

## A measured value triggers action; it is not a diagnosis

The technical action value for *Legionella* species under the German Drinking Water Ordinance (TrinkwV) is 100 CFU per 100 ml. A result acquires technical meaning only in relation to its sampling point, time, installation condition and sampling plan. Reaching that value starts a structured task for the operator; the sample alone does not identify the cause, extent or a lasting remedy.

### Build a picture of the findings

Assess the sampling location, temperature, operating conditions, use, hydraulic connection and other results together. Ask what condition the measurement reveals. Is water stagnating? Is a section rarely used? Are temperatures insufficient, or is cold water being warmed unintentionally? Is a branch weakly connected hydraulically? Do several findings form a pattern?

These questions prevent a single intervention from being accepted too quickly as the solution. Disinfection may influence a result in the short term while the operating conditions that favour growth remain. Durable remediation addresses the cause and demonstrates that the intervention worked.

### Three perspectives must be combined

First, identify the people and areas that may be exposed. Second, investigate the installation as a connected system. Third, set criteria for assessing effectiveness. Keep the laboratory report, technical interpretation and operator decision as distinct records, while linking them clearly in the case file.

Source: TrinkwV Annex 3 Part II and section 51; German Environment Agency (UBA) recommendations dated 13 October 2025.

## What matters when the action value is reached

The sequence is to assess the finding, investigate causes, assess risk, implement measures and demonstrate effectiveness. Under section 51 TrinkwV, an operator must act without delay when the technical action value for *Legionella* species is reached. If there is no evidence that the authorised laboratory has already notified the authority, the finding must be reported to the public health office.

Investigation of the cause begins at the same time. This includes an on-site inspection and an assessment of whether the affected drinking-water installation complies with generally accepted engineering practice. A laboratory result does not describe pipe routing or day-to-day operation; knowledge of the installation, patterns of use and further results are needed to assess the situation.

### Written risk assessment

The written risk assessment identifies and evaluates hazards to human health and the events or situations that could cause them. It should describe the water supply system, observations from the site visit, deviations from generally accepted engineering practice, and other findings about water quality, the installation and its use. It must connect test results with sampling points, dates and times to the installation and possible exposure.

Its purpose is to show which risks must be limited first and which causes each proposed measure

addresses. The operator implements the health-protection measures required by generally accepted engineering practice and informs the health authority of the measures taken. Information to affected consumers depends on the finding, risk assessment and protective measures; section 52 TrinkwV governs consumer information.

After the measures are completed, document them in writing or electronically. The records must remain available for ten years and be supplied to the health authority on request. Work ends with a verifiable chain from decision to implementation and evidence of effectiveness, not merely with the engineering intervention.

Legal basis: TrinkwV sections 51 to 53, version consulted August 2026.

## Treat the installation as a connected system

A current system map connects water paths, operating states, sampling points and actual use. This is the starting point for a sound root-cause investigation. The installation includes water heating, storage, circulation, distribution, risers, outlets, mixing sections and rarely used areas. What matters is not just which components exist, but how the system is operated and used.

Drawings often show the original installation. Alterations, changes of use, decommissioned areas and temporary connections may have changed the real hydraulics. An on-site inspection compares plans, visible pipework and operating data.

### Construction, operation and use

The construction level covers pipe routing, volumes, storage, fittings and connections. The operating level includes temperature, circulation, run times, flow rates and controls. The use level shows when and how regularly water is drawn. Their interaction explains risk. A correctly designed outlet may stagnate if seldom used, and an acceptable temperature at the heater outlet says little about a distant or hydraulically weak branch.

The system map should unambiguously show relevant water paths, operating conditions and sampling locations. It supports the sampling plan, risk assessment, action plan and subsequent monitoring. Update it when findings, modifications or operating deviations become known. Every abnormal sampling point should be traceable to a water path, an operating state and documented use.

## Sampling must answer a technical question

One sample can reveal a local problem but cannot explain the whole drinking-water installation. The UBA recommendation of 13 October 2025 describes systemic investigation as a standardised way to detect possible contamination in the system. Sampling, testing and reporting must follow a clear question and be documented so the process can be reconstructed.

### Representative locations

Choose sampling points from the installation's structure, including locations at the water heater, in circulation and on relevant supply branches. Convenient locations are not automatically informative. A systemic investigation gives a standardised view. If it finds a problem, further investigation may be needed to locate its extent and possible causes. The two types of investigation have different purposes and should not be conflated.

A follow-up sampling plan tests hypotheses: Is the problem central or confined to one branch? Does the finding change along the water path? Are rarely used or temperature-critical areas affected? Every additional sample should answer one of these questions.

Interpret results alongside the date and time, sampling location and procedure, temperature, use and relevant operating state. Flushing, interruptions of use or other interventions shortly before sampling may affect the result and should be recorded. The right plan is as detailed as the

technical decision requires, neither maximal nor minimal. Bring its results together with the system map, site inspection and operating data.

Source: UBA, Systemic investigations of drinking-water installations for Legionella, 13 October 2025.

## Legionella risk seldom has a single cause

Assess temperature control, stagnation and use, biofilm and deposits, hydraulics and unwanted warming of cold water, and whether findings are local or form a system-wide pattern. It is their interaction in the specific installation that matters.

### Temperature control

The temperature profile along the system matters more than one reading: heater outlet, circulation return, distant branches, cold pipes in warm shafts and temperatures at outlets that are actually used. A deviation may have a structural, hydraulic or operational cause. Determine whether generation, distribution, circulation or use prevents the intended condition.

### Stagnation and use

Long residence times arise in rarely used areas, oversized pipework, weakly supplied branches or decommissioned parts. Record when water exchange occurs and which areas regularly stand idle. A flushing schedule can help organise exchange, but does not replace a technical assessment of pipe routing and long-term use.

### Biofilm, deposits and surfaces

Biofilm and deposits can maintain microbiological niches. Materials, age, operating method, corrosion, sediment and temperature may interact. Cleaning and disinfection should therefore be considered within the root-cause assessment.

## Hydraulics and unwanted warming

Poor hydraulic connections can cause inadequate exchange or temperature deviations. Parallel hot and cold pipes, shafts, plant rooms or heat sources can affect cold water. A single abnormal outlet may have a local cause; repeated findings across several water paths require a wider investigation. The risk assessment separates observation, technical interpretation and priority so each measure can be tied to the cause it is intended to address.

## Protect people immediately while investigating causes

Short-term protection and technical investigation begin in parallel. Determine which areas of use are affected, which people need particular protection and which immediate measures are proportionate. Depending on the case, these may include restrictions on use, alternative supply, point-of-use protection or targeted information. Document and review the decision regularly.

At the same time, combine the system map, on-site inspection, operating data and sampling results. The investigation should test cause-and-effect relationships, not just list deviations. A measure is defensible when its intended effect on a risk condition and the method for measuring that effect are clear.

## Prioritise by risk and effect

The order of remediation follows exposure, extent, technical cause and feasibility. First limit risks, then stabilise operation, then remove technical causes. Operational corrections may concern temperature, circulation, water exchange or use. Construction measures may address incorrect connections, dead legs, poorly connected sections or heat transfer.

An action plan separates immediate protection, operating improvements, technical remediation and verification. Give each measure a goal, owner, date and release criterion. This keeps temporary protection from becoming the unnoticed permanent state and allows new deviations to inform the

technical assessment.

## Place disinfection in the right role

Technology can support remediation, but it cannot replace diagnosis or the removal of conditions that favour growth. Disinfection may be used as a protective measure, part of technical remediation or a means of controlled operation. Its suitability depends on the finding, system structure, water quality, materials, use and defined objective; a generic choice of method is not defensible.

Before applying a method, define its goal, dosing point, operating parameters, monitoring, duration, stop criteria and release criteria. Address stagnation, temperature deviations and hydraulic weak points in parallel. Otherwise, a temporary improvement in microbiological results does not establish lasting stability.

Measurement-led dosing can capture operating states and support documented process control. The design remains project-specific. Dosing section, measurement points, control strategy, water chemistry, material compatibility and drinking-water hygiene requirements must be evaluated together. A control reading is not proof of microbiological effectiveness unless measurement location, maintenance, calibration and its connection to the hygiene goal are understood. Suitable follow-up testing and technical interpretation are still required.

The method decision should state how it limits exposure, stabilises operation or supports remediation, and which tasks remain outstanding.

## Completion requires evidence of stability

Plan verification before the measure begins. Define the intended condition, target values, sampling times and release criteria in a way that fits the measure. Record normal operation before interpreting follow-up results: temperatures, circulation, use, flushing and interruptions all matter.

A context-free sample may capture a favourable moment without representing system stability. Define the use and operational normalisation needed before sampling. The follow-up plan should include previously abnormal points, representative areas and locations linked to the technical cause. If water paths or operating conditions change, sampling must reflect those changes. Record the selection, date, time and operating state.

A new abnormal result may indicate an incomplete causal hypothesis, unstable operation, an unsuitable measure or another affected area. Continue the investigation accordingly. Release is an overall judgement: findings, operating data, the follow-up plan and technical assessment must together show that the intended condition has been achieved and is documented reliably.

## Documentation makes stability verifiable

Section 51(4) TrinkwV requires records to remain available for ten years after completion of the measures. This makes decisions traceable through a change of operator, alterations or a later finding. A sound record links findings, the system map, interpretation, decisions, implementation and evidence of effectiveness. It grows throughout the process; it is not an administrative task added at the end.

Keep an installation diagram with clear area names; the sampling plan, sites, dates, times and laboratory reports; site inspection and technical deviations; risk assessment of exposure and causes; and an

action plan with responsibilities, deadlines and release criteria. Date and version each document and identify its owner. Changes to the system map or action plan must remain visible. The laboratory, technical designer, contractor and operations team contribute different evidence; the operator brings it together.

Good documentation is short enough to use and detailed enough to audit. It distinguishes measurements, observations, assessments and decisions while connecting them through unambiguous references.

Legal basis: TrinkwV section 51(4).

## Remediation is a system task

A Legionella finding is addressed properly when protection, cause investigation, technical correction and verification are managed as one process. The laboratory result starts the investigation. The system map explains how construction, operation and use interact. The risk assessment prioritises exposure and causes. The action plan assigns people, dates and measurable aims.

A technical measure succeeds when the intended condition is stable in real operation and supported by appropriate follow-up findings. The result is a defensible remediation strategy rather than a one-off response: protection is organised, causes are not concealed and release rests on traceable criteria.

## Official references

[1] German Drinking Water Ordinance (TrinkwV), Annex 3 Part II: technical action value for Legionella species, 100 CFU/100 ml. German Federal Ministry of Justice and Federal Office of Justice, Gesetze im Internet.

[2] TrinkwV section 51: operator duties regarding Legionella species, including cause investigation, site inspection, risk assessment, measures and ten-year availability of records.

[3] TrinkwV sections 52 and 53: consumer information and notification and reporting duties of the authorised laboratory.

[4] German Environment Agency (UBA), Systemic investigations of drinking-water installations for Legionella: sampling, testing and reporting of results, 13 October 2025.

[5] UBA, Conducting a risk assessment concerning Legionella species under section 51 TrinkwV, 13 October 2025.

[6] Robert Koch Institute, RKI guidance on legionellosis and technical information on drinking-water installations, for medical and epidemiological context.

Sources: [gesetze-im-internet.de/trinkwv\\_2023](https://gesetze-im-internet.de/trinkwv_2023) · [umweltbundesamt.de/themen/wasser/trinkwasser](https://umweltbundesamt.de/themen/wasser/trinkwasser) · [rki.de](https://rki.de)

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