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Security of drinking water supply — Guidelines for risk and crisis management

Part 2: Risk management

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National foreword

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Security of drinking water supply - Guidelines for risk and crisis management - Part 2: Risk management

Sécurité de l'alimentation en eau potable - Lignes directrices pour la gestion des risques et des crises - Partie 2: Gestion des risques

Sicherheit der Trinkwasserversorgung - Leitlinien für das Risiko- und Krisenmanagement - Teil 2: Risikomanagement

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 15975-2:2013) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2014, and conflicting national standards shall be withdrawn at the latest by February 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

In crisis situations, which are difficult to forecast and, therefore, impossible to make complete provision for in risk management, appropriate crisis response management applies. Such situations are addressed in EN 15975-1.

This second part of guidelines for risk and crisis management describes a risk management approach for routine operations. This standard is complemented by Part 1 addressing crisis management procedures.

This is the second part of the European Standard *"Security of drinking water supply — Guidelines for risk and crisis management*" consisting of two parts as follows:

— *Part 1: Crisis management*;

— *Part 2: Risk management*.

The elaboration of this European Standard has been financially supported by the EC and the CIPS Program (Grant Agreement HOME/2009/CIPS/FP/CEN-002).

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Introduction

A risk management approach, which is focused on all the elements of the drinking water supply chain (protection of sources, water abstraction, transport, treatment, storage and distribution), will contribute to meeting the drinking water supplier's requirements to ensure the safe, reliable, sustainable, environmentally friendly and economical operation of its drinking water supply system in order to provide safe drinking water up to consumers' taps. This standard supports the holistic Water Safety Plans (WSP) approach of the World Health Organization (WHO) (see [2], [3]).

Across Europe, there are many different ways to organise drinking water supply. The responsibility for risk management may differ depending on legislation and the nature of the organisations involved (public or private). National legislation can impose definitions that differ from the ones defined in this standard. In this case, the necessary adaptations should be made in the application of this standard.

This document incorporates fundamental elements of the WHO Water Safety Plan approach. As it is based on risk management, the approach helps to prevent a potential impairment of supply. The goal of the approach is to support water suppliers to actively address safety issues in the context of routine water supply management and operations.

Implementing a risk management approach is of added value as it supports systematic evaluation of the drinking water supply system's setup, diligent performance of system management as well as identification and prioritisation of improvement and upgrade needs. Furthermore, it improves communication among stakeholders, particularly those who share responsibility for the water supply chain.

The overall drinking water risk management approach employs the more general principles of value analysis which can be applied across many fields of business activity. This approach helps reinforce the significance of drinking water supply risk management within the organization.

1 Scope

This European Standard describes the principles of a risk management approach to improve the integrity of the drinking water supply system.

This European Standard addresses all entities and stakeholders sharing responsibility in the provision of safe drinking water throughout the entire supply chain from the source to the point of use.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
drinking water supply system integrity
existence of drinking water supply system suitable to meet specified quality, quantity, continuity and pressure targets in accordance with legal/regulatory requirements and the drinking water supplier's objectives

2.2
hazard
biological, chemical, physical or radiological agent in, or condition of water, with the potential to cause harm to public health

Note 1 to entry: Condition includes quantity.

2.3
hazardous event
event that introduces hazards to, or fails to remove them from, the drinking water supply system

2.4
corrective action
action to eliminate the cause of a non-conformity (non-fulfilment of an operational target) and to prevent recurrence

2.5
risk control measure
any action and activity that can be used to prevent or eliminate a hazard or reduce it to an acceptable level

2.6
risk
combination of the likelihood of a hazardous event and the severity of consequences, if the hazard occurs in the drinking water supply system

2.7
failure
deviation from normal operating conditions characterised by its cause and the extent

2.8
validation
obtain evidence, assessment and approval of the capability of the current or proposed control measures

2.9
verification
routine confirmation, through the provision of objective evidence, that the drinking water supply system is delivering water in accordance with the set objectives and that the risk management approach is effective

2.10
drinking water supplier
body responsible for delivering drinking water

3 Objectives and stakeholders' responsibility

A drinking water supplier should satisfy a number of objectives. For the purpose of this European Standard, the principal goal is the achievement of appropriate objectives in accordance with local and/or national regulations. These may include:

— health-based water quality objectives;

— service objectives (e.g. continuity, sufficient quantity, sufficient pressure at all points of delivery);

— acceptability (e.g. aesthetic) objectives.

The multiple-barrier approach aims to establish risk control measures throughout all processes in the drinking water supply chain (e.g. protection of resources, abstraction, treatment, storage, transport, distribution, water installations inside buildings). The application of the multiple-barrier approach is a sound basis to achieve the above-mentioned objectives.

Responsibilities in the drinking water supply chain may vary and rest with the service providers or other stakeholders (e.g. authorities, property owners). Each of them may have only limited control of the risks affecting the supply chain. In order to achieve the objectives of safe and secure water supply it is necessary that all the stakeholders involved cooperate.

4 Risk management approach

4.1 General

The drinking water supplier should introduce a risk management approach. For the purpose of this European Standard, this approach aims to identify hazards and hazardous events, and assess and control resulting risks that may occur in the drinking water supply chain from catchment to consumer. This approach comprises the elements shown in Figure 1.

All drinking water supply systems are faced with risks which need to be controlled adequately. The method employed to ensure appropriate risk control is called risk management. A consistent and systematic risk management approach allows the drinking water supplier to analyse and to compare risks that may occur in the elements of the drinking water supply chain (e.g. caused by technical failures, natural hazards, disasters or malicious attacks).

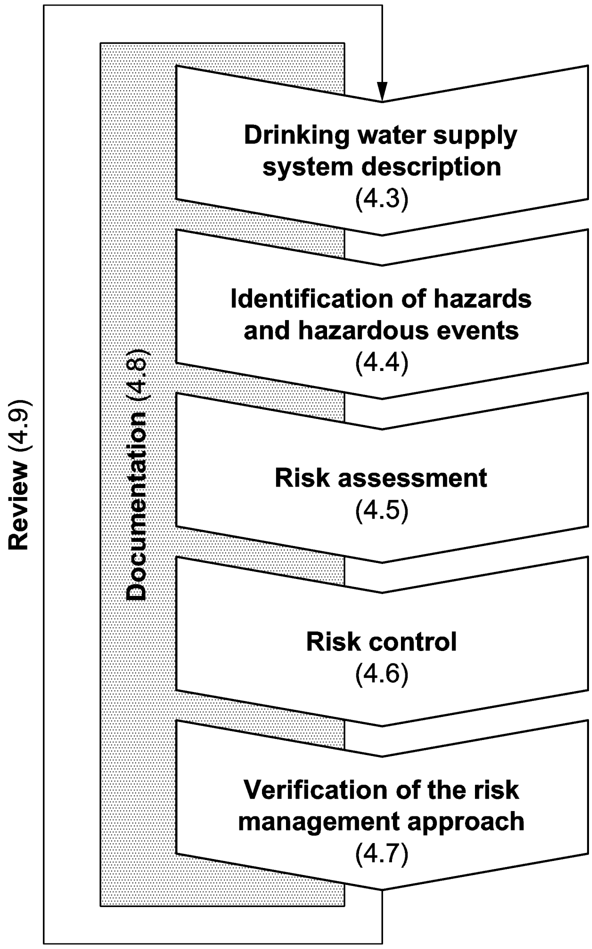

Figure 1 — Overview of risk management approach

4.2 Interdisciplinary group for risk management approach

The risk management approach should be developed and steered by a drinking water supplier's core risk management team.

The risk management approach should be applied by an interdisciplinary group whose members are adequately knowledgeable about the drinking water supply system concerned. External experts may be consulted for example to support the work, if necessary.

The respective roles of the interdisciplinary group, the drinking water supplier's core risk management team and the crisis management team (see EN 15975-1) should be determined.

4.3 Drinking water supply system description

The risk management approach should be based on an up-to-date description of the respective drinking water supply system taking account of relevant legal/regulatory requirements and knowledge gained from the interdisciplinary group. This description should cover all elements from the catchment area to the point of delivery to the customer or downstream distributor. This system description should include a flowchart for each supply system. It can be useful also to describe the situation outside the drinking water supplier’s own responsibility (e.g. conditions in the catchment area or service installations in the customers´ properties).

The responsibilities of the drinking water supplier and all other relevant stakeholders who share responsibility in the drinking water supply chain should be unambiguously defined together with the interfaces between them and their respective responsibilities at these interfaces.

4.4 Identification of hazards and hazardous events

Hazards can occur at various points in the drinking water supply chain and can be triggered by a variety of hazardous events. The goal of this step is to systematically identify hazards to the processes governing the normal operation of drinking water supply systems as well as corresponding hazardous events that can trigger hazards' occurrence. This analysis should be carried out for each element of the drinking water supply chain and be guided by the questions “What could go wrong?", "Where?" and "How?”.

The identification of hazards and hazardous events should include all parts of the drinking water supply system as well as the context in which that system operates. The identification process may initially focus on the aspects identified as essential for safeguarding the integrity of the drinking water supply and drinking water safety.

The identification process should be as precise as possible and each component under review should be analysed individually. This process should also cover associated impacts on relevant stakeholders.

The identification of hazards and hazardous events should always deliberately “ignore” the presence of any existing risk control measures. This will help to analyse hazards and hazardous events regardless of the effectiveness of risk control measures.

Drinking water suppliers should look back on their organisation's history and consider the knowledge gained from their own and others' operating experiences and take into account previous identification of hazards and hazardous events.

Pre-prepared checklists of possible hazards and hazardous events can be useful in hazard identification process. Critical review of the outcomes of the identification process by the drinking water supplier's own personnel and external experts may also be of added value.

4.5 Risk assessment

4.5.1 General

The evaluation of the drinking water supply system's integrity should be based on a process of risk assessment.

Risk assessment comprises the overall process of risk analysis and risk evaluation.

The risk assessment process is a valuable decision support tool which helps drinking water suppliers to identify and prioritise any improvement and upgrade needs required to meet defined objectives. This will facilitate efficient comparison of different types of risk and support decision making in the allocation of scarce resources. This process also supports the drinking water supplier's business planning process.

In preparing to undertake a risk assessment of the drinking water supply system, the drinking water supplier will need to create a framework and set of rules for the task. It is important to clearly define the risk assessment criteria and to ensure that these are consulted widely upon within the organisation and are endorsed by the responsible managers in the organisation.

4.5.2 Risk analysis

Risk analysis requires the interdisciplinary group to work systematically through the list of identified hazards and corresponding hazardous events. The interdisciplinary group should estimate the likelihood of each hazardous event occurring and the severity of consequences of the resulting hazard. The purpose of risk analysis is to score each risk individually. This is achieved by estimating (e.g. by multiplying) the likelihood of a hazardous event and the severity of consequences of the resulting hazard. Analysis of individual risks is undertaken with a view to their later prioritisation for risk control.

NOTE 1 For the purposes of this standard, the word “likelihood” is used to refer to the chance of a hazardous event happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically (such as a probability or a frequency over a given time period).

NOTE 2 The English term “likelihood” does not have a direct equivalent in some languages; instead, the equivalent of the term “probability” is often used. However, in English, “probability” is often narrowly interpreted as a mathematical term. Therefore, in risk management terminology, “likelihood” is used with the intent that it should have the same broad interpretation as the term “probability” has in many languages other than English.

Risk analysis should initially consider the severity of consequences and the likelihood that would exist in the absence of risk control measures (or following their failure). Risk analysis should subsequently consider severity of consequences and likelihood with current risk control measures in place. The reason for doing these two steps in the risk analysis is to identify the significance of individual current risk control measures, were these to deteriorate or fail. The process of risk evaluation (see 4.5.3) is then used to determine the priorities for further risk control measures and improvements.

Different types of risk can be amenable to different risk analysis approaches. However, to evaluate a population of risks a consistent approach should be adopted. There are typically three options to achieve this:

- quantitative analysis;
- semi-quantitative analysis;
- qualitative analysis.

Risk assessment matrices will support analysis and prioritisation of individual risks. To ensure consistency within each option, the drinking water supplier should develop its own tables, defining appropriate terms and ranges for likelihood and severity of consequences. These terms and ranges will assist in scoring individual risks and positioning them on the chosen risk assessment matrix.

Two examples of risk assessment matrices are given in Annex A.

Quantitative measurement of a hazard’s severity of consequences and a hazardous event’s likelihood can be determined for certain processes, but typically not for all. Frequently therefore semi-quantitative or qualitative approaches are adopted. Whichever approach is adopted, risks are scored by estimating the severity rating by the likelihood rating to give a risk rating (e.g. by multiplication in the case of quantitative or semi-quantitative ratings). Caution should be exercised when using a quantitative or semi-quantitative approach. Their apparently precise values can imply a false sense of accuracy although uncertainty may exist.

Any uncertainties in choosing appropriate likelihood and severity of consequence scales should result in a higher risk rating until that uncertainty can be removed or reduced. Such uncertainties may arise, for example, from lack of information, experience or knowledge bases for decisions. A drinking water supplier's approach to risk analysis should provide guidance on such choices. Significant uncertainties in risk analysis should always trigger further investigations.

4.5.3 Risk evaluation

The purpose of risk evaluation is to compare and prioritise risks regarding their estimated effect on the drinking water supply system's integrity and to make decisions about the need for amended or additional risk control measures.

Both the severity of consequences and the likelihood should be analysed twice. Firstly, assuming that no controls are present (“initial risk”), and secondly, taking into account existing control measures including information on their suitability and effectiveness (“residual risk”). This step-wise approach allows comparison of risk exposure.

This approach will reveal:

- where these exposures lie relative to the organisation’s objectives;
- what the effect of failure of existing controls might be; and

— how effective the present controls are.

Priority in terms of improvement and upgrade in order to ensure the ongoing integrity of the drinking water supply system and drinking water safety should be given to:

— high residual risk levels and

— key controls (e.g. disinfection) whose failure may compromise drinking water supply system integrity.

Some of the risks will have consequences (e.g. illness caused by water borne infection) that are unacceptable. In this case, the drinking water supplier should aim to eliminate or, where elimination is impracticable, to lower as far as reasonably practicable the likelihood of hazardous events and/or the hazard's severity of consequences causing this risk. Some risks (e.g. damage to the drinking water supply system's integrity by third parties) present an indirect threat to the delivery of safe drinking water. However, attempts should be made to control these to an acceptable level. In both cases, these can be addressed by risk control (see 4.6).

Risks that cannot be treated effectively should be considered in crisis management.

4.6 Risk control

4.6.1 General

Risk control is selection and implementation of risk treatment options to preserve the integrity of the drinking water supply chain with the aim of ensuring that the objectives (see Clause 3) are consistently met.

Given the drinking water supplier’s role in protecting public health, control measures offering a high degree of process safety and operating stability should be preferred for control of risks that would otherwise have severe consequences for public health.

The suitability of risk control measures should be validated and their effectiveness monitored in accordance with the drinking water supplier's specifications and/or procedures.

4.6.2 Identification of risk control measures

The identification of potential risk control measures should follow a prioritisation amongst the risks identified while the selection of appropriate measures should be based on standard specifications or procedures that the water supplier is able to support.

Risk control measures applied may be preventive or reactive to mitigate the risks.

Some existing control measures identified in risk analysis (see 4.5.2) and risk evaluation (see 4.5.3) may require improvement. For risks with no current risk control measures in place, they may need to be established.

In cases where no risk control measures are reasonably practicable or key control measures fail, crisis management should exist as a final control measure to ensure an effective and efficient response and recovery from this situation.

4.6.3 Validation of risk control measures

Validation is concerned with actively obtaining evidence that existing or new measures are suitable to control a specific risk and perform effectively under a range of conditions.

Complementary steps may be applied for risk control measure validation purposes, e.g.:

- evaluation of comparable long-term data sets collected under expected operating conditions;
- evaluation of critical operating conditions (e.g. by simulating hazardous event scenarios).

Review of published technical and scientific literature (e.g. on performance of individual treatment stages) will support validation.

Once validation has been completed, the risk prioritisation should be reviewed to ensure that earlier assumptions on risk control measures' effectiveness remain valid. If necessary, steps in 4.5.2 and 4.5.3 may require revisiting with improved knowledge of control measures actual effectiveness.

4.6.4 Implementation of risk control measures

The identified and validated risk control measures should be implemented. Implementation should be via improvement/upgrade plans in which short, medium or long-term control measures are identified for each significant risk. It should be recognised that these control measures for significant risks can also control less significant risks.

Once implementation has been completed, the risk prioritisation should be reviewed to identify the now most significant risk exposures.

4.6.5 Operational monitoring of risk control measures

The implementation and operation of risk control measures should be monitored. Operational monitoring requires the selection of suitable procedures and/or meaningful indicators. All established procedures should ensure that deviations from nominal conditions are identified early enough to initiate corrective action. The operational monitoring procedures employed may, for example, include measurements (e.g. water analysis), visual inspection and/or organisational control.

The selected procedures should be as easy as practicable to monitor.

4.6.6 Corrective action

Corrective action should be taken as soon as reasonably practicable once the operational monitoring of risk control measures indicates an unacceptable deviation from the pre-defined nominal conditions. If possible, corrective actions should be pre-defined and documented (e.g. by standard operating procedures).

4.7 Verification of the risk management approach

Verification serves to prove that the risk management approach applied is working properly to ensure the drinking water supply system's integrity, and thus continuous delivery of safe drinking water.

In order to verify compliance with the drinking water supplier's objectives (Clause 3), the quality of drinking water should be analysed in accordance with regulatory provisions to confirm compliance with health and aesthetic parameters.

In-house records and customer complaints, if applicable, should be evaluated, in order to confirm that the drinking water supplier's objectives are being achieved.

Verification should also include auditing whether the risk management of the drinking water supplier is complete, adequate and plausible and whether risk control measures installed ensure the drinking water supply system's integrity.

4.8 Documentation

The outcomes of the steps described in 4.3 to 4.7 should be documented so that:

— those conducting the risk management approach have access to suitable guidance;

— all decisions and assumptions taken in the risk management approach are transparent, traceable and thus revisable;

— review of compliance with the risk management approach is practicable;

— the risk management approach can be developed, maintained and refined.

A procedure how to use and how to maintain the documentation should be defined.

4.9 Review

The steps described in 4.1 to 4.8 should be reviewed:

a) to ensure their continuing validity;

b) in response to relevant changes, for example, to:

   1) the drinking water supply system;

   2) legal and/or regulatory requirements;

   3) technical specifications and procedures;

   4) the environment in which the drinking water supplier operates;

c) in response to incidents or emergencies (actual or narrowly avoided);

d) after each significant hazardous event.

Annex A
(informative)

Risk assessment matrix

The simplest variant (a 3x3 risk assessment matrix) is shown in Table A.1. A 5x5 risk assessment matrix is shown in Table A.2 which permits greater differentiation.

Alternatively a 4x4 risk assessment matrix can have some benefits in preventing choices defaulting to the middle box - and also allows the matrix to be divided into four quadrants. This can have value when considering strategic approaches to alternative risk control measures.

Table A.1 — Example of a 3x3 risk assessment matrix

		Severity of consequences		
		LOW	MEDIUM	HIGH
Likelihood of occurrence	LOW	**Low risk**	**Low risk**	**High risk**
	MEDIUM	**Low risk**	**Medium risk**	**High risk**
	HIGH	**Medium risk**	**High risk**	**High risk**

Table A.2 — Example of a 5x5 risk assessment matrix

			Severity of consequences				
			Insignificant	**Minor**	**Moderate**	**Major**	**Very severe**
		Rating	**1**	**2**	**3**	**4**	**5**
Likelihood of occurrence	**Most unlikely**	**1**	1	2	3	4	5
	Unlikely	**2**	2	4	6	8	10
	Medium	**3**	3	6	9	12	15
	Probable	**4**	4	8	12	16	20
	Almost certain	**5**	5	10	15	20	25

Bibliography

[1] EN 15975-1, *Security of drinking water supply — Guidelines for risk and crisis management — Part 1: Crisis management*

[2] World Health Organisation, *Guidelines for drinking-water quality*

[3] World Health Organisation, *Water Safety Plan manual (WSP manual): Step-by-step risk management for drinking-water suppliers*

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