Methods for risk analysis of drinking water systems from source to tap - Guidance report on Risk Analysis

Executive summary

Introduction

This report provides a complete overview of risk analyses methods for water utilities. The main target groups of the report are management and operational personnel of water utilities with some basic understanding of the main concepts of risk management.

Importance

The report aims at demonstrating the application of various risk analysis methods for water utility systems. Thus, it can serve as a guidance report for management of a water utility regarding which analyses are most relevant in various decision situations. The report is intended to give insight into the capabilities, the use and potential results of the various methods for risk analysis.

Approach

The report will refer to the TECHNEAU Case studies and other literature to give details on the various risk analysis methods. It also refers to the TECHNEAU Hazard Data Base (THDB) and to the TECHNEAU report, "Generic framework and method for integrated risk management in water safety plans".

Results

The main steps of a complete risk analysis are discussed:

- Scope / analysis objective
- System description
- Identification of hazards and hazardous events
- Estimation of risk (probabilities and consequences). Consequences with respect to both water quality and water quantity are considered.

More information

Generic framework and methods for integrated risk management in water safety plans, Deliverable 4.1.1, TECHNEAU, 2007.

TECHNEAU Hazard database (THDB) - Deliverable 4.1.4, TECHNEAU, 2008.

Deliverable number: D 4.2.4
Name of authors: P. Hokstad[1], J. Røstum[1], S. Sklet[1], L. Rosén[2], T.J.R. Pettersson[2]; A. Linde[2], S. Sturm[3], R. Beuken[4], D. Kirchner[6], C. Niewersch[6]
Organizations: [1]SINTEF, [2]Chalmers University of Technology, [3]TZW, [5]KWR, [6]RWTH Aachen
Contact person: Per Hokstad
Email: Per.Hokstad@sintef.no

TKI Categorisation

Classification											
Supply Chain		**Process Chain**		**Process Chain (cont'd)**		**Water Quality**		**Water Quantity (cont'd)**	
Source		**Raw water storage**		**Sludge treatment**		**Legislation/regulation**		- Leakage	
- Catchment		- Supply reservoir		- Settlement		- Raw water (source)		- Recycle	
- Groundwater		- Bankside storage		- Thickening		- Treated water			
- Surface water		**Pretreatment**		- Dewatering		**Chemical**		**Risk Management / Consumers**	
- Spring water		- Screening		- Disposal		- Organic compounds			
- Storm water		- Microstraining		**Chemical dosing**		- Inorganic compounds		**Risk analysis**	
- Brackish/seawater		**Primary treatment**		- pH adjustment		- Disinfection by-products		- Hazard identification	x
- Wastewater		- Sedimentation		- Coagulant		- Corrosion		- Risk estimation	x
Raw water storage		- Rapid filtration		- Polyelectrolyte		- Scaling		**Risk evaluation**	
- Supply reservoir		- Slow sand filtration		- Disinfectant		- Chlorine decay		- Risk tolerability decision	x
- Bankside storage		- Bank filtration		- Lead/plumbosolvency		**Microbiological**		- Analysis of options	
Water treatment		- Dune infiltration		**Control/instrumentation**		- Viruses		**Risk reduction / control**	
- Pretreatment		**Secondary treatment**		- Flow		- Parasites		- Risk reduction options	
- Primary treatment		- Coagulation/flocculation		- Pressure		- Bacteria		- Decision making	
- Secondary treatment		- Sedimentation		- pH		- Fungi		- Implementation	
- Sludge treatment		- Filtration		- Chlorine		**Aesthetic**		- Monitoring	
Treated water storage		- Dissolved air flotation(DAF)		- Dosing		- Hardness / alkalinity		**Risk Communication**	
- Service reservoir		- Ion exchange		- Telemetry		- pH		- Communication strategies	
Distribution		- Membrane treatment		**Analysis**		- Turbidity		- Potential pitfalls	
- Pumps		- Adsorption		- Chemical		- Colour		- Proven techniques	
- Supply pipe / main		- Disinfection		- Microbiological		- Taste		**Trust**	
Tap (Customer)		- Dechlorination		- Physical		- Odour		- In water safety/quality	
- Supply (service) pipe		**Treated water storage**						- In security of supply	
- Internal plumbing		- Service reservoir				**Water Quantity**		- In suppliers	
- Internal storage		**Distribution**						- In regulations and	

								regulators	
		- Disinfection				**Source**		**Willingness-to-pay/acceptance**	
		- Lead/plumbosolvency				- Source management		- For safety	
		- Manganese control				- Alternative source(s)		- For improved taste/odour	
		- Biofilm control				**Management**		- For infrastructure	
		Tap (Customer)				- Water balance		- For security of supply	
		- Point-of-entry (POE)				- Demand/supply trend(s)			
		- Point-of-use (POU)				- Demand reduction			

TKI Categorisation (continued)

Contains		**Constraints**		**Meta data**					
Report	x	Low cost		*Author(s)*					
Database		Simple technology		*Organisation(s)*					
Spreadsheet		No/low skill requirement		*Contact name*					
Model		No/low energy requirement		*Contact email*					
Research		No/low chemical requirement		*Quality controller name*					
Literature review	x	No/low sludge production		*Quality controller organisation*					
Trend analysis		Rural location		Source					
Case study / demonstration		Developing world location		*Date prepared*					
Financial / organisational				Date submitted (TKI)					
Methodology	x			Date revised (TKI)					
Legislation / regulation									
Benchmarking									