Workshop on early warning systems

ERNCIP thematic area Chemical and biological risks in the water sector Task 5, deliverable 1

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Section 1 — Background of the meeting

The European Reference Network on Critical Infrastructure Protection (ERNCIP) aims at providing a framework within which experimental facilities and laboratories share knowledge and expertise in order to harmonise test protocols throughout Europe, leading to better protection of critical infrastructures against all types of threats and hazards. ERNCIP is set up by the European Commission's Joint Research Centre (Institute for the Protection and Security of the Citizen) under the mandate of the Directorate-General for Migration, Home Affairs and Citizenship and the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs.

ERNCIP's thematic area 'Chemical and biological risks in the water sector' deals with the security of the drinking water supply.

One priority of the thematic group (TG) is early warning systems (EWS), which aim at protecting treatment plants and drinking water networks from being affected by malicious or harmful events. Ideally, these systems trigger an alarm as soon as the quality of the source water or the drinking water differs from normality and, hence, allow the operator to supervise it and react properly, if necessary. A second priority deals with the analytical identification of 'unknown' chemical and/or biological contaminations in drinking water following an incident. This rather analytical topic deals with screening methods used for the purpose of identifying and quantifying the individual contaminants rapidly as a basis for risk/crisis/mitigation management. Corresponding state-of-the-art reports were also elaborated.

The thematic group elaborated state-of-the-art-reports, inter alia, on 'sensors and early warning systems', 'biofilm formation' and 'monitoring techniques for biological contaminants'. The reports comprise of an appraisal of available instruments and discuss standardisation, gaps and (scientific) needs.

The workshop aimed at bringing together stakeholders from academia, operators of Critical Infrastructures (CI) (water unit operators) as well as manufacturers, who already offer security solutions on the market.

In parallel, a questionnaire was elaborated by the group in order to survey preparedness of water utilities against incidents and use of security solutions. The questionnaire was issued online approximately one month prior to the workshop. Specific water utilities as well as drinking water associations and governmental institutions were addressed and asked to complete the questionnaire.

Section 2 — Summary of the findings of the thematic group's work to date

The outcomes and conclusions of the mentioned state-of-the-art reports on 'sensors and early warning systems', 'biofilm formation' and 'monitoring techniques for biological contaminants' were the basis for the workshop. The major findings are listed below. At the workshop the authors of the reports briefly presented their work and raised open issues for discussion with the stakeholders. The major outcomes are summarised below.

Review of sensors to monitor water quality

- A number of sensors are available on the market. Lately, they have started to be accepted by water utilities.
- Sensor manufacturer verification schemes do not sufficiently match utility practices. Utilities will require validation studies.
- There is a poor link between sensor technologies and water quality regulations.
- Different types of contaminants and levels of exposure foster the use of event-detection software.
- Management of large data material and its translation into meaningful information constitutes a challenge.
- There are no standardised procedures for data analysis available.
- An increase in collaborating between SMEs and end-users is needed.

Review of monitoring techniques for biological contaminants

- Traditional parameters like turbidity or free chlorine (Cl_2) are surrogate indicators which are unspecific and insensitive.
- Available systems involve time-consuming and complex processes to identify strong biological poisons or pathogens.
- Potential systems like biosensors, electronic tongues and electronic noses, which are performing comparably to chemical sensors, are commercially not available.
- Most technologies are not technically mature for integration in online water surveillance systems.
- Further research and development of suitable systems is needed to identify and characterise waterborne threats in real time.

Deterioration of water quality due to biofilm development

- Deterioration of water quality due to biofilm formation is still a scientific topic with little practical background.
- There is a lack of measurement methods in general.
- The topic is not widespread. There is a lack of knowledge.
- Standard procedures for sampling, characterisation etc. are missing.
- EWS for biofilms are not available. Few systems are suited for monitoring.
- Sensors are theoretically suited for measurement, but limited applications are available for water.
- There is a lack of standard procedures.

In two break-out sessions the following questions were discussed and the outcome was presented by the moderators.

- What are needs of operators in terms of security monitoring?
- What would facilitate applying EWS in the future?
- How would a certain degree of standardisation of EWS help?

Section 3 — Findings and conclusions of the workshop

The outcomes of the state-of-the-art reports were presented and discussed with the stakeholders in order to elaborate their conclusions with operational realities and options for further action. Needs, gaps, drivers and obstacles were identified as far as possible. Special demands were worked out in terms of standardisation, harmonisation or validation.

General conclusions

- Water utilities are interested, open and want to learn to work with EWS, but combined with a good practice of automatic meter reading (AMR) as some of the consumption patterns today are still not perfectly known.
- Sensors should be cheap, simple and efficient. Different uses for sensors are:
  1. real time monitoring to be able to know if a problem is real and where it comes from with proper decision support to minimise problems;
  2. sensors for big events like the Superbowl, the Cannes Festival, etc. which facilitate preparing action plans that also avoid stopping the water supply.
- The project 'Techneau' made a good report on vulnerability; a risk assessment guideline is a result of the project.
- Risk assessment guidelines already exist (EN15975-2: *Security of drinking water supply — Guidelines for risk and crisis management— Part 2: Risk management*).
- One of the main problems for water utilities is the dynamic flow in the network, especially when pipes are being replaced. An increase of health-relevant parameter values indicated by, for example, colour or total organic carbon (TOC) measurements can be solved by chlorination. In susceptible pipes (especially cast iron), however, sensors cannot be placed due to interferences with iron.
- Sensors should be geo-referenced and also used to check efficiency of actions taken in the network (e.g. once a water utility detects a too low concentration of chlorine in the network, chlorine dosing needs to be applied locally. Nevertheless, it is not always possible to check afterwards, that optimal chlorine dosing was applied.)
- Currently, different understandings of EWS exist, which are usually restricted to quite simple 'traditional' parameters' (e.g. physico-chemical parameters) which are not enough.
- The workshop focused on EWS, but only two of the topics discussed are directly associated with this issue. Biofilms should be regarded as a separate issue of concern.

What are needs of operators?

- Operators and managers need to know their water utility risk (vulnerability assessment).
  Needs of operators seem to be focused on, for example, risk management plans. A description of different targets of EWS referring to different conditions and complexity of utilities is needed (e.g. vulnerability assessment, resources, size, general situation referring to security issues) to fix the complexity of a future EWS.
- Operators need clear indications of capabilities and performances of existing systems in order to be able to compare and select appropriate instruments.
  There is the impression that a complete overview of existing systems together with consolidated information on practical experience in everyday operation is missing. Better information would help individual utilities select appropriate

systems more easily and not having to always start again from the beginning by performing their own and local validations.

- Systems need to be simple and provide clear and unambiguous information for decision-making.
  Event detection software should be an important tool to control and evaluate data of the detector network. It should be a mandatory part of a system in order to assist the operator by providing facts for the human decision-making process.

What would facilitate applying EWS in the future?

- Systems should prove to comply (partly?) with legal frameworks (e.g. WHO water safety plan).
  EWS is a complementary instrument/measure for (obligatory) water safety/risk management.
- Uniform vulnerability assessment: A standardised methodology of individual risk/vulnerability assessment of water utilities would reveal areas of concern that need continuous monitoring. This would probably be linked to sensor investment. It is already compulsory for some of the big water companies supplying big populations but not for medium-sized and small ones. A vulnerability study would help to choose locations for sensors and optimise the cost–benefit ratio.

Would a certain degree of standardisation of EWS help?

- Improved general approaches to validation of EWS (single parts of EWS) would be helpful, as single utilities applying EWS have to put a lot of effort into own-validation procedures. A uniform definition of minimum criteria for EWS is still missing.
- Regulations would assist establishing EWS in water utilities. However, political awareness regarding threats caused by drinking water contamination is currently low.

Section 4 — Next steps

A questionnaire was elaborated, piloted and launched by the group which addresses security-relevant issues. It was intended to provide results from this survey at the workshop. However, the survey was delayed and only preliminary results could therefore be presented. The survey was left open until the end of 2014 and all addressees were informed about the extended deadline. All participants who indicated their interest in the results will receive an anonymous evaluation of the survey.

Systems to detect contamination events will be the focus of the thematic group's work in 2015. Specifically, we will address aspects of validation at close to real conditions, validation by external facilities, identification of critical parameters, which describe the system and its reliability and aspects of corresponding software. It is aimed to end up in a workshop agreement under the mandate M487 of DG Growth[1].

To detect a change of the drinking water's quality in real time is a first step to alert the management of a water utility. Consequently, the reason for this deterioration has to be identified by analytical means as a first response to an emergency. Several institutions across Europe have excellent experience in this field but knowledge is isolated and scattered. Proficiency tests for laboratories are available but there are no uniform procedures in place to approach unknown contamination. A workshop to bring together expert institutions in this field could trigger discussion of harmonised approaches and could lead to a process for standardising analytical responses to emergencies. Details will be elaborated by the group early in 2015.

[1] The Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

Annex 1 — Agenda

26 June	
09:30	Welcome with coffee
10:00	Welcome and opening (ERNCIP office)
10:05	Introduction of the workshop's aims (Philipp Hohenblum)
10:10	Introduction ERNCIP (ERNCIP office)
10:20	Introduction TG water (Philipp Hohenblum)
10:30	Presentation of relevant state-of-the-art reports: Sensors to monitor water quality (Jordi Raich) Monitoring techniques for biological contaminants (Peter Hufnagl) Monitoring of biofilms (Iris Trick)
11:30	Discussion and feedback to the reports
12:00	Reflection in working groups
12:30	Lunch (and networking)
13:30	Results of the drinking water utility questionnaires (Philipp Hohenblum)
14:00	Results of the working groups, discussion
15:30	Conclusions, next steps, farewell Closing
16:00	End of the workshop
16:00	Departure to airports

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