

WATER SAFETY PLANNING AS AN EFFECTIVE MEANS OF ENSURING SAFETY OF A DRINKING-WATER SUPPLY SYSTEM

Elena-Georgiana ZLOTEA, Beniamin-Adelin GARVĂN

Scientific Coordinator: Lect. PhD Adriana - Magdalena PIENARU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd,
District 1, 011464, Bucharest, Romania, Phone: +4021.318.25.64, Fax: + 4021.318.25.67,
Email: elenazlotea23@gmail.com, garvanbeny@gmail.com

Corresponding author email: elenazlotea23@gmail.com

Abstract

Effective planning for the supply of safe drinking-water must consider the growing uncertainties associated with a changing climate. Strengthening resilience can support water suppliers to better anticipate, respond to, cope with, recover quickly from, and adapt to, future shocks and stresses associated with climate variability and change. Water safety planning offers a systematic approach to build resilience to current and emerging climate threats by considering the implications of climate variability and change at each stage of the water supply.

In Romania, through the Order no. 2.721/2.551/2.727/2022, regarding the approval of the General Framework for water safety plans (WSP), the responsibilities of competent authorities and water producers and/or distributors regarding the preparation, assessment and approval of water safety plans, have been established.

The obligation to draw up the WSP rests with the producer, in collaboration with the water distributor, depending on the case, the implementation of such a document will be carried out by the water producer/distributor with the support of the WSP team, established at the level of water operators who supply at least 1,000 mc of water/day or supply a community with minimum 5,000 inhabitants.

Key words: *climate variability and change, water producer/distributor, Water Safety Plan.*

INTRODUCTION

The first World Health Organization (WHO) publication dealing specifically with drinking-water quality was published in 1958 as International Standards for Drinking Water.

In 1984-85, the 1st edition of the WHO Guidelines for Drinking-Water Quality (GDWQ) was published. It was recommended in 1995 that the GDWQ undergo a rolling revision process. During the revision of the WHO Guidelines for Drinking-water Quality leading to the 3rd edition, the value of the Water Safety Plan (WSP) approach has repeatedly been highlighted. The potential for water safety plan application has been evaluated in a series of expert review meetings in Berlin (2000), Adelaide (2001) and Loughborough (2001).

“The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that

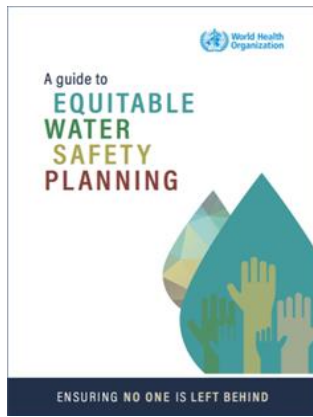
encompasses all steps in water supply from catchment to consumer. In these Guidelines, such approaches are called Water Safety Plans (WSPs)”.

The words above open Chapter 4 of the 3rd edition of the WHO GDWQ (2004) and capture the philosophy of the WSP approach.

The chapter describes the principles of the WSP approach rather than being a guide to their practical application.

This is why in 2009 it was published the “Water Safety Plan Manual, Step by Step Risk Management for Drinking Water Suppliers” by the joint effort of WHO and International Water Association (IWA). The aim of this Manual was to provide that practical guidance to facilitate WSP development focusing particularly on organized water supplies managed by a water utility or similar entity.

In 2023 it was published the Second edition of the manual.



As of 2017, WSPs have been developed and implemented in 93 countries worldwide (WHO & IWA 2017).

Kumpel et al. (2018) investigated the effectiveness of WSP implemented in 99 water supply utilities in 12 countries from the Asia-Pacific region. This study identified both benefits from WSPs and challenges in their implementation, including financial constraints and insufficient capacity.

Gunnarsdóttir et al. (2012) investigated the benefits of WSPs and critically analyzed the requirements for successful implementation and operation in Iceland, one of the first countries to adopt systematic preventive management for drinking water safety. The results showed several benefits of the WSP implementation process including changing the attitude of the staff to water safety and the culture within utilities. The lack of documentation and lack of regular internal and external audits were key obstacles to implementation of the WSP. The most important elements of success were the intensive training of staff and participation of staff in the whole process.

MATERIALS AND METHODS

In Romania, through the Order no. 2.721/2.551/2.727/2022, regarding the approval of the General Framework for water safety plans (WSP), the responsibilities of competent authorities and water producers and/or distributors regarding the preparation, assessment and approval of water safety plans, have been established.

The obligation to draw up the WSP rests with the producer, in collaboration with the water distributor, depending on the case, the

implementation of such a document will be carried out by the water producer/distributor with the support of the WSP team, established at the level of water operators who supply at least 1,000 mc of water/day or supply a community with minimum 5,000 inhabitants.

In order to produce a plan, a thorough assessment of the water supply process from water source to the consumer's tap must be carried out by the water provider.

Hazards and risk should be identified, and appropriate steps towards minimizing these risks are then investigated.

Stakeholders' communication and cooperation is vital for the success of WSP's implementation.

The development and implementation of WSP approach for each drinking water supply is as follows:

- Set up a team and decide a methodology by which a WSP will be developed
- Identify all the hazards and hazardous events that can affect the safety of water supply from the catchment, through treatment and distribution to the consumers' point of use
- Assess the risk presented by each hazard and hazardous event
- Consider if controls or barriers are in place for each significant risk and if these are effective
- Validate the effectiveness of controls and barriers Implement an improvement plan where necessary
- Demonstrate that the system is consistently safe
- Regularly review the hazards, risks and controls
- Keep accurate records for transparency and justification of outcomes.

Water safety planning is a systematic process that is widely recognized as the most reliable way to manage drinking-water supplies for the protection of public health.

Effective implementation of water safety planning can help to ensure that users receive safe and acceptable drinking-water in sufficient quantity. It achieves this by (see Figure 1):

- understanding the complete water supply;
- identifying where and how problems could arise;

- focusing initially on the priority risks, and putting barriers and management systems in place to proactively manage these risks;
- ensuring that all parts of the system continue to work effectively; and
- actively involving all stakeholders concerned with the supply of safe drinking-water.

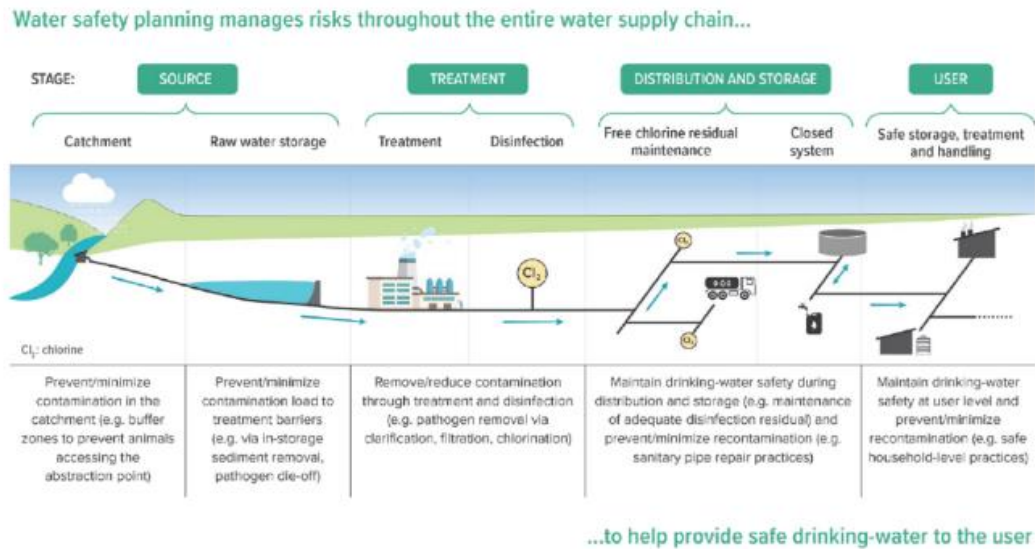


Figure 1. Stages of a Water Safety Plan

There is no single model approach for a water supplier to develop and implement water safety proper planning.

However, practical application of WSPs globally has identified several practices that underpin successful water safety planning, which should be considered by WSP teams.

Water safety planning is a continuous and iterative process for making stepwise improvements in the management of drinking-water supplies.

Water safety planning occurs in four phases (see Figure 2):

- WSP development: The WSP is established, and all 10 modules are developed and documented in the WSP.
- WSP operation: The WSP is applied routinely – that is, in activities that are conducted daily, weekly, and so on.
- WSP verification: WSP verification programmes take place.
- WSP review: The entire WSP is periodically reviewed. It is updated if needed (e.g., after an incident, a significant change in the water supply

or an audit). This review leads back to the WSP development phase.

Critical to success is ensuring that the WSP is a living document that is embedded within routine water supply management and is continuously reviewed and progressively strengthened.



Figure 2. Stages of a Water Safety Plan

RESULTS AND DISCUSSIONS

Pilot Study for the Water Safety Plan for Ploiesti Water Supply

As part of an EU project, implemented between 2008 – 2009, a Water Safety Plan was drafted for the municipality of Ploiesti, which was recommended as a site with a number of unique challenges:

- It has a complex management system including several key stakeholders.
- The water supply is run by a private company Apa Nova.
- It has a complex water supply from three groundwater field wells and two surface water sources.
- The surface water is treated by a separate branch of National Administration Romania Waters (ANAR).
- It has suffered from oil pollution on a number of occasions with oil refineries within the catchment.
- It is a manageable area and close to Bucharest.
- Apa Nova is accredited with ISO 9001 and 14001. Apa Nova is a French company which has experience in applying the WSP concept.

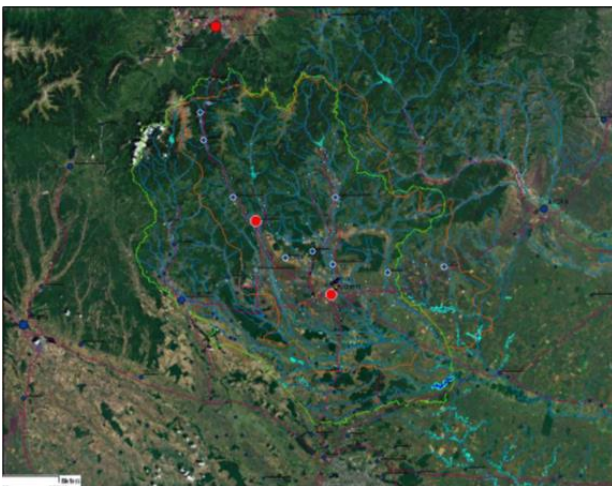


Figure 3. GIS Prahova County – water intakes

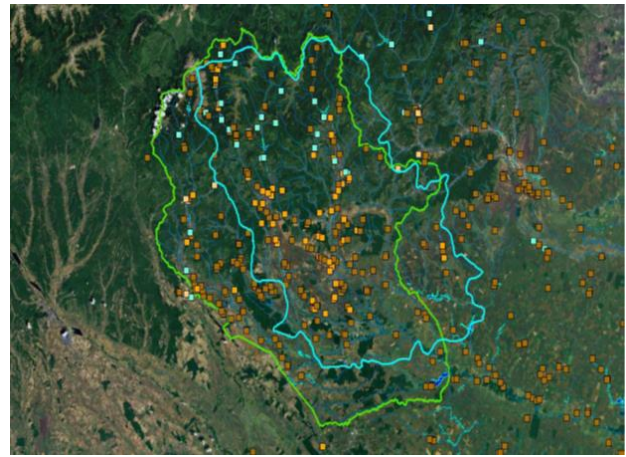


Figure 4. Water supply sources

This pilot study has covered the concepts of designing a WSP and provided eight tables showing the main items that need to be included in the WSP.

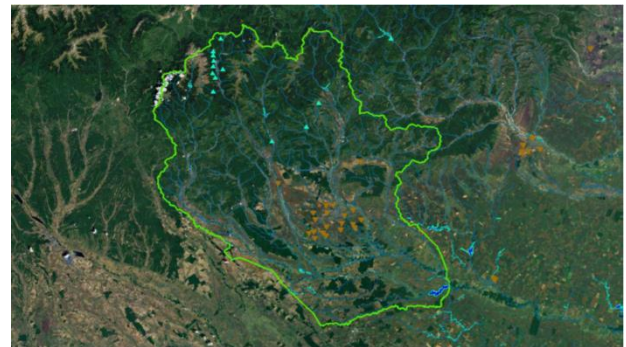


Figure 5. The National Administration Romanian Waters (ANAR) – Water intakes from surface and groundwater sources

As the WSP is a controlled document it has to be signed and authorised by the team. To improve the flexibility of the WSP, each table can be authorised separately and then combined in the final document.

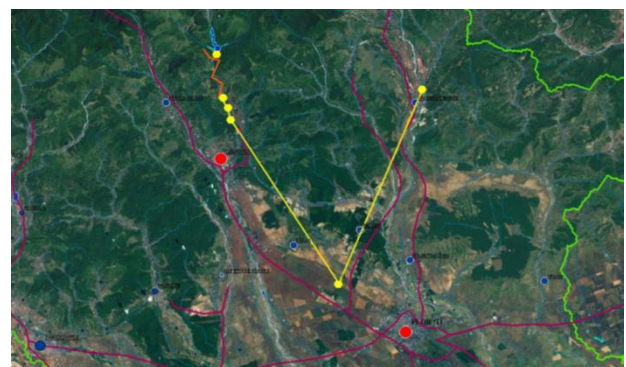


Figure 6. Water Supply System for Ploiesti



Figure 7. Deep groundwater front – monitoring points Apa Nova (GPS)

All WSPs should be derived by a dedicated WSP team of experts all conversant with the Ploiesti water supply.

Within the limited scope of the project it was impossible to establish such a team, as the members need to be appointed by senior management and apportioned time and resources to be established.

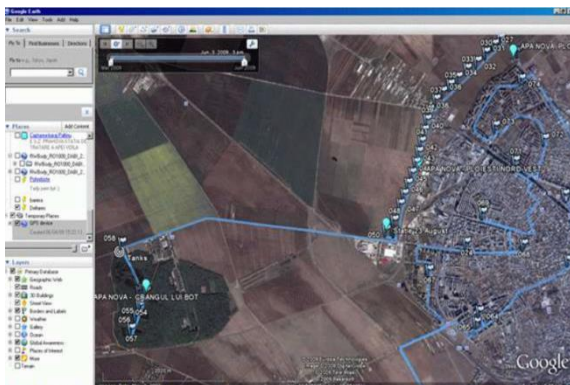


Figure 8. GPS Data for the waterwells and monitoring points Apa Nova

Therefore, the approach was to obtain as much data as possible, derive a template of the WSP, with suggestions on how this could be incorporated into the formal WSP, and to recommend how it should be further developed. Data and information were collected as follows:

- Nomination of the representatives of representative institutions for the Technical Working Group for WSP (the names and positions of the nominated persons, with responsibilities in monitoring and protecting the water source, were communicated).
- Specifications of the Treatment with Chemicals & Materials used together with the Quality Control procedures.

- Known dangers or threats to the safety of water quality in the pilot area, the reception basin, the treatment plant and the distribution systems.
- An audit plan/schedule compliance, including monitored parameters, monitoring frequency, analysis methods used, as well as quality control procedures
- List of historically contaminated sites in the pilot area.
- The documented list of measures (corrective actions or resistance to these threats), with any information that could be helpful.
- Records of any previous pollution incident in the pilot area.
- Water source protection programs
- Early warning and emergency procedures following a water pollution incident.
- Registration and preservation of procedures.
- Operating manuals (including preventive maintenance, as well as calibration equipment for measurement equipment).
- Training programs and relevant records for all staff (just one example would be useful at this stage).
- Laboratory manuals (including calibration procedures)
- The policy of customer complaints and the necessary procedures for resolving them
- Supporting ongoing programs, such as public awareness to protect water sources

CONCLUSIONS

One of the main advantages of drawing up a WSP is that any problem/gap in the protection and safety of the water supply should be highlighted.

A number of gaps were identified:

- Apa Nova is not the owner of the land on which the northeast catchment front is located, so it is difficult for the land to be fenced and the protection zone to be imposed. This legal contradiction must be resolved.
- The oil pipeline in the area of the raw water source from Lake Paltinu and Voila belonged to an oil company that apparently stopped working. Therefore, the issue of ownership and liability of the oil pipeline must be resolved, as currently the pipeline may continue to deteriorate due to lack of maintenance, posing an ongoing and increasing danger to the water

treatment plant. For this reason, once the property issue is resolved, it would be preferable to remove the pipeline.

- Apa Nova does not have a bacteriological laboratory, so the samples for the analysis of E. coli and total coliforms are sent to the Public Health Laboratory in Bucharest.

- A series of boreholes from the Crângul lui Bot catchment front indicate contamination with nitrates, in high concentrations. However, the data are insufficient to process the trend analysis, that is, to determine whether the nitrate concentration is increasing or decreasing over time.

ACKNOWLEDGEMENTS

This article represents the activity of documentation regarding the topic, the authors intend to continue research and draft a WSP for another water supply system for an urban or rural area in Romania.

REFERENCES

- Integrated Management Plan of the Buzău – Ialomița River Basin, the National Administration “Romanian Waters”, <https://rowater.ro/despre-noi/descrierea-activitatii/managementul-european-integrat-resurse-de-apa/planurile-de-management-ale-bazinelor-hidrografice/>
- PHARE Project 2006/018-147.03.03/05.06: „, Technical assistance for the preparation of the implementation of the requirements of the Directive on the quality of water for human consumption”
- Water Safety Plans (WSP) for public water supply systems in developing countries, Sam Godfrey și Guy Howard, © WEDC, Loughborough University, 2004
- Water Safety Plans Manual: <https://iwanetwork.org/publications/water-safety-plan-manual-2nd-ed/>
- WHO/SDE/WSH/05.06 Water Safety Plans – The Management of drinking water quality from the catchment to the consumer's tap, Annette Davison, Water Futures, Dundas Valley, Australia, Guy Howard, Jamie Bartram, WHO, Geneva, 2005
- World Health Organization, https://www.who.int/health-topics/water-sanitation-and-hygiene-wash#tab=tab_1

SECTION 04
CADASTRE

