Environmental Science and Policy 84 (2018) 97–104

Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

Risk governance of potential emerging risks to drinking water quality: Analysing current practices

Julia Hartmann[a,b,*], Monique van der Aa[a], Susanne Wuijts[a,c], Ana Maria de Roda Husman[a,d], Jan Peter van der Hoek[b,e]

[a] National Institute for Public Health and the Environment (RIVM), PO Box 1, 3720 BA Bilthoven, The Netherlands
[b] Delft University of Technology, P.O. Box 5, 2600 AA Delft, The Netherlands
[c] Utrecht University, P.O. Box 80125, 3508 TC Utrecht, The Netherlands
[d] Institute for Risk Assessment Sciences, P.O. Box 80178, 3508 TD Utrecht, The Netherlands
[e] Waternet, P.O. Box 94370, 1090 GJ Amsterdam, The Netherlands

ARTICLE INFO

Keywords:
Emerging contaminants
Risk governance
Drinking water quality

ABSTRACT

The presence of emerging contaminants in the aquatic environment may affect human health via exposure to drinking water. And, even if some of these emerging contaminants are not a threat to human health, their presence might still influence the public perception of drinking water quality. Over the last decades, much research has been done on emerging contaminants in the aquatic environment, most of which has focused on the identification of emerging contaminants and the characterisation of their toxic potential. However, only limited information is available on if, and how, scientific information is implemented in current policy approaches. The opportunities for science to contribute to the policy of emerging contaminants in drinking water have, therefore, not yet been identified.

A comparative analysis was performed of current approaches to the risk governance of emerging chemical contaminants in drinking water (resources) to identify any areas for improvement. The policy approaches used in the Netherlands, Germany, Switzerland and the state of Minnesota were analysed using the International Risk Governance Council framework as a normative concept. Quality indicators for the analysis were selected based on recent literature. Information sources used were scientific literature, policy documents, and newspaper articles.

Subsequently, suggestions for future research for proactive risk governance are given. Suggestions include the development of systematic analytical approaches to various information sources so that potential emerging contaminants to drinking water quality can be identified quickly. In addition, an investigation into the possibility and benefit of including the public concern about emerging contaminants into the risk governance process was encouraged.

1. Introduction

Human activities affect the chemical and microbial composition of the aquatic environment. The effects on water quality may be both direct and indirect. Direct effects include the release of anthropogenic chemicals into freshwater resources as a result of industrial and municipal wastewater discharges (Pal et al., 2010). An example of an indirect effect is the positive correlation between the temperature increase caused by climate change and pathogen survival in aquifers (Sterk et al., 2013). Because of demographic and environmental changes such as rapid urbanisation and extreme rainfall, the intensity and number of these direct and indirect effects is expected to increase (Gavrilescu et al., 2015; Lindahl & Grace, 2015).

Newly recognised potential hazards in the aquatic environment are often referred to as emerging contaminants and may be of both microbial and chemical nature. In this study, we focus on emerging chemical contaminants. The presence of emerging chemical contaminants in the aquatic environment may be a threat to human health, as water resources are being used for recreation as well as food and drinking water production. In addition, even if some of these emerging contaminants were not of concern from a public health point of view, their presence might still influence the public perception of drinking water quality (Schriks et al., 2010). Negative risk perception of drinking water quality might lead consumers to search for alternatives to tap water.

* Corresponding author at: National Institute for Public Health and the Environment (RIVM), P.O. Box 1, 3720 BA Bilthoven, The Netherlands.
E-mail address: Julia.hartmann@rivm.nl (J. Hartmann).

https://doi.org/10.1016/j.envsci.2018.02.015
Received 14 November 2017; Received in revised form 26 February 2018; Accepted 28 February 2018

Alternatives include bottled water and sweetened beverages, which are related to sustainability issues and in some cases even human health concerns (Doria et al., 2009; Doria, 2006; Lustig et al., 2012). Therefore, emerging contaminants are defined here as any chemical compound that may pose a new, or increased, threat to public health through the exposure to drinking water. The threat might be real, perceived or expected.

In regard to drinking water production, it is the emerging chemical contaminants found in groundwater (Lapworth et al., 2012), and surface water resources (Pal et al., 2010) that are of particular concern. Examples include pharmaceuticals, personal care products, and microplastics (Houtman et al., 2014). Technological advances in analytical techniques will enable the detection of even more contaminants in the future. Thus, the effective risk governance of emerging contaminants in drinking water and its resources is and will remain very important in order to protect public health.

Over the past years, much research has focused on emerging contaminants in the aquatic environment (Noguera-Oviedo & Aga, 2016). Studied topics include: the identification of emerging contaminants through screening efforts (Richardson & Kimura, 2016), the prioritisation of monitoring programmes (Smital et al., 2013), and the investigation into the toxicological potential of emerging contaminants (Houtman, 2010; Schwarzenbach et al., 2010). The risk management of emerging contaminants in drinking water (Murphy et al., 2012), and in the environment in general, has also been studied (Naidu et al., 2016a). However, as far as we understand, any research into the risk governance of emerging contaminants in drinking water and if, and how, scientific knowledge is implemented into current policy approaches has not yet been published.

This paper describes a comparative analysis of a range of existing policy approaches to the risk governance of emerging contaminants in drinking water and its resources. The objective is to identify areas in current risk governance approaches that are suitable for improvement and make suggestions for future scientific research, which will add to the proactive risk governance of emerging contaminants in drinking water.

2. Analytical approach

2.1. The IRGC risk governance framework

In this study, the risk governance framework issued by the International Risk Governance Council (IRGC) was used as a normative concept. Risk governance refers to the identification, assessment, management, and communication of potential chemical risks to drinking water quality (IRGC, 2012). The IRGC framework was chosen because of its proven applicability to the risk governance of emerging chemical and microbial risks (Assmuth et al., 2016; Roodenrijs et al., 2014).

The IRGC risk governance framework consists of five elements: pre-assessment, risk appraisal, risk evaluation, risk management and risk communication. We redefined two steps of the five elements to make them more readily applicable to the governance of drinking water contaminants. Pre-assessment and risk evaluation were redefined into identification of emerging contaminants and risk acceptance respectively.

2.2. Selected countries and state

Transboundary differences in a river catchment area were examined using the policy approaches for emerging contaminants in drinking water employed by the Netherlands, Germany and Switzerland, countries which all lie within the Rhine River catchment area. The Rhine is a multifunctional river that is used for transportation purposes, power generation, and urban sanitation, while at the same time providing drinking water for 25 million people (Uehlinger et al., 2009). These characteristics make the Rhine highly susceptible to the influence of emerging contaminants and thus interesting for the purpose of this paper.

Minnesota is one of the few jurisdictions which has a specific programme in place aiming explicitly at the identification and risk assessment of emerging contaminants in drinking water (The Minnesota Department of Health Contaminants of Emerging Concern (MDH CEC) program) (http://www.health.state.mn.us/cec). Therefore, the policy approaches used in the Netherlands, Germany and Switzerland were compared to the approach used in the state of Minnesota (the United States of America). This programme has also been analysed by Naidu et al. (2016b).

2.3. Quality indicators

For the analysis of the risk governance process, suggestions for best practice in the governance of emerging contaminants proposed by Naidu et al. (2016a) and Naidu et al. (2016b) were used for defining quality indicators. The suggestions for best practice that were considered were (1) the integration of science into policymaking, (2) the acceptance of the risk governance process by all stakeholders, (3) the defensibility of decisions made, and (4) the consideration of other factors as well as public health-risk reduction when choosing remediation strategies.

Number 2 was not used as a direct indicator. To analyse the acceptance levels of all the relevant stakeholders during the risk governance process required having insight into which stakeholders were involved in the process first. However, this information was not available. We therefore evaluated the stakeholders who were involved in each of the five elements of the risk governance process.

Furthermore, the defensibility of decisions made (3) can be ensured by creating transparency. Indeed, transparency is stated by the IRGC (2012) and the Organisation for Economic Co-operation and Development (OECD, 2015) as one of the principles of good governance. We therefore chose to assess transparency as a quality indicator. Transparency was evaluated upon the sharing of information with involved stakeholders during all the elements of the risk governance process.

2.4. Incidences of PFOA in drinking water or its resources

Four incidences of the same emerging contaminant in drinking water resources and/or treated drinking water were assessed. The emerging contaminant of choice was Perfluorooctanoic acid (PFOA). Additional information on PFOA is included in Appendix A.

Table 1 shows the selected incidences of PFOA in drinking water per country/state. From now on, these incidences of pollution will be referred to as cases. A description of each case study can be found in Appendix B.

2.5. Risk communication

In risk communication, two different models of communication can be distinguished, described by Ramirez-Andreotta et al. (2014) as the technical and the cultural models. The technical model uses one-way communication to inform the public, change behaviour and assure people of the acceptability of the risk as determined by experts. In contrast, the cultural model is based on two-way communication and includes the opinions of the affected public in the risk assessment element.

In this study, the type of communication model used in the different cases was determined. Furthermore, a quantitative analysis of the risk communication process during the four selected cases was performed. During this process, we assumed that less media coverage meant that there would be less tumult in the affected society, and thus less public concern. Although it is recognised that the relationship between news media coverage and public opinion is a dynamic process, studies have