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Promoting justified risk-based decisions in contaminated land management

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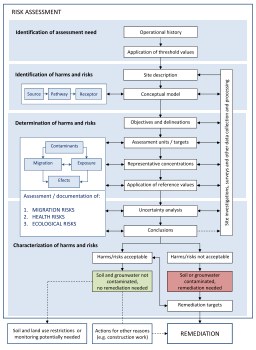
HIGHLIGHTS

- Decision making and practices on contaminated land are often not truly risk-based
- Unjustified decisions may result from using generic guideline values
- Adoption of more realistic approach for risk assessment should be preferred
- New Finnish guidelines promote justified risk-based decision making and practice

GRAPHICAL ABSTRACT



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ABSTRACT

Decision making and regulatory policies on contaminated land management (CLM) are commonly governed by risk assessment. Risk assessment, thus, has to comply with legislation, but also provide valid information in terms of actual risks to correctly focus the potentially required measures and allocate the available resources. Hence, reliable risk assessment is a prerequisite for justified and sustainable risk management. This paper gives an introduction to the Finnish risk-based regulatory framework, outlines the challenges within the policies and the practice and provides an overview of the new guidance document to promote risk-based and sustainable CLM. We argue that the current risk assessment approaches in the policy frameworks are not necessarily efficient enough in supporting justified risk-based decisions. One of the main reasons for this is the excessive emphasis put on conservative risk assessments and on generic guideline values without contributing to their appropriate application. This paper presents how some of the challenges in risk-based decision making have been tackled in the Finnish regulatory framework on contaminated land. We believe that our study will also stimulate interest with regard to policy frameworks in other countries.

1. Introduction

Contamination of soil and groundwater by a variety of chemical substances is a well-recognized and challenging environmental problem in the whole industrialized world posing risks to both human health and the environment. The number of potentially contaminated sites only in Europe totals around 2.5 million of which about 340,000 sites are

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expected to be contaminated, and hence likely to require remediation (Van Liedekerke et al., 2014). The annual expenditure on the management of these sites is estimated to be around 6 billion euros (Panagos et al., 2013). As a result of the increased awareness, most of the developed countries around the globe have built up national policy frameworks for the systematic management of contaminated land. Such frameworks include legislation, inventories, and funding mechanisms. Moreover, several international networks have defined joint policies, initiatives and projects in collaboration between the representatives of regulatory agencies, industry and academia.

Changes in the evolution of thinking about contamination issues has resulted in a continuous development of regulatory policies on contaminated land management (CLM) during the last decades (e.g. Ferguson, 1999). The initial approach of multifunctional land use with low tolerance of risk and the consequent exhaustive remediation actions has been replaced by 'fitness-for-use' and sustainable remediation, i.e., approaches that rely on the concept of risk-based land management (RBLM) where site-specific risk assessment is the main decision-support tool (Vegter et al., 2002). We can identify several reasons behind such progress, which include the growing number of contaminated sites, limited financial resources, increased pressure on the redevelopment of old industrial sites, improved knowledge on risks and feasibility of remediation techniques, consensus on the need for the saving of natural resources and restricting emissions, and improved social trust (e.g. Ellis and Hadley, 2009). Moreover, the development of risk assessment methods has enabled the inclusion of risk assessment as an essential part in national CLM procedures.

In RBLM, a tiered risk assessment procedure that relies on the 'source–pathway–receptor' pollutant linkage and the integration of health and environmental considerations is the most common approach (U.S. EPA, 1998; Nathanail and Bardos, 2004; Suter et al., 2006). In such a procedure, the application of soil guideline values (SGVs) as generic decision benchmarks is a common practice, having also resulted in the development of technical approaches for their derivation (e.g. Carlon et al., 2007).

The RBLM principle, that incorporates risk assessment procedures and SGVs, is also embedded in the Finnish regulatory framework. So far having been adopted in more than 3000 projects (Pyy et al., 2013), the risk-based decision making on contaminated land still involves many challenges and inconsistencies, especially with regard to the application of SGVs as decision criteria. This paper discusses such complications, and describes how the Finnish regulatory framework addresses and tackles them. Here, the new policy guidance is one of the key policy instruments. We also provide an introduction to the Finnish regulatory framework and the SGVs for better understanding of the rationale behind the new guidelines. The focus of the paper is solely on the risk-based decision making within the regulatory CLM context. Here, the term 'risk-based' refers to the environmental and health risks caused by contamination only, based on which decisions on potential risk reduction measures such as remediation are determined. Hence, economic, social and other factors that also influence the practical risk management decision are not considered, but will be discussed elsewhere (Reinikainen et al., 2015). Furthermore, this paper does not deal in detail with the methods of risk assessment though their misuse and failure to exhibit actual site-specific conditions and phenomena can be regarded as real barriers to risk-based decision- making (Sorvari et al., 2009). Thus, here we focus on the more generic policy approaches of the methodology and some practical problems, such as the use of SGVs.

2. Background to Finnish CLM: policy instruments

2.1. Risk-based regulatory framework

Risk management of contaminated sites in Finland has been promoted by the development of a legal framework and supportive policy instruments. Regulation of environmental contamination, including soil and groundwater, is integrated in the Environmental Protection Act (EPA 86/2000) that was replaced by the new EPA 527/2014 in order to implement the requirements set by the EU Directive 2010/75/EU. The main objective of the EPA is to prevent environmental contamination,[1] reduce emissions, and eliminate any harm caused by contamination. The EPA includes generic prohibitions on soil and groundwater contamination, defines duties regarding remediation[2] of contaminated sites for both the liable parties and the authorities, and presents general principles for sustainable environmental practice, such as the precautionary and 'polluter pays' principles, and the principle of using the best available technique (BAT).

Though the EPA's definition of environmental contamination and the specific provisions regarding remediation of soil and groundwater clearly indicate the need for a site-specific risk assessment, they are also rather non-specific leaving the interpretation of when, how, and to what extent remedial actions should be carried out somewhat uncertain. Therefore, a mandatory risk assessment protocol was integrated into the regulatory framework by a specific Government Decree (214/2007). This 'Decree on the Assessment of Soil Contamination and Remediation Need' was prepared to specify the EPA's generic definitions and provisions by providing an explicitly framed procedure for site-specific risk assessment. Its main objective was to promote the implementation of risk-based remediation practice that relies on actual site-specific risks instead of generic concentration benchmarks, i.e., the soil screening values from 1994. These values were originally adopted from other countries without sufficiently justifying their applicability in Finnish conditions (Puolanne et al. 1994).

According to the Decree, the assessment of soil contamination and remediation need shall be based on a site-specific estimate of the risks to human health and the environment. The Decree describes the elements that have to be taken into account and discussed in the assessment, but does not explain its implementation. Therefore, a separate technical guidance document was given to clarify the generic principles of the regulation and to provide supporting information for risk assessors and the authorities (Pyy et al., 2007). In the guidance, a tiered approach was suggested for site-specific risk assessment, starting from a qualitative evaluation, i.e., by taking into account the elements described in the Decree, and the application of SGVs, and further moving to a more detailed assessment whenever considered necessary. These principles were well compatible with the contemporary risk assessment frameworks adopted in several other European countries (Sorvari, 2010).

In Finland, a remediation project, according to the EPA 527/2014, requires approval from the competent environmental authority. This approval is usually granted in a notification procedure. This means that the applicant, i.e. the party who is responsible for carrying out the remediation, draws up a written notification regarding the planned remediation project and delivers it to the authority before launching the project. The notification must include the necessary documents, such as the reports from site investigations and risk assessment and the general remediation plan. The authority will then scrutinize the notification and the additional documents and give an administrative decision on the matter. This decision generally includes specific provisions on how the remediation work must be organized and supervised.

2.2. Soil threshold and guideline values

The annex of the Decree (214/2007) presents three categories of risk-based soil screening values, namely threshold values and the

[1] In the Finnish legislation the terms contamination and pollution are synonymous contrary to the practice in some other countries and policy frameworks (e.g. Chapman, 2012).

[2] In the Finnish regulatory context, remediation refers solely to the removal or transformation of contaminants, while risk management covers all the measures for managing risks on a single site as well as at the other stages and levels of decision making, such as regional land use planning.

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