

The Swedish Environmental Protection Agency's work concerning PFAS contaminated sites



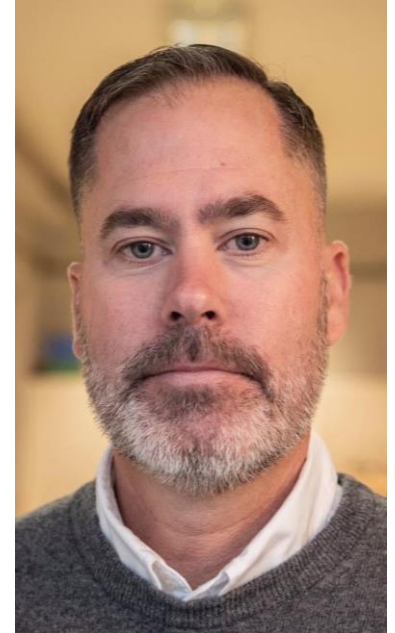
SWEDISH
ENVIRONMENTAL
PROTECTION
AGENCY

SWACCS presentation
January 24, 2023

SWACCS

January 24, 2023

The Swedish Environmental Protection Agency's work concerning PFAS contaminated sites



Niclas Johansson, PhD Environmental toxicology

My background

- Master in Biology, *Uppsala University*
- Licentiate degree in Toxicology, *Uppsala University*
- Doctoral degree in Environmental toxicology, *Uppsala University*

- Trainee, *Swedish Food Agency*
- Environmental consultant, *NIRAS Sweden AB*
- Project leader, *Helldén Environmental Engineering AB*
- Project manager, *Swedish Armed Forces*
- Project leader, *Swedish Environmental Protection Agency*



UPPSALA
UNIVERSITET

*Digital Comprehensive Summaries of Uppsala Dissertations
from the Faculty of Science and Technology 619*

Neonatal Exposure to Highly
Brominated Diphenyl Ethers and
Perfluorinated Compounds

Developmental Dependent Toxicity and Interaction

NICLAS JOHANSSON



ACTA
UNIVERSITATIS
UPSALIENSIS
UPPSALA
2009

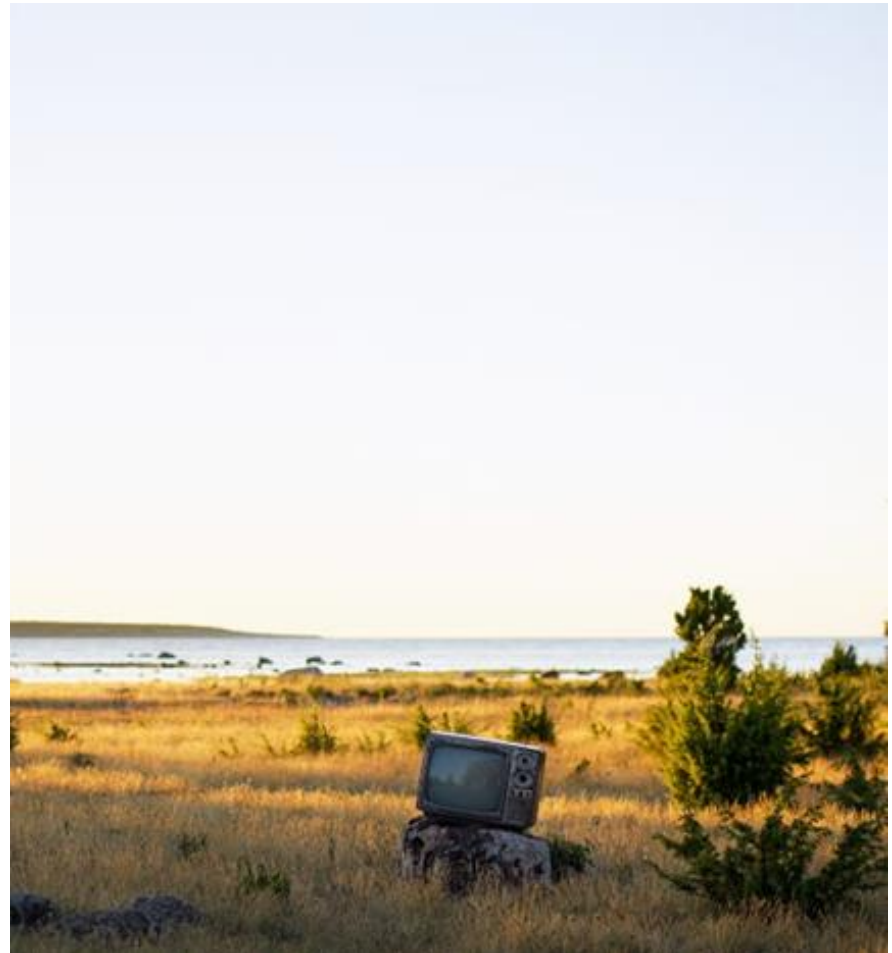
ISSN 1651-6214
ISBN 978-91-554-7456-0
urn:nbn:se:uu:diva-99255

General info about PFAS

- Per- and polyfluoroalkyl substances (PFAS) are a large group of thousands of chemicals widely used in industrial and consumer applications since the 1950s.
- PFAS consist of a fully (per) or partly (poly) fluorinated carbon chain connected to different functional groups. Many PFAS are highly persistent in the environment.
- The length of the fluorinated carbon chain can result in different physicochemical properties that influence the substance behavior in the environment as well as its toxicity.

Supervision and regulatory development

In Sweden, there are many government authorities involved in supervision and regulatory development in areas where PFAS occur.



Other government authorities and their responsibilities

- The Swedish Food Agency is the central authority for issues related to drinking water and food quality, as well as materials that come into contact with foodstuffs; [Swedish Food Agency \(livsmedelverket.se\)](https://www.livsmedelverket.se)
 - The Swedish Geotechnical Institute (SGI) is responsible for research and development of new methods for investigation and remediation of contaminated sites. [Startpage - SGI](#)
 - The Geological Survey of Sweden (SGU) is responsible authority for issues related to bedrock, soil and groundwater in Sweden. [About SGU](#)
 - The Swedish Agency for Marine and Water Management is responsible authority for marine and water related issues, [Start - Swedish Agency for Marine and Water Management \(havochvatten.se\)](https://www.havochvatten.se)
 - The water authorities are responsible for implementation of the EU Water Framework Directive. [English | Vattenmyndigheterna](#)
 - The Swedish Chemicals Agency is responsible for the regulations for manufacturers or importers of products containing PFAS that are placed on the Swedish market. [Startpage - Kemikalieinspektionen](#)
- The responsibility for groundwater is however split between SGU, the Swedish Agency for Marine and Water Management, the water authorities and the County Administrative Boards.
- The County Administrative Boards and the local municipalities are the responsible enforcement authorities for environmentally hazardous activities. The Defence Inspectorate for Medicine and Environmental Health is the enforcement authority for the Swedish Armed Forces' environmentally hazardous activities.

The Swedish Environmental Protection Agency

The Swedish EPA is working with PFAS-related issues in a wide context, such as

compiling knowledge and documentation

environmental monitoring

developing environmental policy by providing the Government with a sound basis for decisions and by giving an impetus to EU and international efforts

The agency also produce guidance on how to implement environmental policy to ensure compliance with the Swedish Environmental Code and achievement of the national environmental objectives





As an employee at the Swedish Environmental Protection Agency, you work to develop the environmental work in Sweden.

We have many different professional groups who, with their broad expertise, contribute to offensive environmental work.

The Swedish Chemicals Agency's report

The Swedish Chemicals Agency commissioned a report to provide a broad and easy-to-understand guide to introduce the PFAS issue to non-experts.

The report is aimed at, for example, officials and environmental officers with some scientific background who will work with PFAS-related issues but who are not yet familiar with the subject.

[PM 3/22 Overview of knowledge on PFAS -
Kemikalieinspektionen](#)

KEMI
Swedish Chemicals Agency

Overview of knowledge on PFAS

PM 3/22

kemikalieinspektionen.se

SEPA guidance document regarding risk assessment and remediation of sites contaminated by PFAS

The Swedish EPA has, in collaboration with the Swedish Geotechnical Institute (SGI), developed a joint guidance document regarding risk assessment and remediation of sites contaminated by PFAS.

This guidance document is primarily intended for authorities that conduct regulatory supervision on contaminated sites.



Contaminated areas in Sweden

Sweden's long industrial history has left behind many contaminated sites.

These sites must be:

- investigated
- evaluated
- and if necessary, remediated



Situational picture of PFAS

- In Sweden, there are many PFAS contaminated areas that can pose a potential risk to human health and the environment, both on land and in water.
- The single largest point source of PFAS-contaminated sites has previously been identified as fire drill sites where PFAS-containing firefighting foam has been used.



Remediation of contaminated sites

- Remediation is needed when a land or water area, a building or a facility is contaminated to such an extent that it entails unacceptable risks to human health, the environment or natural resources.
- Remedial actions are intended to reduce such risks to acceptable levels.



Remediation of contaminated sites

- The role of the Swedish EPA is to coordinate, prioritize, provide guidance and follow up on the remediation of contaminated sites at a national level.
- The Swedish EPA also administers governmental grants for the remediation of contaminated sites and evaluates their effects.
- Furthermore, the Swedish EPA is involved in international cooperation concerning remediation of contaminated sites both within the EU and globally.

Remediation methods for PFAS contaminated soil and groundwater

- The Swedish Geotechnical Institute (SGI) is responsible for research and development of new methods for investigation and remediation of contaminated sites.
- Publication published in 2022.



Åtgärdstekniker för PFAS i jord och grundvatten

Kunskapssammanställning

Michael Pettersson, Malin Montelius, Dan Berggren Kleja och Anja Enell

Uppdragsgivare: SGI

2022-09-15

Environmental law in remediation of contaminated sites

- The Environmental Protection Act from 1969 dramatically strengthened the role of the State in the protection of the environment.
- In 1989, these provisions were strengthened to assign responsibility for remediation of sites solely on the basis that a site was contaminated.
- The Swedish Environmental Code is Sweden's most comprehensive piece of environmental legislation and entered into force on 1 January 1999. The Environmental Code was based on 15 environmental acts, which were all reviewed and consolidated into one single act.



Environmental law

- Chapter 10 of the Environmental Code contains provisions concerning contaminated sites and the remediation thereof. There it is stated that the operator, who is presently operating or previously operated a site which is polluted, is considered liable for conducting investigations and if necessary, remediation, of the site.
- The above is based on what is often called the "Polluter Pays Principle".
- However, if a polluting activity ceased before the introduction of the Environmental Protection Act in 1969, the polluter cannot be held liable. Where a responsible polluter cannot be identified or held responsible, public funding may be used to conduct investigations and remediation. This funding is administered by the Swedish EPA.



Stakeholders involved in the remediation of contaminated sites

- The Swedish EPA has been working with remediation of contaminated sites for several decades together with the County Administrative Boards and local municipalities. But there are many other organizations contributing to the work on remediation of contaminated sites – including the Geological Survey of Sweden, the Swedish Geotechnical Institute and the Swedish Agency for Marine and Water Management, as well as higher education institutes and private operators.
- The Swedish Geotechnical Society and "the Clean Soil Network" are non-profit networks of organizations including consultants, researchers, government authorities, and remedial contractors, who coordinate the exchange of information and experiences in meetings, conferences and courses.

National inventory of potentially contaminated sites (not PFAS)

- In order to identify contaminated sites in Sweden, the County Administrative Boards have, with the support of the Swedish EPA, carried out an extensive inventory of sites which previously had, or currently have, operations that may cause contamination of soil, sediment, surface water and groundwater. Examples of such activities are chemical industries, dry cleaners, mines or sawmills. The inventory was conducted between 1999 and 2015 and resulted in the identification of approximately 85 000 potentially contaminated sites in Sweden, of which around 26 000 are classified according to potential risk.
- About 1 200 of these sites are classified as risk class 1 and may constitute a "Very high risk to human health and the environment", and around 8 000 sites are classified as risk class 2, "High risk to human health and the environment". Sites in class 1 and 2 are prioritized to receive funding from the Swedish EPA to be investigated and, if needed, remediated.

Class 1 objects

- Identifying a site as risk class 1 during the inventory does not necessarily mean it is contaminated to such an extent that it constitutes a very high risk to human health and the environment. Site investigations and studies must be conducted to verify if the site truly is contaminated.
- Today, approximately 128 of the most severely contaminated sites in Sweden have been remediated with funding from the Swedish EPA.



Risk assessment methodology for contaminated sites

The SEPS risk assessment method is composed of 4 major parts:

- Problem description and conceptual model
- Exposure analysis
- Effect analysis
- Risk characterization

<https://www.naturvardsverket.se/vagledning-och-stod/forenadede-omraden/riskbedomning-av-forenadede-omraden/>



Riskbedömning av förorenade områden

En vägledning från förenklad till fördjupad riskbedömning



RAPPORT 5977 • DECEMBER 2009



Risk assessment methodology

By following the methodology, you get a structured risk assessment, whether it relates to soil, sediment, water or buildings.

The methodology can be used to assess both environmental and health risks and regardless of the scope and level of ambition of the risk assessment.

However, you should adapt the scope of each part based on the scope and complexity of the project.



Government mandate

During the years 2022–2024, the Swedish Environmental Protection Agency will work to develop and strengthen national coordination and guidance on the problems with PFAS contaminated areas to strengthen collaboration and direct the work forward.

PFAS contaminated areas are a widespread problem worldwide and in many places in Sweden they risk affecting, among other things, drinking water.

In order to create the conditions for solving the problems posed by PFAS contaminated sites, strong collaboration between the relevant authorities is needed.

Total number of PFAS contaminated sites and technology development

In order to get a better mapping and overall picture of the total number of PFAS contaminated areas in Sweden, the county administrative boards will contribute to the work.

The authorities will also collaborate with the Swedish Geotechnical Institute (SGI) and their assignments on technology development and research to increase the pace of work to be able to remediate areas contaminated by PFAS.

Riskbedömning och inventering av data på nationell nivå

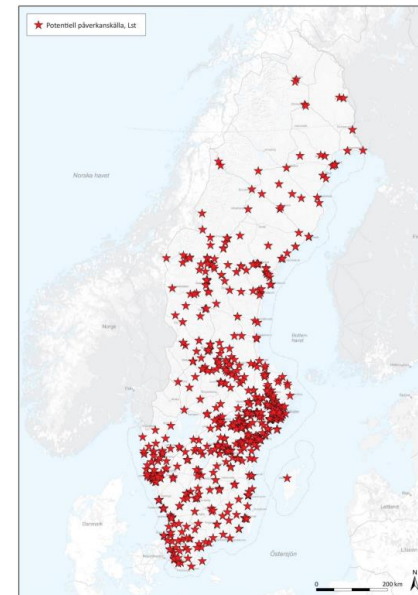
Utvärdering av påverkan på grundvatten från platser där släckskum hanterats

Lars Rosenqvist

Underlag och kunskapsstöd till seminarier 12 och 19 oktober 2020

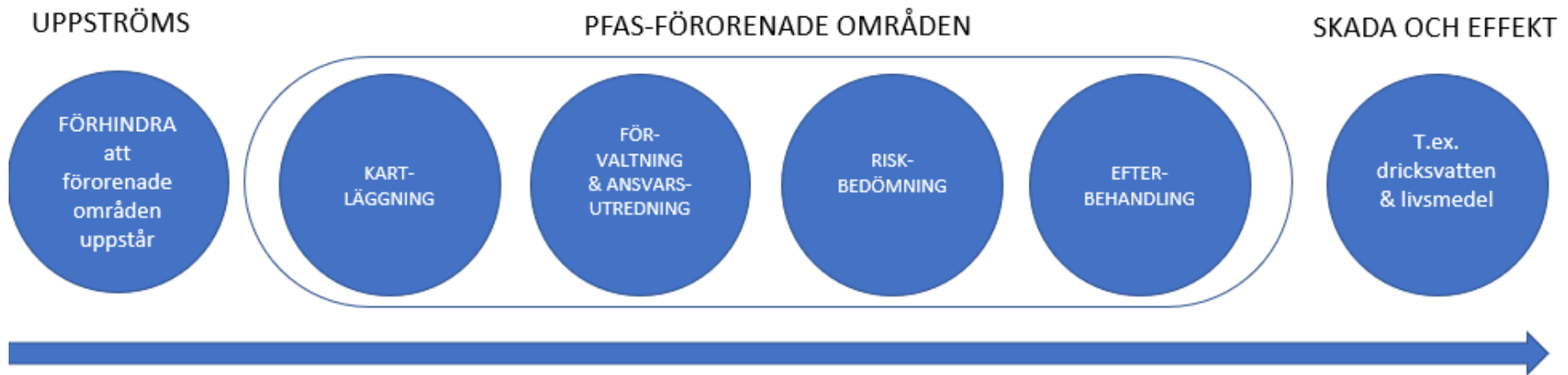


SGU Sveriges geologiska undersökning

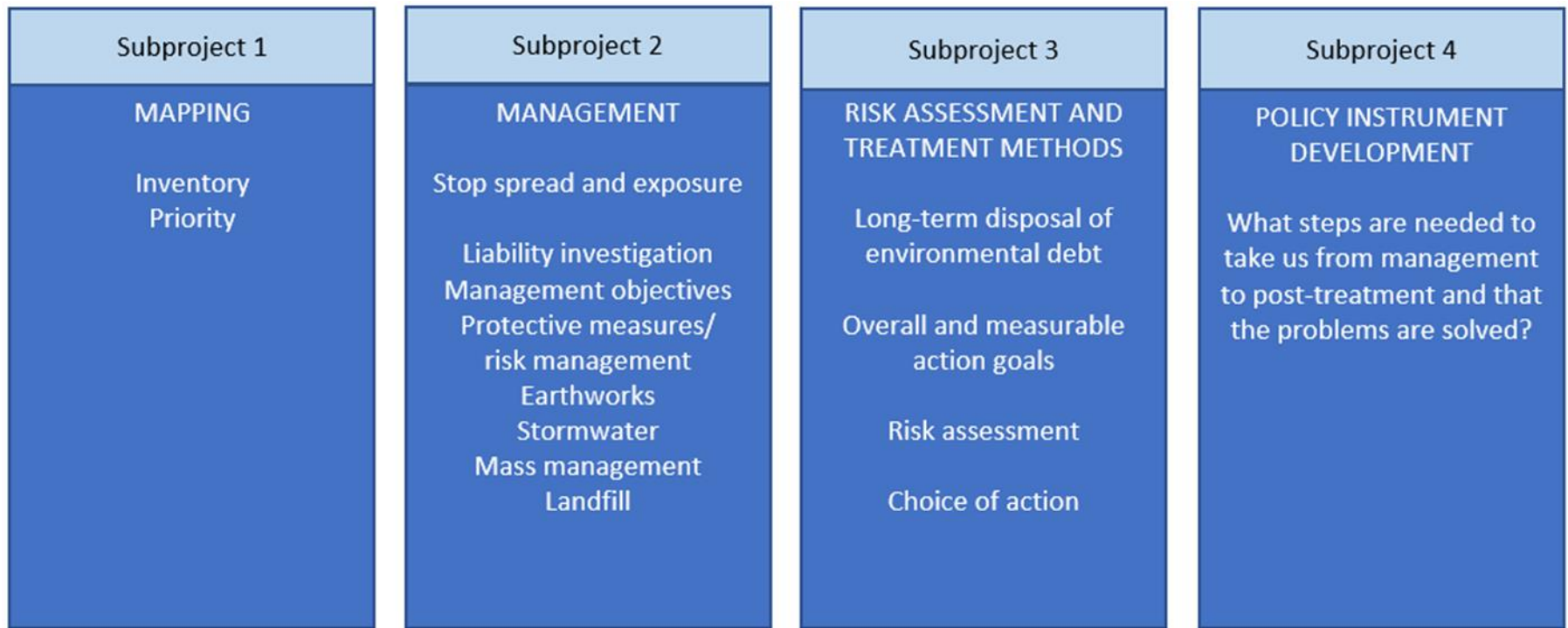


Figur 3. Distributionen av potentiella påverkanskällor från länsstyrelsernas sammanställning. Riskbedömning utfördes för samtliga påverkanskällor.

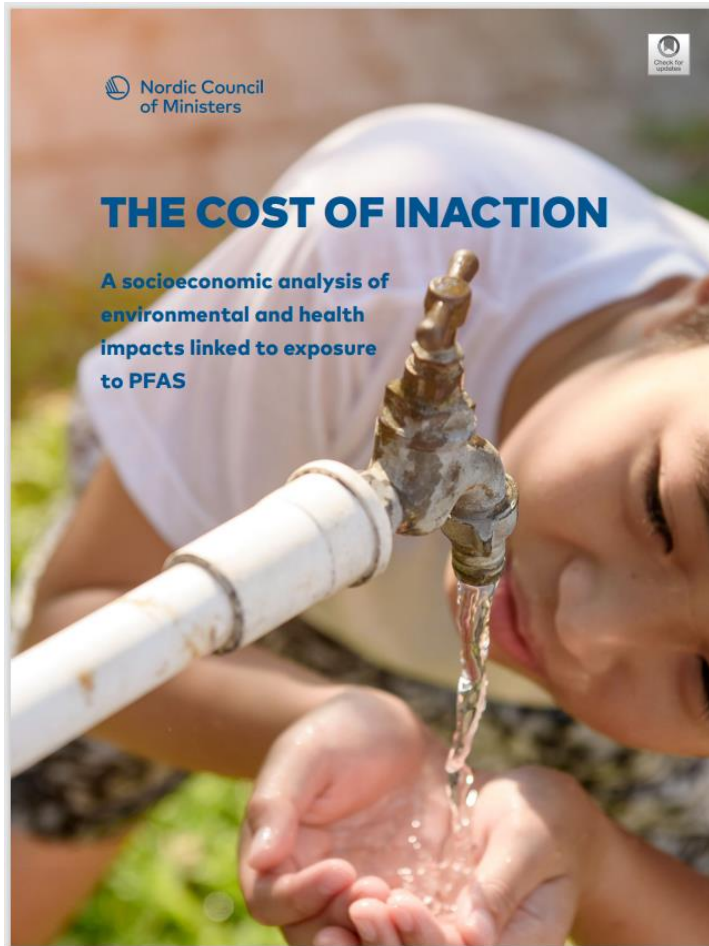
How one can handle contaminated sites in general



The project RUPFO driven by the Swedish EPA (PFAS contaminated sites)



The cost of inaction



[The cost of inaction \(norden.org\)](https://norden.org)

Because of the extreme persistence of PFAS in the environment, this contamination will remain on the planet for hundreds if not thousands of years.

Human and environmental exposure will continue, and efforts to mitigate this exposure will lead to significant socioeconomic costs – costs largely shouldered by public authorities and ultimately taxpayers.

The focus of this study is on the costs of inaction with respect to regulation of PFAS in the countries comprising the European Economic Area (EEA).

Costs of inaction are defined as the costs that society will have to pay in the future if action is not taken to limit emissions of PFAS today.

Estimates of annual health impact-related costs

Table 1: Estimates of annual health impact-related costs (of exposure to PFAS)

Exposure level	"Exposed" population and source	Health endpoint	Nordic countries		All EEA countries	
			Population at risk	Annual costs	Population at risk	Annual costs
Occupational (high)	Workers at chemical production plants or manufacturing sites	Kidney cancer	n.a.	n.a.	84,000–273,000	EUR 12.7–41.4 million
Elevated (medium)	Communities near chemical plants, etc. with PFAS in drinking water	All-cause mortality	621,000	EUR 2.1–2.4 billion	12.5 million	EUR 41–49 billion
		Low birth weight	8,843 births	136 births of low weight	156,344 births	3,354 births of low weight
		Infection	45,000 children	84,000 additional days of fever	785,000 children	1,500,000 additional days of fever
Background (low)	Adults in general population (exposed via consumer products, background levels)	Hypertension	10.3 million	EUR 0.7–2.2 billion	207.8 million	EUR 10.7–35 billion
<i>Totals</i>			<i>Nordic countries</i>	<i>EUR 2.8–4.6 billion</i>	<i>All EEA countries</i>	<i>EUR 52–84 billion</i>

Estimates of costs non-health, 20 years

Table 2: Summary of estimates of mean cost data for non-health expenditures, 20 years

Action taken when PFAS found	Unit	Best estimate	Range from studies	Adopted range
Monitoring – checks for contamination due to industrial or AFFF use	Cost per water sample tested	EUR 340	EUR 278–402	EUR 278–402
	Cost/case of contamination	EUR 50,000	EUR 5,200–5.8 million	EUR 25,000–500,000
Health assessment (including biomonitoring)	Cost/person	EUR 50	No range	EUR 5–95 (+/-90%)
	Total biomonitoring and health assessment per case where considered appropriate	EUR 3.4 million	EUR 2.5 million–4.3 million	EUR 1 million–5 million
Provision of temporary uncontaminated supply	Cost/person	No relevant data		
Provision of a new pipeline	Cost/person	EUR 800	EUR 37–5,000	EUR 100–1,500
Upgrading water treatment works (capital)	Cost/person	EUR 300	EUR 8–2,200	EUR 18–600
Upgrading water treatment works (maintenance)	Cost/person	EUR 19	EUR 8–30	EUR 8–30
Excavation and treatment of soils – contamination from industrial or AFFF use	Cost/kg PFAS	EUR 280,000	EUR 100,000–4.3 million	EUR 100,000–1 million
	Cost/case	EUR 5 million	EUR 100,000–3 billion	EUR 300,000–50 million

Thank you



SWEDISH ENVIRONMENTAL
PROTECTION AGENCY