

Inventory of contaminated sediment

A summary of the the process applied in Sweden for conducting an inventory of contaminated sediments and finding the potential contributing sources of contamination.

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About this document

This document briefly describes the process applied in Sweden for identifying and conducting an inventory of contaminated sediments and finding the potential contributing sources of contamination. Inventories are mainly performed by supervising authorities and consultants. The translation of the document into English is part of a HELCOM collaboration to make available relevant information about the work to prevent pollution of the Baltic Sea.

An identification and inventory method has been developed within the government assignment on contaminated sediments (reported 2022¹). The methodology is based on the Swedish Environmental Protection Agency's methodology for inventorying contaminated areas (MIFO) and further developed in a collaboration between the Swedish EPA, the Swedish Geotechnical Institute (SGI), the Geological Survey of Sweden (SGU) and the water authorities. The methodology is described in detail in a report published by SGI².

Introduction

Healthy sediments are important for the animals and plants living in the aquatic environment. It is also an important basis for many different ecosystem services. Contaminants accumulated in sediments can have a negative impact on different parts of the ecosystem and can also spread to other bottom areas and into the food chain, potentially affecting human health. Contaminants found in sediments can come from many different sources of pollution (ongoing inputs of pollution as well as historical pollution). Contaminants can also be transported to the sediments through different dispersion pathways which can be direct emissions from a point source or diffuse releases from several smaller sources.

The goal of conducting an inventory is to identify sediment sites with associated sources of pollution that need to be prioritised for further studies and possible measures. Pollution sources that contribute contaminants to sediments need to be prioritised for further investigation and measures both in the supervision of ongoing economic operations and in the work with contaminated sites.

The inventory process

An inventory of contaminated sediment areas can be initiated in different ways. There may be suspected sources of contamination or a known contamination of sediments, but both ways require determining the source of pollution and evaluating if the level of pollution in the area is a risk for the ecosystem. High

¹ [Slutredovisning av regeringsuppdrag om förbättrad kunskap för hantering av förorenade sediment. Swedish Environmental Protection Agency, 2022 \(In Swedish\).](#)

² [Inventeringsmetodik förorenade sediment. Swedish Geotechnical Institute Guidance 11, 2024 \(In Swedish\).](#)

levels of pollution may also be found in fish or other biota, which requires conducting an inventory of potential pollution sources.

The process for inventory of sediment is similar to the one for conducting an inventory of contaminated sites in general³ and consists of the following steps:

- Phase 0: Identification. An initial desk study where potential sources of contamination are identified and assigned a sediment class (the potential to contaminate sediment).
 - Prioritisation of pollution sources for Preliminary Survey, Phase 1.
- Phase 1: Preliminary Survey: This phase is an in-depth desk study. It aims to verify the potential sources of pollution.
 - Prioritisation of pollution sources and sediment areas for Preliminary Site Investigation, Phase 2.
- Phase 2: Preliminary Site Investigation: A verifying field investigation is conducted to study whether the sediments are contaminated and to determine the extent of the pollution damage as well as to verify which sources of pollution contribute to the pollution in the sediment.
 - Prioritisation of sediment sites for further study and risk assessment.

Each step results in prioritising areas and/or pollution sources that pose the greatest risk. The process can help to find the highest priority areas although the assessment of risk during the inventory phases may need to be based on a limited amount of data. If the field investigation in Phase 2 reveals contaminated sediments and the level of contamination may pose a risk to human health and the environment, the area should be prioritised for further investigation.

Phase 0: Identification

Identification means finding the pollution sources that can potentially lead to contamination of the sediments. Sources of contamination can include contaminated sites as well as ongoing operations, which can potentially spread contaminants to the sediments.

Industries use various kinds of processes and chemicals with different potential for polluting sediment. The potential of polluting the sediment is described using a so-called sediment class divided into four risk levels:

- Low
- Moderate
- High
- Very high

³ [Methods for Inventories of Contaminated Sites. Swedish Environmental Protection Agency Report 5053, 2002.](#)

The purpose of the sediment class is to mark the polluted areas that have the greatest risk of spreading and impacting sediments so that the spread of contaminants to the sediment can be investigated and prevented. To support the work of identifying which activities could have potentially led to the spread of pollution to sediments, the Swedish EPA provides a list of industries and polluting substances associated with these industries. The industry list is continuously updated with new information.

The industry list can be found at [Contaminated sites \(naturvardsverket.se\)](https://naturvardsverket.se)

Sweden has a national database over registered potential polluted areas (“EBH-stödet”) administered by the County administrations. The objects in the database consist mainly of contaminated land areas, however, they have been assigned with a sediment class indicating their potential of affecting sediments. GIS-layers with these objects are available in the [Geodata catalogue \(lansstyrelsen.se\)](https://lansstyrelsen.se)

To get indications of what emissions ongoing industries may have to the sediment a similar industry list has been developed. Information on location of ongoing industries is available in different databases administered by the municipalities, County administrations and other authorities.

The prioritisation of sediment areas or sources to the next phase can be based on the industry list’s sediment classification and/or on local knowledge of known and potential sources of pollution.

Other relevant supporting material:

Sediment class for ongoing economic operations can be found here [Branschutsläppsverktyget \(naturvardsverket.se\)](https://naturvardsverket.se)

GIS layers with the sedimentclass for polluted areas [Geodata catalogue \(lansstyrelsen.se\)](https://lansstyrelsen.se)

Potential total load of contaminants from polluted sites [Geodata catalogue \(lansstyrelsen.se\)](https://lansstyrelsen.se)

Phase 1: Preliminary Survey

The identified potential pollution sources prioritised from Phase 0 are to be investigated to verify or disprove the potential impact on the sediments. This phase is a desk inventory, which is adapted according to whether there are ongoing operations or contaminated sites. The Swedish EPA recommends a site visit in this phase.

Ongoing economic operations

For a Phase 1: Preliminary Survey of an ongoing economic operation, information and documentation about the operation needs to be collected, including results from internal inspections, data from recipient controls, other relevant samplings and information. The website VISS (Water Information System Sweden) includes information from the impact analysis performed within the water management on

priority substances and river basin specific pollutants assessed to affect the body of water. The County Administrative Boards may contribute with material that are not available in VISS. If substances are identified with the potential to accumulate in sediments, they should be included in the assessment. Relevant information linked to what the operation produces and is permitted to release may be available from the operation's environmental permit and to which matrices the releases occur.

When assessing and supervising an activity, it is possible to set requirements based on the general rules of consideration. Chapter 2, Section 8 of the Environmental Code states that a current or former operator or an operator that has taken measures resulting in damage or inconvenience is responsible for mitigating these until they cease.

There may be unintentionally formed substances (e.g., dioxins and PAHs) that are not always included in the requirements of a permit or included in the internal inspection conducted by the economic operator. These substances are often found in the sediments and should be included in the inventory.

According to a survey by the Swedish Chemicals Agency, around 120 substances are produced and/or used on the Swedish market (2020) that may have negative impact on aquatic environments (Hazard statements H400, H410-413) and that potentially accumulate in sediments ($Kow \geq 3$) when spread to aquatic environments. Only a few of these substances appear in permits or control programs for ongoing economic operations. The industry list of ongoing economic operations lists what processes that may result in emission of various substances.

Contaminated sites

To verify the impact from a contaminated site (soil or sediment), data from already completed studies, measures and other relevant documentation need to be compiled. This can include studies on soil, groundwater, surface water and/or sediment in the relevant recipient(s). This data, together with site-specific conditions, are evaluated to verify if a contaminant source has the potential for dispersal assumed in Phase 0 or if the dispersal can be confirmed based on existing data. If evidence is largely lacking, the object should not be de-prioritised if the potential risk is considered significant and other local knowledge confirms the potential for dispersal.

Information from Phase 1 linked to the specific object is added to the current objects in the database. In this phase, the preliminary classification made in Phase 0 is being verified. The pollution sources deemed to have the highest dispersal are further prioritised for the next phase. The water bodies that have the highest cumulative load from pollution sources are also prioritised for further investigation. There may be bodies of water with a very high load from individual sources, and these bodies can be prioritised for further investigation based on local information.

Upstream areas

Many sediment sites receive pollution from sources located upstream, in addition to the pollution sources located within the closest catchment area of the water

body. This makes it also important to gather information on upstream sources of pollution.

Phase 2: Verifying field investigation

The pollution sources identified to have a high potential for dispersing pollution to sediments in the recipient should be prioritised for a verifying field investigation. Even those water bodies with several associated pollution sources should be prioritised for a verifying field investigation.

The verifying investigation is primarily aimed at confirming whether the sediments are contaminated or not. The field survey will also provide a first rough estimate of which pollutants have been added to the sediments and at what level they are present, as well as which point sources may have contributed to the pollution.

A simple risk assessment is necessary to estimate the pollution risk. The risk assessment results in a risk class that indicates whether the contaminated sediment needs to be prioritised further for further investigations and measures to reduce the risk. The risk assessment is based on the toxicity of the compounds present in the sediment, the level of contamination, the risk of spreading to biota and to other areas, the sensitivity of the area (as drinking water) and the level of protection of the area (threatened habitats/species and protected areas). The sediment class for the pollution sources should also be updated based on the results of the field investigation.

When pollution damage in the sediment is confirmed, possible sources still dispersing pollution to the sediments, which can be both ongoing operations and/or contaminated sites (soil and sediment), need to be investigated and possibly remediated before the contaminated sediment area is remedied. Ongoing operations dispersing pollution to the sediments must be further prioritised for supervision where requirements for investigations and preventive measures must be set.

If a polluted site is determined as the source of pollution to the sediments, it is further prioritised for a closer investigation of the risk of dispersal and the need for preventive measures or remedial measures for the pollution damage. If there is a known economic operator, the supervisory authority can instruct the operator to investigate whether there is dispersal from the site.

The Swedish EPA wishes to highlight several factors that can influence prioritisation for further investigation.

- High natural values and risk of natural disasters, including from climate change
- Presence of highly hazardous substances
- Risk to human health and the environment
- Risk of bioaccumulation in the food web
- Risk of influencing the status of the body of water

- Spreading of hazardous substances to downstream areas
- Sensitive areas nearby
- Protective status of the water body, eg drinking water

Investigation into liability

Before a Phase 2 Sediment Inventory, the extent of the pollution damage is often unknown and whether the sediment site needs to be prioritised further for investigation of risk and whether measures are needed.

If there are multiple potential sources, it is usually unknown or uncertain which of the sources have contributed to the pollution damage in the sediments. In some cases, the initial field investigation can provide information that can be used to link pollution to current pollution sources. In more complicated cases, additional field investigation and source tracing may be required to enable linking the pollution damage to the source or sources. This information is important for investigating liability for the pollution damage.

Is there a responsible economic operator?

In cases where there is a responsible economic operator, the supervisory authority instructs the operator to investigate the dispersion from a pollution source and/or the contaminated site more closely to see if there is a need for measures.

[Supervision as specified in the Environmental Code \(in Swedish\) \(naturvardsverket.se\)](#)

Is there no responsible economic operator?

In cases where there is no responsible economic operator, the supervisory authority can prioritise which objects should be investigated further. In these cases, the Swedish EPA can provide government funding for investigations and possible remedial measures.

[Remediation of polluted sites \(in Swedish\) \(naturvardsverket.se\)](#)