

Physical and chemical assessment

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Background information on the collection and preservation of sediment

1 Purpose and scope

This document describes important considerations prior to undertaking a sediment sampling plan. The associated document *Collection and preservation of sediment* outlines steps to be undertaken when collecting sediment.

Objectives **not** covered in this manual include:

- Where sediments are to be sampled as part of an evaluation of the suitability of dredge sediments for ocean or land disposal. Information of sediment sampling requirements for dredging activities can be obtained from the *National Assessment Guidelines for Dredging* (Commonwealth of Australia 2009). Information on appropriate sampling equipment to be used to collect samples for this purpose can be obtained from the U.S. EPA (2001) *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*.
- Where sediments are to be used as part of a sediment toxicity assessment. Methods relating to the collection of sediments for this purpose are presented elsewhere in this manual (see *Direct toxicity assessments*).

2 Associated documents

Physical and chemical assessment:

- *Collection and preservation of sediment*
- *Manual collection of surface water samples (including field filtration)*

Sampling design and preparation:

- *Background information on water quality measurements using in situ water quality instruments*
- *Water quality sampling using in situ water quality instruments*

Biological assessment: Direct toxicity assessments

3 Introduction

The analysis of inorganic and organic contaminants in sediment allows for the assessment of the risk to aquatic or benthic ecosystems or other environmental values. Sediment samples are typically more heterogeneous (poorly mixed) than water and wastewater samples, and as such, care must be taken when designing a sediment sampling plan to ensure the sample is representative of the environment being assessed.

4 Considerations for sediment sampling

In order to collect a representative sample, there are a number of considerations that need to be made. The exact sampling design will depend upon many factors, such as the purpose of the sampling, the type of aquatic environment and sediment composition to be sampled, site access and availability of equipment. More detailed information on sediment sampling and considerations are available in Simpson and Batley (2016).

Although the collection site may be predetermined (e.g. to correspond to water sample collection, or ease of access), sediments should be collected from locations where finer sediments tend to be deposited. This is

because fine sediments offer a greater surface area for adsorption of contaminants, and also because fine sediments generally contain higher proportions of organic matter that can readily bind metallic and organic compounds. Sediments with a higher proportion of finer grains can typically be found where water current velocities are low (e.g. large and deep water-holes, inside bends in rivers).

Sediment is typically heterogeneous both horizontally and vertically. Therefore, care must be taken to ensure replication and/or composite sampling is sufficient to obtain a representative sample from the potentially impacted area of sediment being assessed. For example, a composite sample can be made up with multiple samples collected one to ten metres apart and combined by thorough mixing. Alternatively, where disturbance of sediments prior to testing needs to be minimised (e.g. for analysis of volatile substance or where reduction/oxidation (REDOX) conditions need to be maintained), multiple samples may be collected for testing. Ideally, the number of replicate samples required, the depth at which they are taken, and the distance between sampling sites should be defined prior to collection.

4.1 Holding times and preservation

Sediment samples must be delivered to the laboratory to allow for analyses or tests to be conducted within the prescribed holding and testing times. Holding times will vary depending on the analyses to be performed and are dictated by the compound-specific analysis requirements. Sediment toxicity tests should be commenced as soon as practical after sample collection and two weeks is recommended as a maximum holding time. A summary of the preservation and holding times for various sediment analyses is presented in Table 1; however, it is best practice to seek advice on preservation and holding times from the laboratory that will be conducting the analysis.

Table 1: General guide to preservation and holding times for sediment analyses

Analysis	Preservation	Holding Time
Pore-waters	For metals, consult testing laboratory for specific instructions. For dissolved metals, filter (0.45 µm) and acidify immediately after pore-water extraction. If oxidation state of metal is likely to affect solubility, extraction and preservation should be performed in an inert atmosphere (e.g. under nitrogen). For organic contaminants: refrigerate at <6°C. For ammonia or sulfide, see testing laboratory for instructions.	Analyse samples that may contain volatile analytes (ammonia, sulfide and organics) as soon as possible after collection. Analyse preserved metal samples within 14 days.
Whole sediments for total particulate metals (with exception of mercury)	None	Six months.
Whole sediments for mercury	Refrigerate at <6°C and store in the dark.	28 days.
Whole sediments for bioavailable metals or for metal speciation.	Refrigerate at <6°C, unless metals associated with acid volatile sulfide (AVS) are the contaminants of interest, in which case freezing is appropriate.	Analyse as soon as practical, but generally within 7 days.
Whole sediments for extractable organics.	Refrigerate at <6°C and store in the dark.	Analyse within seven days for volatile compounds or those prone

Analysis	Preservation	Holding Time
Note: Total Organic Carbon should always be measured when sampling for organics.		to microbial degradation. Analyze within eight weeks for stable organics such as organochlorine pesticides, dioxins/furans, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH).
Whole sediments for acid volatile sulfide (AVS), ammonia or other volatile inorganic compounds	Frozen	28 days
Where sediments are to be used for toxicity assessments, holding times and sample storage conditions should meet the requirements described for the specific compounds present (with appropriate refrigeration; <6°C), but generally no longer than two weeks.		

5 References and additional reading

AS/NZS 5667.12:1999, *Water quality—Sampling—Guidance on the Sampling of Bottom Sediments*.

Commonwealth of Australia 2009, *National Assessment Guidelines for Dredging*, Commonwealth of Australia, Canberra, 81pp.

Simpson, SL, and Batley, GE 2016, *Sediment quality assessment: A Practical Handbook*, 2nd edn, CSIRO Publishing, Canberra, 360pp.

U.S. EPA 2001, *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. Office of Water, U.S. Environmental Protection Agency, Washington, DC. 208pp.