

PUBLICLY AVAILABLE SPECIFICATION

Determination of priority pollutants in surface water using passive sampling

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Contents

Foreword *ii*

Introduction *1*

1	Scope	<i>3</i>
2	Normative references	<i>3</i>
3	Terms and definitions	<i>3</i>
4	Principle	<i>4</i>
5	Handling sampling devices	<i>5</i>
5.1	General	<i>5</i>
5.2	Organics sampling devices	<i>5</i>
5.3	Metals sampling devices	<i>5</i>
6	Estimation of appropriate field deployment time	<i>5</i>
7	Sampling device preparation and assembly	<i>6</i>
7.1	Sampling device preparation	<i>6</i>
7.2	Sampling device assembly	<i>6</i>
7.3	Sampling device storage	<i>6</i>
8	Quality assurance	<i>6</i>
8.1	General	<i>6</i>
8.2	Replicate quality control sampling devices	<i>7</i>
8.3	Sampling device controls	<i>7</i>
9	Selection of sampling site and safety precautions	<i>9</i>
9.1	Selection of sampling site	<i>9</i>
9.2	General safety precautions	<i>9</i>
10	Sampling device deployment and retrieval	<i>10</i>
10.1	Materials and apparatus	<i>10</i>
10.2	Deployment procedure	<i>10</i>
10.3	Retrieval procedure	<i>11</i>
11	Extraction of analytes from sampling devices and preparation for analysis	<i>12</i>
12	Analysis	<i>12</i>
13	Calculation	<i>13</i>
14	Test report	<i>14</i>

Bibliography *18*

Annexes

Annex A (informative) Relevant analytical methods (European and international standards) *15*

Annex B (informative) Quality control measures *16*

B.1 Recovery *16*

B.2 Method detection limits (LoD) *17*

B.3 Precision *17*

List of figures

Figure 1 Schematic representation of a passive sampling device *2*

Figure 2 Quality control samples involved in passive sampling *7*

List of tables

Table 1 Sampling device control requirements *8*

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 19 and a back cover.

Foreword

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Introduction

Priority pollutants have been defined by the EU and are listed in Council Decision 2455/2001/EC [1]. They include:

organohalogen compounds and substances that may form such compounds in the aquatic environment;

organophosphorus compounds;

organotin compounds;

substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment;

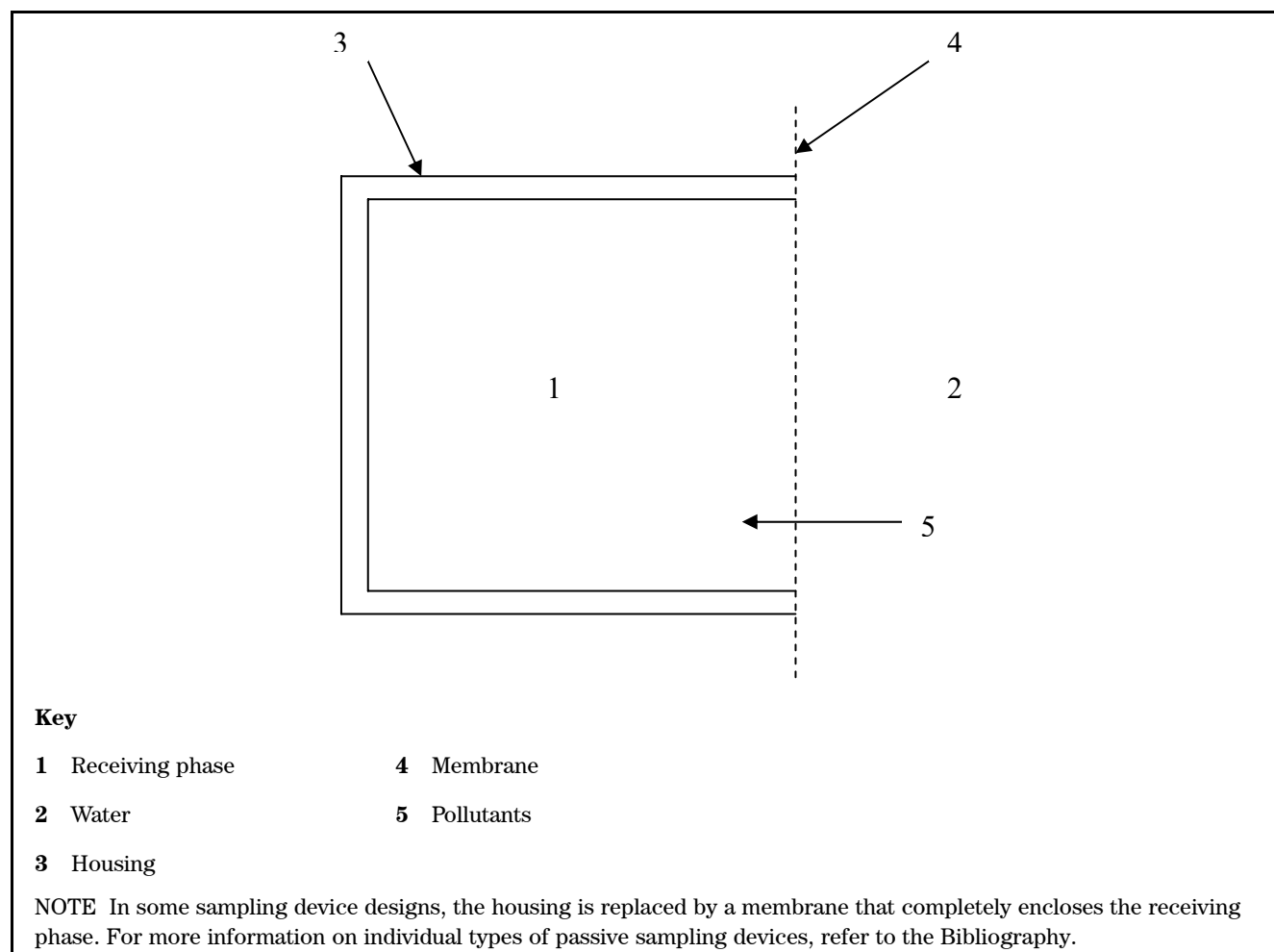
- persistent and bioaccumable and toxic (PBT) and very Persistent and very Bioaccumulating substances (vPvB);
- cyanides;
- metals and their compounds;
- arsenic and its compounds;
- biocides and plant protection products;
- materials in suspension;
- substances that contribute to eutrophication (in particular, nitrates and phosphates);
- substances that have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD (biochemical oxygen demand), COD (chemical oxygen demand), etc.

Pollutant levels in surface water have traditionally been monitored by spot sampling (also known as bottle or grab sampling). Such sampling gives a snapshot of pollutant levels at a particular time. But pollutant levels in surface water have a tendency to fluctuate and so it is desirable to monitor pollutant levels over time. This may be achieved by repeated spot sampling, continuous monitoring, biomonitoring or passive sampling.

Passive sampling involves the deployment of a calibrated device that uses a diffusion gradient to collect pollutants over a period of days to weeks, followed by extraction and analysis of the pollutants in a laboratory. This provides a measure of time-weighted average concentrations of pollutants to which the sampling device was exposed.

Passive sampling devices used in surface water typically consist of a receiving phase (typically a solvent or sorbent) that acts as a sink for compounds of interest, which may be held behind or surrounded by a membrane through which the target substances can permeate. A schematic representation of such a sampling device is shown in Figure 1. In its simplest form a passive sampling device is comprised solely of a membrane, or fibre, or bulk sorbent which acts as a receiving phase.

Figure 1 Schematic representation of a passive sampling device



1 Scope

This PAS describes a method for the determination of time-weighted average concentrations of priority pollutants in surface water by passive sampling, followed by analysis.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 6068-1.2, ISO 6107-2, *Water quality – Glossary – Part 2: Additional terms relating to types of water, and treatment and storage of water and waste water, and terms used in sampling and analysis of water*

BS 6068-6.4, ISO 5667-4, *Water quality – Sampling – Part 4: Guidance on sampling from lakes, natural and man made*

BS 6068-6.14, ISO 5667-14, *Water quality – Sampling – Part 14: Guidance on quality assurance of environmental water-sampling and handling*

BS EN 25667-1, BS 6068-6.1, ISO 5667-1, *Water quality – Sampling – Part 1: Guidance on the design of sampling programmes*

BS EN ISO 5667-3:2003, BS 6068-6.3:2003, *Water quality – Sampling – Part 3: Guidance on the preservation and handling of water samples*

BS ISO 5667-6, *Water quality – Sampling – Part 6: Guidance on sampling of rivers and streams*

3 Terms and definitions

For the purposes of this PAS, the terms and definitions given in BS 6068-1.2 (ISO 6107-2) and the following apply.

3.1 analytical recovery standard

compound added to sampling device receiving phase prior to analysis and whose recovery levels during analysis are used to provide information about recovery efficiency

3.2 fabrication control

quality control sampling device to record contamination from the manufacturing process, sampling device components, laboratory storage, processing and analytical procedures

3.3 field control

quality control sampling device to record any chemical accumulated in sampling devices during transportation, deployment and retrieval

3.4 passive sampling

collection of chemical compounds without provision of energy from an external source

3.5 priority pollutant

substance which is a potential source of water pollution

NOTE A list of priority pollutants is given in the EU Water Framework Directive [2].

3.6 performance reference compound (PRC)

compound that has moderate to high fugacity from the sampling device, which does not interfere with the sampling and analytical processes and which is added to the device receiving phase prior to deployment

NOTE 1 The off-loading (elimination) rates of the PRCs are used to provide information about in situ uptake kinetics.

NOTE 2 Currently there are no PRCs available for metals sampling devices.

3.7 reagent control

retained aliquot of reagent used in preparation and analysis of sampling devices which is analysed with the samples in order to diagnose any contamination from the reagents used

3.8 recovery spike

quality control sampling device, pre-spiked with known mass of compounds of interest, used to determine the recovery levels of target compounds from processed sampling devices to establish control limits for the analytical process

3.9 sampling device class

class of target analytes which a sampling device is designed to accumulate

NOTE Sampling device classes include the following:

- polar organic compounds;
- non-polar organic compounds; and
- inorganic compounds, including metals.

3.10 shipping control (optional)

quality control sampling device to record any contamination or changes during transportation and storage of sampling devices on their way to and from the manufacturer to the user and from the user to the laboratory that performs the preparation of sampling devices for analysis

4 Principle

Target priority pollutants accumulate in the receiving phase of a passive sampling device over a defined time period of exposure to surface water. The pollutants are extracted from the sampling devices in the laboratory and the amount of each pollutant accumulated is determined by chemical analysis. Provided that mass transfer of the pollutant to the sampling device varies linearly with concentration, the time weighted average concentration of pollutants to which the sampling device was exposed over the deployment period can be calculated.

The process is illustrated in a flow chart in Figure 2 in Clause 8.