

SAMPLE BLANKS

Introduction

The use of “Blanks” as part of the sampling and analytical procedures for environmental samples is essential for any Quality Assurance programme.

To assist our clients, Hill Labs have prepared this Technical Note which is based on our experience and the references (eg from US EPA and APHA) listed at the end.

Definition

A blank is an artificial sample designed to monitor the introduction of artifacts into the analytical process (US EPA, Reference 1). Many different types of blanks can be used and they can be conveniently grouped as either blanks used in sampling and transport or blanks used within the laboratory. Both types will be briefly discussed in this Technical Note which is restricted to covering blanks used in collecting and analysing aqueous samples on

Using blanks

As every field situation is different it is up to the project designer to decide on appropriate blanks to use. The following guidelines may be of use.

- A) It is better to collect many blanks, even if only one or two, usually the field blanks, are analysed. If problems are shown up in this analysis other blanks can be analysed to identify the source of the problem (Reference 2). The maximum holding time for the blanks must be taken into consideration.
- B) The lower the required detection limit for the analytes the more important it is to collect blanks. For the lowest detection limits full protective equipment must be used for sampling and exacting procedures must be followed. Hill Labs have installed a “Clean Room” to enable us to handle low level elemental analyses on environmental samples with a minimum risk of contamination from the laboratory environment.

If containers, and water for blanks, are obtained from sources other than Hill Labs the consideration should be given to having us carry out “Blank” tests on the containers and/or water. We have had, for example, cadmium contamination from red caps on plastic bottles and mercury and zinc contamination from plastic bottles. Iron leaches from many glass bottles.

Aluminium, lead and calcium are also common contaminants.

“Pure Water”

Type 1 Water

This is defined as water having a resistivity of >10 megohm-cm. In our laboratory we prepare Type 1 water by passing deionised water through a Barnstead Model E-Pure Water purifier fitted with anion, cation and carbon bed cartridges. The resistivity of the water is continuously monitored to ensure its purity, and the water is used as a blank for all of our laboratory tests which serves as a further purity check.

Deionised Water

This is water purified by passing through anion and cation ion exchange columns. These remove all ‘ionic’ impurities but have no effect on non-ionised species such as many organics and some silica.

Distilled Water

Water which is boiled to produce steam and then recondensed is termed ‘distilled water’. This process removes many major impurities and dissolved CO₂, but may not remove volatile species such as fluoride and ammonia.

Blanks used in Sampling and Transport

1. Field Blanks

These are samples of Type 1 water and measure sample contamination during the whole process (bottle preparation, sampling, transport, sample preparation and analysis). There are two different procedures suggested in the references for using field blanks.

A) Transfer type field blanks. A capped, clean container, containing a preservative if appropriate, is taken to the site along with a sample of Type 1 water. At the site, the cap is removed from the clean container, the water is transferred into the container and the cap replaced tightly. The container is then labelled as appropriate. This would be our recommendation for most circumstances.

B) Exposure type field blanks. A blank sample is prepared in the laboratory by adding preservative, if appropriate, to a clean container and then filling the container with Type 1 water. The cap is replaced tightly. This container is taken into the field, the top removed for the time equivalent to that needed to fill one of the other sample bottles, the cap replaced and the container labelled as appropriate.

2. Trip or Transport Blanks

Samples of Type 1 water are prepared in the laboratory, taken to the field site and then returned to the laboratory unopened. They measure sample contamination by cross-contamination from other samples, field handling, storage and transport. Cross-contamination is only likely to occur in samples collected for Volatile Organic Compounds (VOC, which includes BTEX, halomethanes and solvents)[US EPA] or mercury [our experience].

3. Equipment or Rinsate Blanks

These are samples of Type 1 water which have been used to rinse field equipment such as pumps, bombs or filtering equipment. They are collected after equipment decontamination and before resampling. They can be used to document adequate decontamination of the equipment after use.

Blanks Used in the Laboratory

1. Calibration Blanks

These are prepared from AR Grade chemicals and Type 1 water and are used solely to calibrate laboratory instruments prior to analysing unknown samples.

2. Sample, Procedural or Reagent Blanks

Type 1 water is substituted for a sample and is usually carried through the whole analytical procedure, eg digestion, extraction, etc, along with a batch of samples. This gives a measure of any contamination from reagents, tubes, equipment, etc.

3. Solvent Blanks

These consist only of the solvent used to dilute or extract samples and are used to identify, and sometimes correct for, impurities present in the solvent. These are primarily used with analysis for organic compounds.

4. Matrix Blanks

These are analyte-free samples prepared in the laboratory to have a matrix similar to that of the samples being analysed eg 5% alcohol for beer samples, saline solutions for seawater, etc. They are used to correct for any matrix interferences which may occur during the analysis. Our laboratory uses matrix matched standards wherever possible, and the matrix blank is equivalent to the "zero" standard.

5. Bottle or Container Blanks

As part of our Quality Assurance programme we regularly remove a random set of cleaned bottles from our bottle preparation store, fill them with Type 1 water and analyse them for all appropriate analytes as if they were real samples. Results are available for inspection at our laboratories.

Blanks Used in the Laboratory

Note that we do not normally report the results of blanks used in the laboratory as these are part of our in-house QC monitoring programme. Results are available for inspection if required.

References

1: "Test Methods for Evaluating Solid Waste, Volume 2: Field Manual Physical/Chemical Methods, QC Procedures, Sampling, Monitoring", US EPA, SW-846, 3rd Edition, Nov 1986.

2: LH Keith, "Environmental Sampling and Analysis", Lewis Publishers (1991)

3: APHA "Standard Methods for the Examination of Water and Wastewater", (Online Edition)