FIELD PROCEDURE: GROUNDWATER SAMPLING

This is not a health and safety risk assessment

1. APPLICABILITY

This document describes the standard field procedures used for sampling groundwater.

2. OBJECTIVE

The key objectives of groundwater sampling are:

- To obtain samples of groundwater representative of in-situ groundwater conditions.
- To minimise changes in groundwater chemistry during sample collection and handling.

3. SELECTION OF SAMPLING METHOD

Several different methods are available for groundwater sampling, taking into account the following considerations:

- Sampling objectives
- Well geometry and depth to groundwater
- Well yield (known or anticipated, based on geology)
- Methods previously used for sampling the well in question
- Wastewater collection and disposal requirements

The most common methods and the circumstances in which they may be appropriate are as follows:

Low flow purging and sampling.

This is often the preferred method for sampling but is not possible where the transmissivity is too low for a stable water level to be maintained during purging.

The method involves purging a relatively low volume of water (e.g. 1 well volume) at a low rate, while monitoring wellhead parameters to assess their stability, then sampling using the same equipment while pumping at a similar or lower flow rate.

4. STANDARD PROCEDURES

Pre-Sampling

To the extent practical, sampling should be planned so that the wells are sampled in order of increasing contaminant concentrations (if prior knowledge is available) in order to reduce the potential for cross-contamination.

Where purging and sampling equipment is not dedicated or single-use, it must be decontaminated before use.

On arrival at a well, note its condition particularly any factors that may compromise or affect the quality of the groundwater sample to be collected (e.g. missing cap, cracked seal, surface spill). If wellhead gas monitoring is to be carried out, do this before groundwater gauging and sampling. Take care when removing airtight well caps in case there is sudden release of air or other vapours from inside the well casing.

Take care to prevent contact of purging and sampling equipment with the ground or with other potential sources of sample contamination.

Gauging of Fluid Levels

Measure the depth to water using an electronic water level indicator or other suitable device. Fluid depths in any wells in which non-aqueous phase liquids (NAPLs) have been previously detected or are suspected should be gauged using an electronic interface probe. Measurements with an interface probe should be checked both while the probe is being lowered and while it is being raised and should be repeated at least once in order to check for consistency. This is important because sometimes NAPL can smear on the probe and erroneously indicate a thicker layer of NAPL than is actually present in a well.

If the well has an airtight cap, the groundwater level may take some time to stabilize after the cap is removed, due to equilibration of the groundwater level with the ambient atmospheric pressure (which may be different from the pressure on the day the cap was fitted). This is especially the case if the well is screened in clay or other low permeability material. The escape or inflow of air to the well casing may be noticed when the well cap is removed. In such cases, the depth to groundwater should be gauged upon removal of the cap and then again after a period of time (e.g. 10 minutes) to assess stability. This information should be recorded in the field notes.

The probe and line used should be appropriately decontaminated between each well. This is particularly important where petroleum hydrocarbons are present or suspected.

Purging

Low flow Purging

Only pumps that are able to minimize disturbance of the water in the borehole column should be used for low flow purging (e.g. peristaltic pumps or pneumatic bladder pumps). Inertial pumps, bailers and other grab samplers should not be used. The same pump should subsequently be used for sampling without removal to reduce the chance of mixing in the borehole.

The pump intake depth should normally be set approximately midway within the saturated part of the screened interval. The precise depth is not critical because the sample that is obtained will be a flow- weighted average from the full saturated screen length of the well, irrespective of the intake depth.

Wellhead parameters such as electrical conductivity, pH, temperature, turbidity and dissolved oxygen should be monitored during purging (e.g. at 5 minute intervals) using a flow-through cell. Purging should be continued until (i) at least one well volume of water has been removed and (ii)

the parameter values are approximately stable (see below). Document calibration of the water quality meter.

Field Parameter Stabilisation

Purging under the volume purging method or the low flow method should continue until the differences between successive sets of field parameters, taken at intervals of at least 5 minutes or 0.5 well volumes, are within the following criteria:

- pH: ± 0,1
- EC: ± 3%
- Redox: ± 10 mV
- DO: ± 10%
- Temperature: 0,2ºC

Disposal of Purge Water

All purge water should be collected in suitable containers and disposed of appropriately. Water will be temporarily stored in drums or other watertight containers for subsequent collection and on-site or off-site disposal at appropriate locations.

Sampling

If the well has been purged, sampling should be conducted as soon as practicable following purging, and at a lower flow rate than used in purging.

Samples should be collected into appropriately prepared bottles or vials supplied by the laboratory and should be free of air bubbles. Bottles containing samples for analysis of volatile compounds should be filled to the top including a meniscus before the cap is put on, in order to avoid the presence of air bubbles in the sample bottle.

Samples that need to be filtered on site (e.g. samples for analysis of metals, sulphide or cyanide) should be filtered using a filtration unit fitted with a dedicated sample-specific high capacity 0,45 micron filter and transferred to a plastic sample bottle, as supplied by the laboratory with appropriate preservative. On-site filtration is essential when the sample bottles contain preservatives, otherwise the preservatives may dissolve sediment from the sample and produce unrepresentative results.

Sample bottles should be labelled using a unique identifier and stored in insulated cool boxes containing bags of ice (water ice is much more effective than frozen blue ice packs). The ice should be present prior to sample collection and should be double-bagged to reduce the chance of water leakage into the cool box. A chain-of-custody form must be kept with the samples, recording the sample type, sampling time, date and required analysis. This form should also be used to record the handover of the samples. All samples should be transferred by same-day or overnight courier to the laboratory (generally within 24 hours of sampling if volatile chemicals are being tested for) in the sealed insulated cool boxes.

After Sampling

Replace well caps and locks and leave the area around the well in a tidy condition. Dispose of all wastes in an environmentally responsible manner.

Information to be recorded

- Identification of sampling personnel;
- Identification of wells measured/sampled;
- Date and time of measurement/sample collection;
- Weather conditions;
- Results of static water level measurements, including the thickness of NAPL, where present;
- Observations, such as deficiencies in the physical condition of wells and any pertinent observations of surrounding land- use (e.g. spills, chemical storage, vegetation die-back);
- Purging/sampling methods and volumes;
- Confirmation of which samples were filtered on site;
- Visual and olfactory observations of water quality;
- Results of field water quality measurements
- Purge volume;