DEQ Montana Department of Environmental Quality

REMEDIATION DIVISION
Petroleum Cleanup Section

Technical Guidance Document

This guidance was developed to assist with remediation and cleanup actions at petroleum releases overseen by the Petroleum Tank Cleanup section.

Groundwater Sampling Methodologies

Groundwater samples are routinely collected during site assessments, remedial investigations and corrective action activities. This guidance has developed the following specifications to address acceptable well purging methodologies and acquisition of groundwater samples.

General Requirements

Monitoring wells should be evacuated and sampled beginning from the least contaminated to the most contaminated well to minimize the potential for cross-contamination. The sampling order of the wells from least to most contaminated should be based on historical data or knowledge of the existing site conditions.

Measuring and recording groundwater geochemistry is necessary during groundwater sampling. These parameters should include, at a minimum, pH, temperature and conductivity. Other parameters that should be considered would include dissolved oxygen, oxidation-reduction potential (ORP) and turbidity.

Prior to initiating sampling activities at a given location, depth to water should be measured at all existing wells that are accessible. The static water level in a well will be measured using an electronic water-level indicator or an electronic oil/water interface probe to the nearest one hundredth of a foot (0.01 foot). The water level will be measured from a scribed mark at the top of the steel or PVC well casing that corresponds to the point at which the elevation for the well was surveyed. All measurements will be recorded.

Field meters used during sampling will be checked for calibration consistent with manufacturer-recommended procedures. At a minimum, field instrument and equipment calibration should be

conducted at the beginning of each day of sampling. Calibration is the process of establishing a relationship of a measured output to a known input and provides a point of reference to which other sample analyses can be correlated. More frequent calibration will be conducted as necessary, based on instrument performance checks and operator judgment. All calibrations will be performed using standard industry practices and/or equipment manufacturer recommendations.

Care should be taken to ensure the cleanliness of all sampling equipment. Non-disposable sampling equipment should be decontaminated between each different monitoring well. An acceptable decontamination protocol should be included in the firms Standard Operating Procedure (SOP) documents on file with the PTC and strictly adhered. If a current SOP is not on file with the PTC, a detailed decontamination procedure will be included in the work plan.

Purge water should be handled in a manner consistent with Bureau guidance. Sampling consistency will produce repeatable results and data of a higher quality. Multiple purging methods will not be accepted at a site unless approval is granted by the PTC project manager.

Methods

Low-Flow or Micropurging

Low-flow or Micropurge sampling is the preferential methodology for groundwater sampling. Low-flow sampling allows wells to be purged and sampled without causing excess agitation within the water column and reduces concerns associated with turbidity. It also allows for greater sample consistency. Specially designed pumps and equipment should be used for true low-flow sampling protocol. Pre-cleaned or dedicated, low-flow bladder pumps should be used for purging and sampling. The disposable tubing and pump should be lowered gently and set at approximately the upper third or fourth of the screened interval. If the static water level is below the top of the screen, then the pump will be lowered to the upper third or fourth of the water column. In either case, the pump intake will be placed a sufficient distance above the bottom of the well to avoid mobilization of any accumulated sediment. Well purging should begin at a rate of 0.2 to 0.5 L/min while continuing under a maximum purge rate of 1.0 L/min. The optimum pumping rate should be determined with continuous water level measurements using an electronic water-level indicator. The appropriate rate must be equal to or less than the natural recovery rate of the well. Drawdown in the well should be minimized. The pump intake may be adjusted as the water level responds to pumping. During low-flow purging, pH, specific conductance, dissolved oxygen and temperature will be monitored approximately every three to five minutes using a flow through cell. Well purging should be considered complete when at least three consecutive readings of pH, temperature, dissolved oxygen and specific conductance have been collected and have stabilized to within ten percent of the last series of measurements (or one tenth of a unit in the case of pH). Once field parameters have stabilized, samples should be collected directly from the end of the discharge tube after disconnecting the flow-through cell.

Submersible Pumps

Submersible pumps (e.g. Grundfos or Whaler type) can be used for well purging and groundwater sampling. The flow rate of the pump should be regulated to the lowest flow possible during purging. Disposable polyethylene or similar tubing should be affixed securely to the submersible pump. The pump and tubing should be gently lowered into the well bore so as not to cause undue agitation. The depth of the purge pump intake will depend on well yields and construction details. The ideal intake will be below the static water level in the well and in the upper third or fourth of the screened section. If the static water level is below the top of the screen, then the pump will be lowered to the to the upper third or fourth of the water column. The pump should never be placed directly at the bottom of the well. The pump intake may be adjusted as the water level responds to pumping. If wells are purged that have very slow recovery rates, the well can be pumped dry and allowed to recover before sampling. Standard purge protocols require measurements of pH, temperature and specific conductance, and a visual determination of groundwater turbidity. Other parameters that may be measured include dissolved oxygen and oxidation/reduction potential. These parameter readings should be collected after the evacuation of one well volume. Well purging should be considered complete when at least three well volumes are evacuated and readings of pH, temperature and specific conductance have stabilized to within ten percent of the last series of measurements (or one tenth of a unit in the case of pH). Once purging is complete, samples should be collected directly from the pump discharge tubing. Disposable tubing should be used only once and should not be reused for subsequent sampling events. It is imperative that non-disposable pumping equipment be thoroughly decontaminated between each location.

Peristaltic Pumps

In some instances, the use of a peristaltic pump for groundwater sampling may be warranted. Peristaltic pumps should be used minimally for well purging as they may contribute to agitation of the water column and excess volatilization of constituents of concern (COCs). Disposable tubing should be used at each well and should never be reused. Standard purge protocols require measurements of pH, temperature and specific conductance, and a visual determination of groundwater turbidity. Other parameters that may be measured include dissolved oxygen and oxidation/reduction potential. These parameter readings should be collected after the evacuation of one well volume. Well purging should be considered complete when at least three well volumes are evacuated and readings of pH, temperature and specific conductance have stabilized to within ten percent of the last series of measurements (or one tenth of a unit in the case of pH). Groundwater samples may be collected directly from the tubing once purging is complete.

Bailing

If low-flow purging or other appropriate sampling methodologies are not practical due to field conditions, monitoring wells may be evacuated using a disposable or pre-cleaned bailer. Bailers should be used minimally for well purging as they may contribute to agitation of the water column causing excess volatilization of COCs and may cause turbidity concerns. PTC strongly discourages the use of bailers for groundwater sample acquisition and this method should be discussed with the appropriate Case Manager before sampling is conducted. Standard purge protocols require measurements of pH, temperature and specific conductance to be collected during well purging. These parameter readings should be collected after the evacuation of one well volume. Well purging should be considered complete when at least three well volumes are evacuated and readings of pH, temperature and specific conductance have stabilized to within ten percent of the last series of measurements (or one tenth of a unit in the case of pH). Surging of the water column with the bailer should be avoided. Disposable bailers should not be reused. Non-disposable bailers should be thoroughly decontaminated between locations.

Temporary Well or Hydropunch™ Sample Collection

A temporary well or Hydropunch™ sampler may be used at locations to collect shallow groundwater samples with approval or at the request of the PTC. A Hydropunch™ or similar well point may be used to collect a one-time groundwater sample only. A temporary well will be allowed for use up to 180 days. Once this time period has expired, the temporary well must be abandoned or replaced with a permanent well that meets the Department of Natural Resources (DMRC). For Hydropunch™ or similar technology sampling, a stainless steel sampler should be pushed to the desired depth and the push-rod pulled back to expose a porous screen. For a temporary well point, the well screen should be set at the first encountered groundwater. Depth-discrete groundwater entering the sampler or temporary well may be collected by one of two methods: 1) by use of a decontaminated stainless steel bailer and/or a disposable polyethylene bailer 2) or with disposable polyethylene tubing and a peristaltic pump. Parameter stabilization should be attempted before sample acquisition, but it is understood that this may not be possible under certain circumstances.

Other Technologies - Diffusion Bags, Multi-Port Systems (Westbay® or Solinst®)

Other methodologies for acquisition of groundwater samples on a site-by-site basis maybe considered. It should be demonstrated to the PTC project manager that the proposed methodology is technically sound and cost effective for use at the site.

Residential Wells

In some instances, samples will be acquired from residential wells. Several factors should be considered when collecting samples from a residential well. It should be determined if the residence is equipped with a water softener or other filtration system. Samples should be collected before any type of treatment systems, if possible. Samples should also be collected

from as close to the well influent as possible. Sampling through hoses or tubing should be avoided. The sample should be collected directly from spigots or faucets. In residences, the size of the holding tank should be determined. The volume of the holding tank should be purged before sample acquisition, if feasible. Water quality parameters should be collected after sample acquisition. Sample analysis requirements are case specific; however when sampling for petroleum compounds, total petroleum hydrocarbons should be targeted in addition to Volatile Organic Compounds utilizing EPA method 524.2.

Irrigation Wells

Groundwater samples may also be collected from irrigation wells. If possible, these wells should be purged for a sufficient length of time to evacuate the casing of all stagnant water before a sample is collected. Water quality parameters should be collected after sample acquisition.