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Standard Operating Procedure for a FACT – (FLUTe Activated Carbon Technique) Installation

Standard Operating Procedure for the Installation of a FACT System

The following description is for the typical borehole for which the transmissivity profile is unknown since the FACT system is usually installed before a transmissivity profile is performed. The lack of information about the new borehole requires the assumption that the bottom end of the borehole is of low transmissivity.

Purpose

The FACT is a technology developed by FLUTe to map the relative distribution of dissolved phase contaminants in a sealed borehole with 6" to 3' resolution. The FACT works by adsorbing the contaminants from the rock matrix and fracture flows via diffusion, and is then analyzed via a MS/GC to produce a relative contaminant distribution profile.

Construction

The FACT is continuous strip of activated carbon felt which is attached to a NAPL FLUTe hydrophobic cover between the NAPL reactive cover and the diffusion barrier. The NAPL FLUTe and FACT are then attached to a standard blank FLUTe liner as a slip on cover which is fixed to the liner via a pigtail knot at the bottom end. This modified blank liner is sometimes called a carrier liner.

Shipping and Arrival at the Site

The FACT liner system is shipped to the site with the liner rolled on a shipping reel inside out with the open end of the liner on the outside of the roll. An air vent tube attached to the end of the liner is positioned at the edge of the reel for access to a vacuum source. The vacuum source is usually a venturi vacuum pump connected to a compressed air liner with a compressor

A pump tube is usually shipped on the exterior of liner roll. A metal rod weight is inserted into the pump tube. The rod must not be able to fall out of the pump tube. The end of the pump tube is covered with a plastic ball to avoid the entrapment of the tube as it is lowered to the bottom of the borehole. The pump tube is perforated with short scallops cut into the pump tube above the weight to allow easy flow into the pump tube.

Installation

The pump tube is lowered to the bottom of the hole, less one foot. The pump tube is secured to the top of the casing. Don't drop the pump tube into the hole.

The open end of the liner is extended from the reel, slipped over the top end of a surface casing and clamped. This usually requires a slit cut into the seam of the liner for passage of the top end of the pump tube. Be careful to not twist the cover material within the liner. (The cover is stapled to the top edge of the liner, unless the liner is shortened. The liner is then pushed down into the borehole about three feet or more to form an annular pocket between the liner against the casing

and the inverted liner. The liner is sometimes inverted before being inserted into the casing and the open end is slit and then attached to the casing.

Water is added to the annular pocket providing a weight/pressure against the inverted end of the liner. The liner then everts down the borehole as it is fed from the shipping reel. A minimum of ~5 lb. of tension is maintained on the liner as it everts to the water table.

Once the end of the everting liner enters the water table in the borehole, more water is added to the liner driving it deeper into the borehole. Prior to further descent of the liner beneath the water table in the borehole, the vacuum pump should be connected to the hollow axle on the reel stand and the reel axle connected with a jumper tube to the vent tube at the side of the reel. The vacuum should be applied until the liner is visibly collapsed at the top of the surface conductor before more water is added to the liner. Then the water addition can proceed.

Once the liner has descended a short distance below the water table, a slender tube is inserted into the pump tube to form an air lift pumping system. The slender tube is installed to at least 3 times the depth to the water table, but not beyond the scallops in the pump tube, preferably 10 ft above the scallops. A compressed air source is connected to the slender tube to generate water flow from beneath the everting liner to the surface through the pump tube.

When the liner has everted to half its length into the borehole, the end of the liner descends into the borehole followed by the tether. The same tension is applied to the tether as the liner descends further.

If the liner is equipped with a water addition system for use during the removal of the liner, there is often a tube that descends with the tether as the tether is fed from the reel.

As the liner descends in the borehole, the water is removed from beneath the liner using the pump tube air lift system until the liner reaches the bottom of the borehole.

Once the liner has reached the bottom of the borehole, the flow from the pump tube will cease. At that point the tether is secured to a support bar placed across the casing. The support bar is provided with the liner as are the clamps for the casing.

Once the tether is supported, a pump must be lowered into the liner to remove water allowing the liner to collapse until the pump tube can be removed from the borehole. The liner is then refilled to 5-10 ft above the original water level in the borehole. This can take some time because the liner will dilate forcing the water trapped between the borehole and liner to be forced back into the formation. When the liner water level is no longer descending with the liner dilation, the cover and FACT are pressed against the borehole wall. FLUTe personnel may then perform a test to determine the highest head in the formation by lowering the water level in a stepwise manner until the water level no longer descends with water removal. That is the level of the highest head in the formation. The water level in the liner should then be raised to 5-10 ft above that level. Ten feet is preferred if available without overflow of the surface casing. If there is a substantial open hole in

the vadose zone, the water level can be raised to 30 ft above the original water level to allow a FACT assessment of the vadose zone.

The liner is left in place for ~2 weeks.

The Removal Procedure

Then the liner is inverted from the borehole. If the bottom end of the borehole is impermeable, water must be added beneath the liner using the water addition system. This is best done by FLUTe personnel.

Upon the inversion of the liner from the borehole (normally performed using a FLUTe system called a "green machine") the liner is extended on a poly-sheet on a flat surface. Air is blown into the liner between the liner and the cover material. (Note the cover is now inside the inverted liner.) The cover is removed from the liner by sliding the liner sequentially off the cover. The cover is then extended on the poly-sheet. The liner is then best slit from the top to the bottom opposite the FACT silver colored diffusion barrier. A tape measure is placed next to the flat liner in order to determine the depth of the NAPL stains on the cover. Those stains are best photographed with the tape in the photo. The top end of the tape should be positioned at the ground surface position on the liner when it was in the borehole.

FACT Sectioning, Preservation, and Lab Analysis

FLUTe staff will usually then remove the carbon felt from the diffusion barrier and places it in the prescribed lengths in bottles containing DI water for shipment to the lab for analysis. The bottles are labeled for depth in the hole, the hole ID and date and time. With quick removal from the diffusion barrier to the bottles there is minimal loss of VOCs in the carbon. The bottles are then placed in a shipping contain with ice for shipment to the lab.

For any questions about the procedure, contact Ian Sharp at 505-883-4032 or Ian@flut.com.