DRAGUN CORPORATION'S
ENVIRONMENTAL MINUTE
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# Conceptual Site Models (Part 6 of 8)

## Getting Subsurface Data

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*Mike is a hydrogeologist with a passion for getting things right the first time. He also isn't afraid to buck conventional thought, when necessary. Mike brings these two characteristics to every environmental project he touches. Mike has a deep and broad background in hydrogeology, formed from a demanding geological engineering undergraduate degree, followed by a Ph.D. from the world-class hydrogeology program at the University of Waterloo. Mike's 15-year academic career prior to consulting served to further broaden his knowledge and hone his communication skills.*

As we have discussed in each of these minutes, any hopes of finding the proper remediation approach rest on understanding site conditions. Just as there are many remediation technologies, there are many site investigation tools. We use a variety of methods to investigate subsurface conditions and geology and to install monitoring wells. Although not discussed here, geophysical methods (e.g. ground penetrating radar, electromagnetics, etc.) are sometimes used to help gain site knowledge.

For the purpose of this environmental minute, we focus on the physical collection of subsurface data (i.e. soil, groundwater, and chemistry data). Knowing which tools to use for the site conditions and purpose of the investigation will narrow the options and help assure that your samples are representative of the site conditions.

**Selecting Your Subsurface Tools**

The starting point in collecting subsurface data is appropriate equipment for specific site conditions. There are (at least) 10 questions to ask when deciding which drilling method to use:

1. What is the geology – is there rock or boulders?
2. How deep do you need to go?
3. Do you need an "undisturbed" soil sample?
4. Can you use water in drilling?
5. Are there site access issues: wet conditions, narrow doors, low ceilings?
6. Do you need to install a monitoring well?
7. How quickly do you need to complete the investigation?
8. Is dealing with waste soil from borings a problem?
9. What is available from contractors?
10. What is the budget?

Answering these questions will assist you in selecting the appropriate method of drilling such as direct push, hollow-stem augers, sonic rigs, etc. In some cases, it may be appropriate to simply use a hand auger or backhoe. It will also help in avoiding wasting time and effort by choosing the "right tool for the job."

**Soil Logging**

Selecting the appropriate method to get the soil sample from the subsurface is only the first step to make sure that the sample is representative. Once brought to the surface the sample needs to be properly "logged" or described.

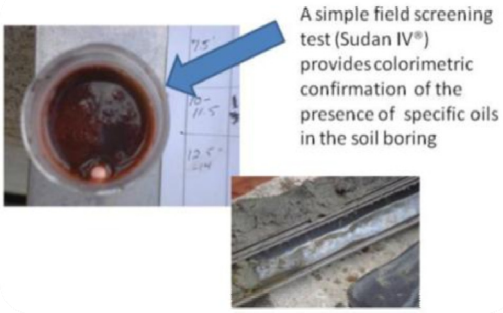

The field geologist inspects the soil core, assessing soil grain size distribution, moisture, odor, staining, and "sniffs" for organic vapors. Note that accurate logging of the subsurface soil is critical when developing the Conceptual Site Model (CSM) and understanding where contamination is currently and where it may go in the future.

There are many tools that can be used to improve our understanding of the subsurface, especially tools that can be used with a Geoprobe® to obtain real-time vertical data


(chemical data as you advance the soil probe) to understand groundwater movement and chemical distributions. Here are some of the current tools to help assess conditions in the field.

- Hydraulic Profiling Tool (HPT) – permeable vs. impermeable zones
- Membrane Interface Probe (MIP) –VOCs in soil and groundwater
- Laser Induced Fluorescence (LIF) – free product
- Halogen Specific Detectors (XSD) – chlorinated hydrocarbons in soil and groundwater

Another useful tool for identifying free product is a hydrophobic dye, such as Sudan IV®, that indicates the presence of separate phase. This is useful because it provides real-time data and decisions can be made in the field.




Once you have accurately logged the soil boring and know the depth at which groundwater is encountered, you can install a monitoring well. There is a right way and many wrong ways…and the wrong ways will produce misleading data.

**Getting representative groundwater data**

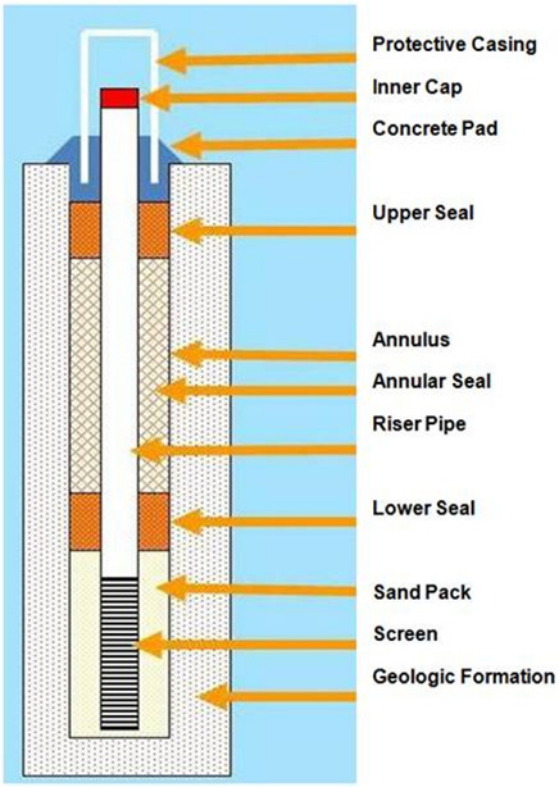
In our peer reviews, we have seen many investigations go way off track because of incorrect well screen placement or grouping and using wells screened at different depths for interpretation.

Too often site investigations are conducted by simply putting holes and wells in the ground and then connecting the dots. In many cases, these dots have no business being connected. Again, there is a right way and many wrong ways to properly collect data. If you hope to create an accurate CSM, you must collect data that accurately reflects site conditions.

We need to ask questions relative to the goal of the investigation; does the well and data from that well tell the right story? Is the screen placed opposite the most likely zone of impacted groundwater? ***Getting the well screen at the right depth is critical.***

For example, when well screens are ***too deep*** they miss the water table and consequently they will miss "floating" chemicals like gasoline (see photograph below). On the other hand, if they are ***too* shallow** the well may go dry in the summer. Additionally, a well screen that is too shallow may miss "sinking" chemicals like trichloroethylene (TCE).

Beyond providing erroneous chemical representation of groundwater quality, improperly placed wells and well screens will result in erroneous groundwater flow data and skewed flow directions and rates. Well screens need to be in the same geologic formation and at about the same elevation if they are going to be used to figure out which way and how fast groundwater is flowing. While this may seem somewhat basic, we have seen multimillion dollar remediation systems being proposed due to a very poor representation of site conditions because of improperly installed monitoring wells.




**Getting groundwater without getting "dirt"**

Assuming that the wells and well screens are located properly, we have seen many mistakes made in relation to monitoring well installation. It is important that the monitoring well provide a representative groundwater sample from the formation that it is screened within. That is, you want a groundwater sample and not a sample of the soil ("dirt, if you will"). Although a relatively routine procedure, care and thought need to go into the design and installation of the monitoring well.

The important parts of a monitoring well are shown on the right.

The well screen and the sand pack keep the "dirt" out and let the groundwater in. A demonstration well screen with varying slot sizes is shown here. Note the quarter as a frame of reference.

Well screens used in environmental work typically have a single slot size, usually the smallest one (0.010 inches).


Improper selection of screen slot size, improper installation of sand pack, and improper development of the well prior to sampling can all lead to unrepresentative groundwater data and worse, lead your investigation and remediation efforts astray.

Remember, all of this information and data go into the development of the CSM for the site. Nothing should be considered routine. If any of this information is skewed, it will result in an inaccurate CSM and can result in a remediation design that will never be successful or in some cases may not have even been necessary.

Dragun Corporation
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In our next Environmental Minute, we will discuss groundwater flow evaluation. If you have questions about this series of Environmental Minutes, or if you have an immediate question or concern, please contact Dr. Michael Sklash (msklash@dragun.com) at 248-932-0228, ext 120.

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