

Ground water Monitoring

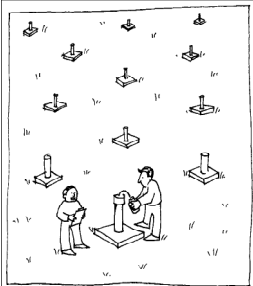
What is the Goal of the Monitoring Program?

Define your monitoring goals.

- Ground water levels
- Ground water quality
- Ground water contamination

Where Should I Monitor? How Many Monitoring Points Do I Need?

The first step to designing or optimizing a groundwater monitoring program is to identify monitoring points that provide the right amount of coverage in the right locations.



How Often Should I Monitor? For How Long?

Identify tools for determining appropriate monitoring frequency and duration, including decision criteria and groundwater modeling.

What Contaminants Do I Need to Monitor?—

Tailoring the data collection and quality assurance practices to the goals of the monitoring program will ensure that you are not managing and reporting excessive amounts of data. collecting the right types of data and defining appropriate quality assurance requirements is very important

How Should I Collect the Samples?—

There is more to collecting a sample than just “filling a bottle.” This is one of the most important steps of the monitoring process.

How Do I Evaluate and Present My Data So It’s Easy to Understand?

Your periodic monitoring reports shouldn’t be a “data dump.” Make them clear, concise, and easy to understand. From evaluating your data to reporting and presenting your data,

How Can I Ensure Regulatory Acceptance?—

Effective communication is the cornerstone of any relationship. This is especially true of the relationship between you and your regulator.

What Tools Can I Use to Facilitate Optimization of My Monitoring Program?—

Additional tools that can be applied to facilitate monitoring optimization from start to finish

Goals of Your Monitoring Program

Typically, monitoring objectives fall into one or more of the following categories:

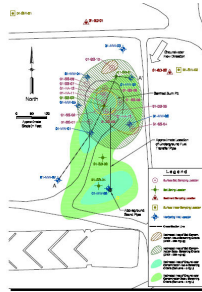
- § Determine if contamination is migrating
- § Determine if contamination will reach a receptor (such as a drinking water supply well);
- § Track contaminants exceeding some standard;
- § Track the changes in shape, size, or position of a contaminant plume;
- § Assess the performance of a remedial system

Conceptual Site Model (CSM)

The first step in identifying goals of a monitoring program is to understand what problems exist at the site.

A good CSM addresses the following elements:

- § Nature and extent of contamination;
- § Geology;
- § Hydrogeology;
- § Biological and geochemical conditions;
- § Transport pathways of contamination;
- § Monitoring points;
- § Receptors and potential receptors;
- § Historical uses;



Performance Monitoring

The primary purpose of performance monitoring is to provide the quantity and quality of data necessary to make informed decisions regarding remedial system operation, and to verify progress toward your overall monitoring program goals.

- § Measure the change in contaminant concentration resulting from treatment and estimate the mass of contaminant reduction;
- § Compare data to all decision criteria and exit points;
- § Measure the rate and direction of any contaminant migration to confirm containment or noncontainment; and
- § Determine the effects of contaminant source areas on remedy effectiveness.

Groundwater Monitoring Plans (GMPs)

The primary purpose of the GMP is to specify how the monitoring program will be conducted in order to meet the site-specific objectives.

The following components should be included in your GMP:

- § Statement of program goals;
- § Current monitoring network;
- § Frequency and anticipated duration of monitoring;
- § Specific field procedures (e.g., purging, Collection of water levels and water sampling, decontamination, record keeping, etc.);
- § Analytical methods, sample handling requirements (e.g., containers, preservation), and quality assurance/quality control (QA/QC) sample collection rates;
- § Data handling and reporting procedures; and
- § Decision criteria (including exit strategies) and review process to periodically optimize all of the above.

Re-evaluating the Goals of Your Monitoring Program

It is important to reevaluate the goals of your monitoring program on a regular basis.

Annual Reviews

Annual reviews should be conducted to determine if the monitoring goals have been achieved at any of your sites, or if the past year of site data result in any changes to the program goals.

It may be helpful to conduct annual reviews well in advance of budgeting for the next fiscal year.

Annual and 5-year reviews are an opportunity to make changes to your monitoring program and the GMP, if necessary.

Five-Year Reviews

a 5-year review period allows an opportunity to make formal changes to a monitoring program. The 5-year review may be used to help make decisions regarding the effectiveness of the remedy, including whether the system should be shut down and replaced with an alternative technology, or whether the site should be closed out based on the most recent five years of monitoring data.

The 5-year review should be conducted with the involvement of all stakeholders, including installation personnel, contractors, regulators, and community members.

Designing a Monitoring Network

The number and placement of wells needed to ensure adequate monitoring of groundwater contamination will be a function of many site-specific characteristics.

As a first step, a comprehensive review of applicable regulatory requirements should be conducted

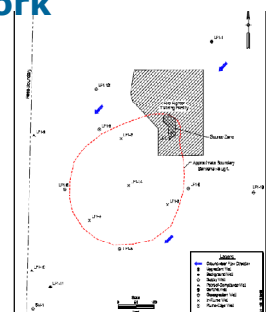


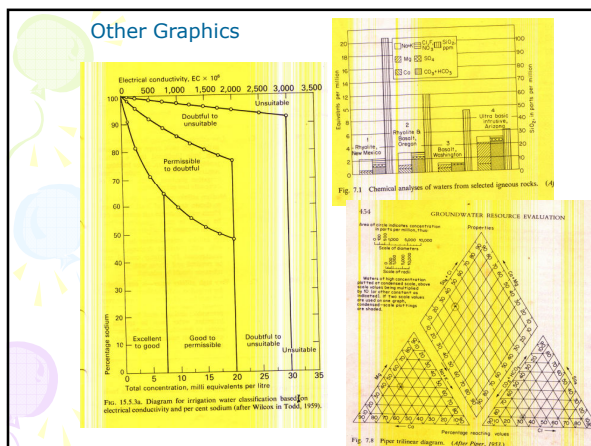
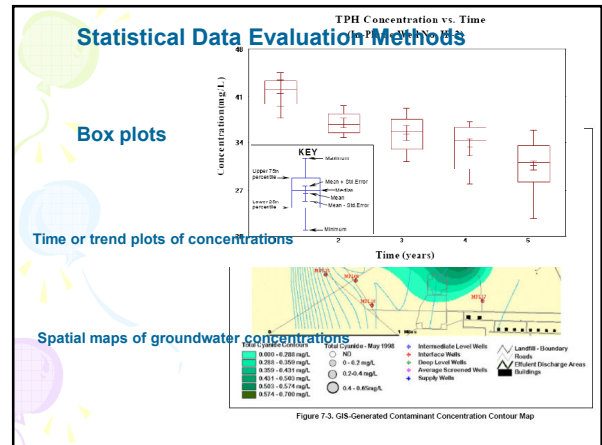
Figure 3.1. Remedial Monitoring Well Network

Well Type	Location Relative to Source	Description
Upgradient	Upgradient	Upgradient wells are located away from the source of contamination in the direction from which groundwater flows. Concentrations in these wells represent contaminants flowing into the site, if any. An uncontaminated upgradient well may be used as a background well.
Background	Upgradient or Crossgradient	Background wells are located where they cannot be affected by contamination. They are used to determine background concentrations of contaminants, usually metals or other naturally occurring compounds. An upgradient well may serve as a background well.
Crossgradient	Crossgradient	Crossgradient wells are located adjacent to the source of contamination in a direction perpendicular to the direction of groundwater flow. These wells may be used to ensure that diffusion, dispersion, or seasonal variations in flow direction do not result in the additional spread of contamination from a site.

Plume-Edge	Downgradient or Crossgradient	Plume-edge wells are located immediately downgradient or crossgradient of a plume and are used to track plume movement by flow, diffusion, or dispersion. Wells designated as plume-edge wells may need to change as the plume size and shape change. These wells may be part of a remedial system.
In-Plume	Downgradient	In-plume wells are located both vertically and horizontally within the known extent of contamination. These wells are used to track concentration changes over time. These wells may also serve as extraction wells for a remedial system.
Downgradient	Downgradient	Downgradient wells are located in the direction of groundwater flow from the source of contamination. Downgradient wells are used to track the concentration and movement of contaminants from a site. In-plume, plume-edge, point-of-compliance, and sentinel wells may all be downgradient wells.

How Often Should I Monitor? For How Long?

Well Type	First Year Frequency	Second Year Frequency	Third Year Frequency	Considerations
Background	Quarterly	Annually	Annually	On site migration of contaminants, naturally-occurring compounds
Upgradient	Quarterly	Annually	Annually	On-site migration of contaminants
Downgradient	Quarterly	Semiannually	Annually	Migration of site contaminants
Crossgradient	Quarterly	Semiannually	Semiannually	Dispersion of site contaminants
In-Plume	Quarterly	Semiannually	Annually	Remediation progress, if applicable
Plume Edge	Quarterly	Semiannually	Semiannually	Plume movement
Point-of-Compliance	Quarterly	Semiannually	Semiannually	Maintaining community relations
Sentinel	Quarterly	Quarterly	Quarterly	Safeguarding human health
Off Base	Quarterly	Semiannually	Annually	Maintaining community relations



End