

### Who should attend this course?

This course was designed to be of interest to any environmental or groundwater professional, novice or experienced, who deals with projects that have a component related to groundwater quality analysis or water quality data management.

### How do I register?

- Register online at: [www.swstechnology.com](http://www.swstechnology.com)
- Or complete the registration form on the back and fax it to us!

### Can't make the Course?

Contact us about our "ON-SITE Custom Training" program. We're ready to deliver any one of our popular courses or tailor the course topics to address your specific organizational needs!

### Questions? Contact Us!

Schlumberger Water Services  
460 Phillip Street - Suite 101  
Waterloo, Ontario, Canada N2L 5J2  
Tel: +1 519-746-1798 Fax: +1 519-885-5262  
Email: [sws-training@slb.com](mailto:sws-training@slb.com)  
[www.swstechnology.com](http://www.swstechnology.com)



### Course Objectives

From hands-on experience, you will learn...

- How to effectively apply AquaChem to water quality projects
- How to create your own hydrochemistry database
- How to generate data plots and prepare professional reports
- A basic understanding of rock/water interactions
- What to look for when evaluating data quality
- How to solve geochemical modeling problems using PHREEQC
- Hands-on experience in water quality data management
- Exposure to real-life hydrochemistry examples

### Course Schedule

#### Day 1

Lecture: Building a Hydrochemistry database  
Lecture: Introduction to AquaChem  
Exercise: Lab 2.1 – 2.5  
Lunch  
Lecture: AquaChem 5.1: Reports, Tools and Plotting  
Lecture: QA/QC Techniques

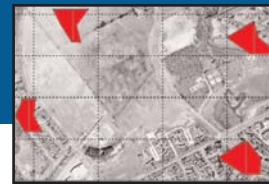
#### Day 2

Lecture: Techniques for Interpreting Data I  
Lecture: Techniques for Interpreting Data II  
Lunch  
Lecture: Statistics in Groundwater Analysis and Interpretation  
Exercise: Importing and Analysing Water Quality Data

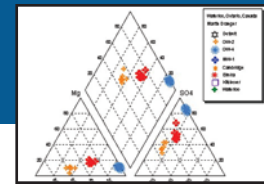
#### Day 3

Lecture: Geochemical Modeling  
Lecture: The AquaChem-PHREEQC Interface  
Lunch  
Lecture: Introduction to PHREEQC and PHREEQCI  
Exercise: Simulation of calcite precipitation due to groundwater heating

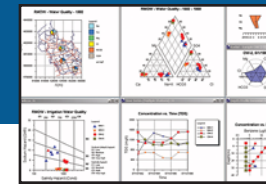
Stiff Diagram



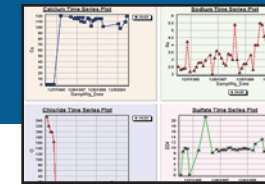
Piper Diagram



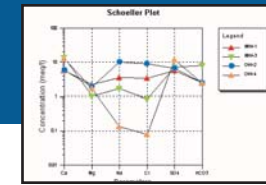
Water Quality Analysis



Time Series Graphs



Schoeller Graph



## Water Quality Data Management & Modeling Applications using AquaChem and USGS PHREEQC

The storage and management of large volumes of water quality data in a suitable format is a major challenge in geochemical interpretation and analysis. This hands-on course introduces environmental professionals to the application of AquaChem to projects requiring the interpretation of aqueous geochemical data. Hands-on exercises using AquaChem will be completed throughout the course to demonstrate various techniques for importing, querying and reporting water quality data; the process of quality control in the development and use of a database; and the use of the program to complete temporal and spatial geochemical data interpretation. In addition, participants will learn the fundamentals of using PHREEQC to model dissolved concentrations in groundwater.

This 3-day course is designed to give groundwater professionals hands-on experience in applying AquaChem to projects requiring geochemical data interpretation and management of water data.

The study of water chemistry data involves the storage and management of large volumes of water quality data, and a large number of numerical and graphical techniques, which are not readily available with Standard Office software such as MS Excel. AquaChem offers an extensive but easy-to-use numerical and graphical toolset for efficient analysis of most water chemistry data sets. In this course you will be given detailed background information on how to apply these methods in order to track down the formation history of the studied water samples. You will also learn how to document and present your findings efficiently. For complex geochemical modeling problems, AquaChem offers a seamless interface to the USGS code PHREEQC, the 'de facto' standard in this field. You will learn how to apply this software to simple problems in order to quantify your hypothesis of the change in water quality through an aquifer system. Additionally, you will receive an overview of more complex modeling capabilities of PHREEQC.

### Course Topics

- Fundamentals of managing water quality data
- Concepts and benefits of relational databases for hydrochemistry data
- Importing water quality data from various data sources into a relational database
- Assessing the quality of lab data, indentifying trends and performing statistical analysis
- Detection and interpretation of water quality exceedances
- Understanding and dealing with detection limits
- Interpretation of aquifer conceptual model (Rock source deduction)
- Identifying water types and aquifer composition
- Calculation of saturation indices and pH
- Plotting spatial patterns of water quality data
- Geochemical modeling with AquaChem and PHREEQC

### Managing Water Quality Data

Storing and managing water quality data represents a major challenge, in particular if you have large volumes of data stored in various file formats. Understanding the data and maximizing the use of your data management system will be discussed.

### Quality Control and Statistics

Analytical lab results tend to appear accurate and indisputable. However, many sources of error can be introduced to a sample throughout the sample collection and delivery process. This section of the course covers the principles of quality control and the role of a database in this process.

### Effective Use of Data Plots

It is difficult to present and understand water quality data when presented in tabulated or spreadsheet formats. Data plots represent a more effective method to detect patterns and identify trends in data. As a plotting tool, AquaChem will be used to create a wide variety of standard water quality data plots.

### Geochemical Modeling using PHREEQC

The effects of changing geochemical conditions caused by landfills, wastewater, injection wells, mine tailing, etc. have a non-intuitive effect on dissolved concentrations in groundwater. Geochemical modeling using PHREEQC can be used to help anticipate these changes.

### Course Software

AquaChem (used as a standard for the UK Environment Agency and US Office of Surface Mining), and PHREEQC.

