Case Study

Schlumberger WATER SERVICES

About Schlumberger Water Services

We offer innovative groundwater solutions through professional expertise to meet the advancing technological requirements of today's professionals.

Schlumberger's Water Services division specializes in assessing, developing, and managing groundwater resources using some of the finest, advanced and cost-effective technologies available today.

Whether you're looking for field-scale data collection, data management, modeling, or resource decision-making solutions, our teams of specialists are here to help you address all your groundwater projects safely and efficiently.

Applied Technologies:

- Westbay System*
- Pressure Profiling
- Discrete Sampling
- Hydraulic Testing
- Automated Monitoring
- Remote Data Acquisition

Multilevel Monitoring for Geologic Repository

ANDRA URL, Bure, France

A portion of the surface facilities at Bure during shaft construction.

Highlights:

- At the Meuse/Haute Marne underground research laboratory ANDRA is studying the feasibility of establishing a deep repository in clay for storing high-level and long-lived intermediate-level radioactive waste
- As part of its initial investigation ANDRA installed six Westbay Systems to monitor fluid pressure changes in the geological formations overlying the clay
- A seventh Westbay System was installed several years later to obtain a comprehensive profile of the hydrology of the clay
- ANDRA found the Westbay System to be both robust and accurate

Background

The French National Agency for Radioactive Waste Management (ANDRA) is responsible for the long-term management of radioactive waste produced in France. The agency protects humans and the environment against the emission and dissemination of radioactive materials, which must be isolated from the environment until their radioactivity has decayed to an acceptable level. This means the waste must be carefully controlled at all stages – production, conditioning and final disposal.

In 1999, ANDRA established the Meuse/Haute Marne laboratory to study the feasibility of building a deep geological repository in clay (argillite) for high-level and long-lived intermediate-level radioactive waste. The underground research laboratory is a multi-disciplinary research facility with a concerted scientific experimental program.

Challenges

The Meuse/Haute Marne laboratory is located in Bure, approximately 200 km [125 miles] east of Paris. The underground portion of the laboratory consists of a network of drifts excavated in the argillite at a depth of 490 meters [1600 ft] below ground surface. Two large shafts connect the laboratory to the surface.

One of the major challenges facing ANDRA during the initial stages of construction was to monitor the effects of construction on the geological formations overlying the argillite. This data would be an integral part of proving the feasibility of building a geologic repository. In addition, data would need to be collected from within the argillite clay. The argillite is particularly difficult to characterize due to its low permeability.

Case Study: Multilevel Monitoring for Geologic Repository

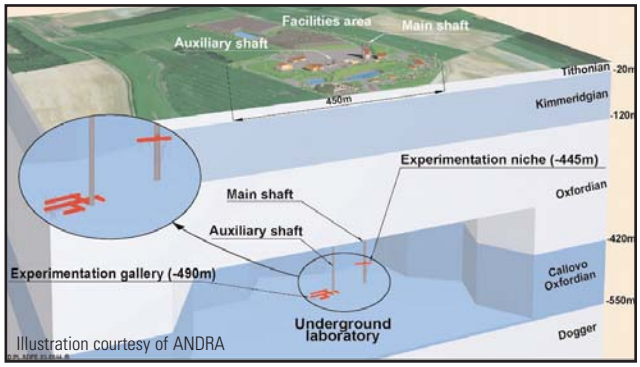
Solution

To monitor changes in groundwater conditions at the Bure site, ANDRA chose the Westbay System. Based on the successful implementation of the Westbay System in granite at another of their sites, ANDRA decided that Westbay System technology would be equally well suited to the geologic conditions at the Meuse/Haute Marne site.

Deep Westbay System Installations

ANDRA initially installed Westbay Systems to monitor fluid pressures in the Oxfordian limestone formations overlying the argillite clay target horizon. Six Westbay Systems were installed in open bedrock boreholes to depths of up to 450 meters. The flexibility provided by the Westbay System enabled ANDRA to target all the zones of interest in each borehole, including flowing zones and transitions between various geologic formations.

Several years later, ANDRA needed to collect data from within the argillite clay layer. Data from other instrumentation at the site suggested the presence of fluid pressures in the clay layer that were higher than those measured in the surrounding limestone (overpressure). They installed a seventh Westbay System at the site, to a depth of over 550 meters, with monitoring zones above, below and within the argillite.



ANDRA is constructing an underground research laboratory at Bure, France. The Westbay System has been used for characterizing groundwater conditions at the site and is being used to monitor the response to construction of the laboratory.

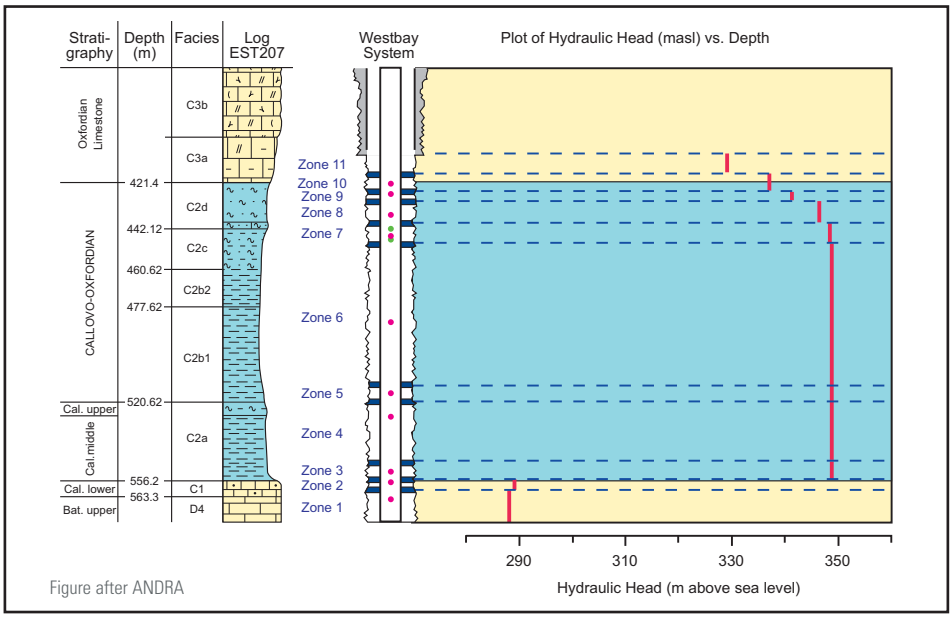
Results

Data from the first six Westbay Systems helped ANDRA to determine bulk hydraulic properties of the bedrock by monitoring responses to other drilling activities, as well as measuring responses to barometric variations and earth tides. These wells were also used to track how the limestone responded to the drainage caused by the laboratory shafts as they progressed through them toward and into the clay.

The seventh Westbay System is currently helping to confirm the conditions in the argillite, including the overpressure.

The data provided by Westbay Systems at Meuse/Haute Marne has proven to be invaluable to the project. Jacques Delay, assistant director of the laboratory and head of the scientific service, summed it up by saying, "Our goal at Bure is to determine the long-term head and to monitor the drainage effect of the storage shaft on the upper aquifer. We also want to measure the long-term head in the argillite. Because it takes 18 months for pressures to stabilize in the very low-permeability argillite, it's essential that we use measuring equipment that is both durable and accurate. Westbay System equipment has met this need."

ANDRA plans to continue testing the argillite until the end of 2006, at which time they hope to receive approval to construct a repository, which would include a regional hydrology program utilizing additional Westbay Systems.



Schematic diagram showing the stratigraphy encountered at borehole EST207, the Westbay System completion with location of packers (black rectangles) and measurement ports monitored by pressure probes (red dots). The plot of hydraulic head vs. depth (vertical red bars) illustrates the change of head with depth, showing the excess pressure encountered in the Callovo-Oxfordian argillite.

Schlumberger WATER SERVICES