

# Westbay System Data Improved Understanding of Groundwater Conditions in Geologic Repository

Multilevel well system delivered accurate measurements of hydraulic properties

## CHALLENGE

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.

## SOLUTION

To monitor changes in groundwater conditions at the Bure site, ANDRA chose the Westbay System\*.

## RESULTS

Results of the first six Westbay Systems hydraulic properties of the bedrock by monitoring responses to other drilling activities, as well as measuring responses to barometric variations and earth tides.



## Accurate groundwater data required for monitoring construction impacts

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 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.

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 the construction the geological formations overlying the argillite. This data would be an integral part of providing 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.



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

**CASE STUDY:** Water levels and geologic model used to predict impacts on water resources

**Westbay System was chosen due to proven track record**

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.

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 the 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.

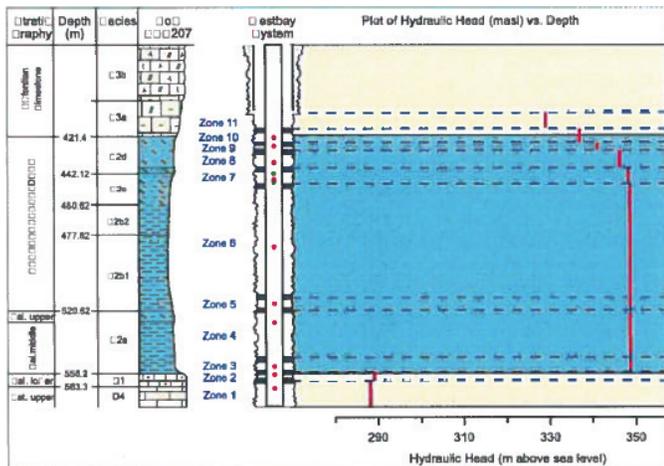
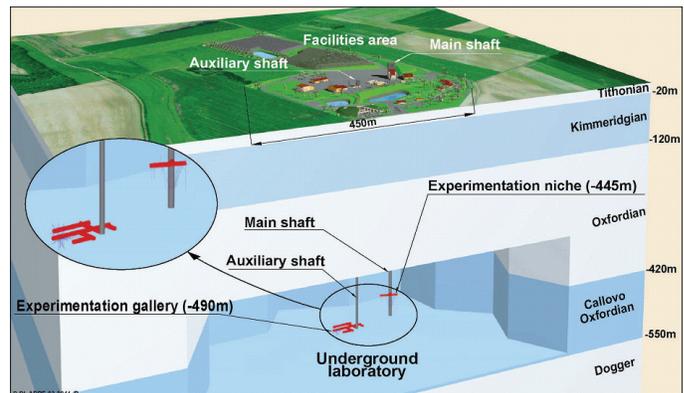
**Durable Westbay System delivered accurate measurements of bulk hydraulic properties**

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 the Westbay System 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 pressure 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 striagraphy 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) illustrate the change of head with depth, showing the excess pressure encountered in the Callovo-Oxfordian argillite.

SANDRA 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.

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