

## Automatic Leakage Detection System for the Marne-Rhine Canal in Saverne, France

The Marne-Rhine Canal is a shipping canal in north-eastern France in the region Grand Est. It connects the river Marne and the Canal between Champagne and Bourgogne with the Mosel and the Rhine.



Automatic Leakage Detection System of temperature anomalies. Flow velocities are calculated automatically and alarms are automatically send by flow velocities  $> 10^{-3}$  m/s. The data loggers (protected in blue tubes) are connected to the measuring chains and send the measuring data via modem for further automated processing.

The impermeability of a canal can be examined by a Thermal Leakage Detection System (GTC Kappelmeyer®). Therefore, soundings are rammed into the dam at its downstream side. Ground temperature measuring chains are installed within the sounding rods. A temperature anomaly caused by seepage water can be assumed if the ground temperature approaches the water temperature of the canal.

A section of several kilometres along the Marne-Rhine Canal was investigated for leakage and an anomalous area could be localised. Thereafter, a Thermal Leakage Detection System was installed in order to locate the area of maximum seepage. In this area, the spacing of soundings was reduced for a more precisely localisation of seepage. The most significant anomaly is characterised by ground temperatures close to the water temperature. Recent findings show that the onset of internal erosion starts with flow velocities of  $10^{-3}$  m/s and greater.

A Thermal Leakage Detection System was installed permanently in twelve soundings within the area of seepage and the maximum anomaly. These data loggers and temperature sensors yield the ground temperatures necessary for the automatic determination and analysis of flow velocities. Since three years the data loggers are regularly maintained and the recorded data are transmitted via modem. The Thermal Leakage Detection System was programmed to automatically send out alarms if it detects in-situ flow velocities greater than  $10^{-3}$  m/s.