# Development of FAC Monitoring System Through Electrochemical Sensors

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## Abstract

Degradation of low alloy steel piping due to flow-accelerated corrosion (FAC) phenomenon is one of consequential problems in nuclear power plants including pressurized water reactor (PWR) and CANDU. The development of an in-situ condition monitoring system through pertinent sensors is highly required to evaluate the severity of FAC phenomenon in the piping components and to take actions before some grave event should occur. As the results of extensive research during the past two decades, it is now possible to predict the corrosion behavior of metals as function of electrochemical corrosion potential (ECP) and pH. For this purpose, it is necessary to develop reference and pH sensors for condition monitoring and life management of a PWR. We report here the results of sensor development for this purpose. Ag/AgCl external electrode and gold-coated nickel electrode have been employed for condition monitoring of water chemistry and ECP. The water-filled Ag/AgCl reference electrode potential remained stable within ± 10 mV over two weeks period. A thermal cycling to 240 °C and back to 288 °C led to a potential shift not exceeding 15 mV. External Ag/AgCl electrode has a temperature limit due to the use of polymer materials. We developed a gold-plated Ni electrode, which was based on the ceramic-to-metal brazing technology. Therefore, it can be used even in high temperature water at 320 °C. Reliability and stability tests have been made in boron and lithium mixture solution at 320 °C. The electrode potential remained stable within ± 10 mV over two weeks period.