

## Accident Level Measurement Device

### Severe Accident Instrumentation

The Accident Level Measurement Device (ALM) is designed to function during and after a postulated severe accident event under extreme pressure, temperature and gamma radiation conditions as well as under seismic events.

#### Challenge

Level measurement devices are required to function reliably during and after severe accident conditions. The most challenging requirement is that they must continue to function after receiving a total integrated gamma dose of up to 20 MGy, at 200°C and with seismic acceleration up to 5 g.

Due to tighter safety requirements, utilities have started to reassess the safety margins of their nuclear power plants in order to develop action plans for possible plant upgrades. One requirement of such safety analyses is the necessity to enhance the robustness of the spent fuel storage pool monitoring system.

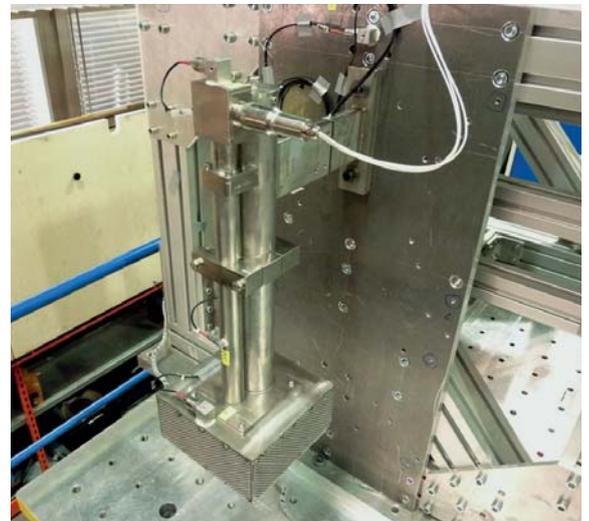
#### Solution

The ALM design provides high reliability and outstanding robustness against radiation as no organic materials are contained in the sensor and cabling. In addition, the design is also capable of withstanding extreme pressure and temperature as well as high seismic loads.

ALM is well-suited to retrofit the existing level measurement instruments as part of the wide range post-accident monitoring systems. As the device has been successfully tested under a wide range of severe accident conditions, it can withstand the accident conditions in the reactor building.

The operating principle of the ALM is based on a magnetic floater actuating reed contacts connected to a chain of resistors. The integrated sensor unit consists of a guide tube. This tube houses the floater and a reed-switch guide tube which contains the reed-switch unit.

Depending on the area of application, several types of measurement ranges are available. The resulting value of the reed-switch unit is converted with Framatome's TELEPERM XS STT1 Signal Conditioning Module to standard I&C current signals. This module was designed without any active electronic components to ensure robustness, simplicity and reduced qualification duration for accident conditions.



Preparation of a specimen for a seismic test on a shaker

#### Customer benefits

- ALM remains functional during and after a severe accident
- All materials used are inorganic and capable of withstanding a high dose of gamma radiation
- The flexibility and modularity of ALM make it suitable for installation in different applications
- ALM is specifically designed for use in new nuclear facilities, for retrofitting existing level measurements and for upgrades

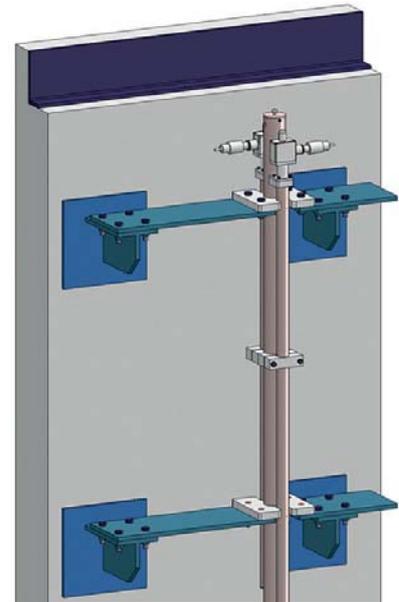
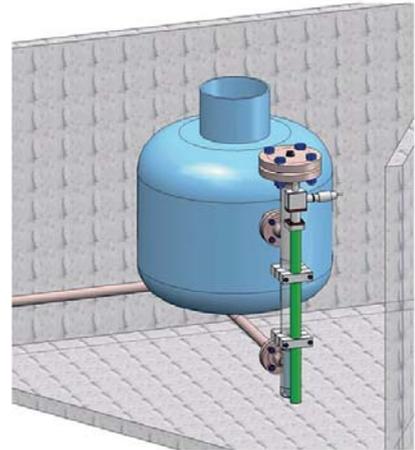
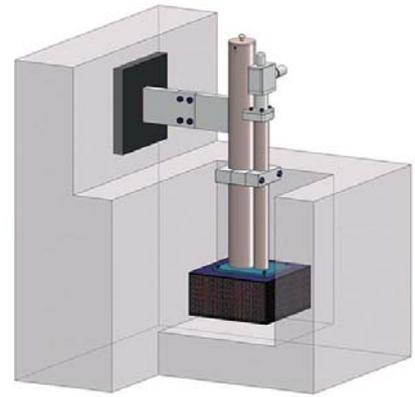
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## Technical information

- The sensor design ensures functionality and integrity of the sensor after events such as an earthquake or severe accident.
- The sensor will continue to function even in case of a loss-of-coolant accident and is fitted with a filter for protection against coarse debris. In a bypass configuration, ALM can be used to perform measurements in tanks.
- An accident-proof connection technology using a mineral insulated cable is used that meets the same standards as the integrated sensor units.
- For less demanding accident applications, a qualified connection technology using a polymer insulated cable will be available.

## Features

- Lengths: 0.4 – 16 m (other lengths possible)
- Weight: 33 kg (for 4 m sensor)
- Operating temperature: 70°C
- Operating pressure: ambient
- Humidity: 100%
- Operational radiation dose:  $\leq 160$  kGy
- Accident temperature: 200°C
- Accident pressure: 11 bar absolute
- Accident mission time: 1 year
- Accident radiation dose:  $\leq 20$  MGy
- Seismic acceleration:  $\leq 5$  g



Sketch of the three possible applications: sump, vessels and filled pools

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