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FAtigue MOnitoring System-i

Load Monitoring System for Nuclear Power Plant Components, Nozzles and Piping

The precision local load monitoring system FAtigue MOnitoring System-i provides the basis for extending the operational lifetime of components and equipment.

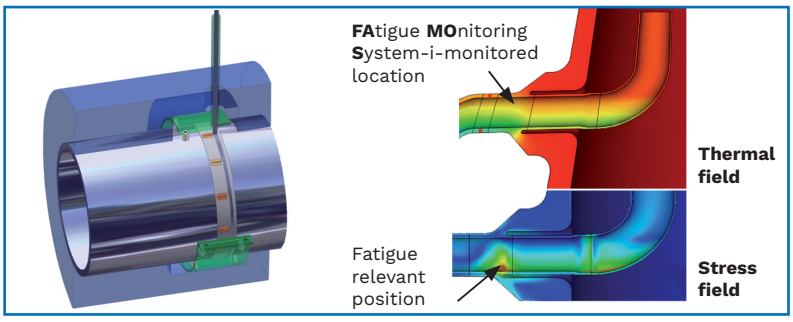
Challenge

Normal operation of a nuclear power plant (NPP) generates cyclic changes in fluid temperatures and pressures which result in mechanical stresses or vibrations and thus cause material fatigue. Reactor trips and load following intensify the cyclic changes. The design lifetime of power plant components and equipment is limited by a conservatively defined number of such cycles. New design code requirements such as the consideration of environmentally assisted fatigue, the operator's own safety management processes, and regulatory requirements specify increasingly demanding targets for fatigue safety margins. When a component is nearing the end of its design life it needs to be replaced.

Solution

The precision local load monitoring system **FA**tigue **MO**nitoring **S**ystem-i provides the basis for extending the operational lifetime of components and equipment. **FA**tigue **MO**nitoring **S**ystem-i uses special thermal load measurement sensors (measurement sections) and existing process instrumentation to detect and monitor the thermal loads occurring in piping systems and nozzles. The measurement sections have been extensively tested and qualified for precise tracking of thermal transients such as thermal shock and thermal stratification.

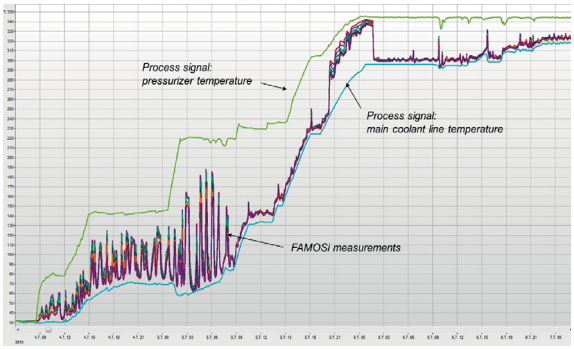
The measurement and recording of local thermal loads provides the basis for increasingly realistic fatigue assessment, thus reducing conservatisms and enlarging safety margins. Component replacements can be avoided.



FAtigue **MO**nitoring **S**ystem-i measurement section (left) and detected thermal load with the corresponding stress field in the nozzle (right).

Customer benefits

- Increasingly realistic computation of cumulative usage factors because of local measurements with qualified instrumentation and data acquisition methods
- Cost savings through component lifetime extension (fewer replacements) and through increased component availability
- Optimization of operating modes that are unfavorable regarding component fatigue
- Supports the optimization of operating modes, in-service inspections and maintenance
- Supports lifetime extension programs and break preclusion



Application example surge line – recorded pipe wall temperatures: comparison of **FA**tigue **MO**nitoring **S**ystem-i measurements and process instrumentation

Your performance
is **our** everyday **commitment**

Technical information

- To obtain precise results highly developed measurement sections with thermocouples are provided. The thermocouple arrangements within the measurement sections allow the identification of thermal shock (two thermocouples) as well as thermal stratification (seven thermocouples). The measurement section can be mounted on and removed (for example, for non-destructive testing) from the pipe very quickly reducing working time which is especially relevant in high radiation areas.
- The modular, decentralized **FA**tigue **MO**nitoring **S**ystem-i data acquisition and processing system provides data storage with a sampling rate of 1 Hz for all measurement signals. It also analyzes the data in real time for events such as “high rate” or “thermal stratification” with adjustable setpoints. All data can be sent via secured Ethernet connections to local computers (for example, in the office) for further assessment.
- The highly automated **FA**tigue **MO**nitoring **S**ystem-i software is used for online visualization and analysis of measured data and process signals. Documents like process and instrumentation diagrams or isometrics can be stored within the data base to provide a clear indication of the location of data signals.

FAtigue **MO**nitoring **S**ystem-i measurement section

Key figures

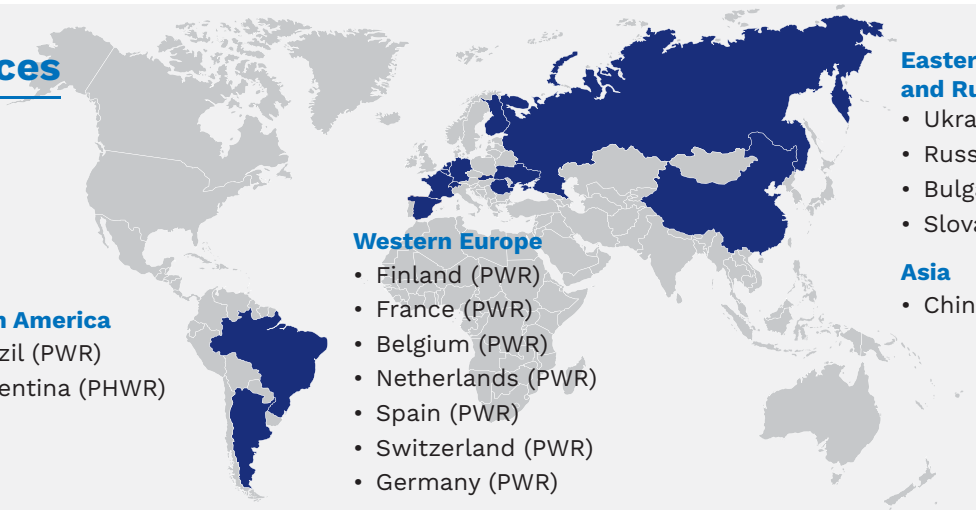
45 systems sold

12 non-OEM plants

35 years of operating experience

OEM: original equipment manufacturer

References



Western Europe
- Finland (PWR)
- France (PWR)
- Belgium (PWR)
- Netherlands (PWR)
- Spain (PWR)
- Switzerland (PWR)
- Germany (PWR)

Eastern Europe and Russia
- Ukraine (VVER)
- Russia (VVER)
- Bulgaria (VVER)
- Slovakia (VVER)

Asia
- China (PWR)

South America
- Brazil (PWR)
- Argentina (PHWR)

PWR: pressurized water reactor PHWR: pressurized heavy water reactor VVER: water-water power reactor

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