

Steam Generator Mechanical Cleaning

Technologies for Efficient Hard and Soft Sludge Removal

Long-term integrity and high performance of major plant systems and components like steam generators (SGs) are of uppermost importance for safe and reliable operation.

Challenge

During their operational life time, the construction materials of nuclear SGs are subject to an aging process based on degradation mechanisms.

Particles in form of ferrous oxide are produced in the secondary feed water system. These particles, so-called sludge, accumulate and contribute to the forming of local aggressive conditions. It is the main reason for SG tube failure creating negative effects to the integrity of the SG during operation.

Effective methods of deposit removal are required to prevent further accumulation and significantly decrease the risk of corrosion damages and performance losses.

Solution

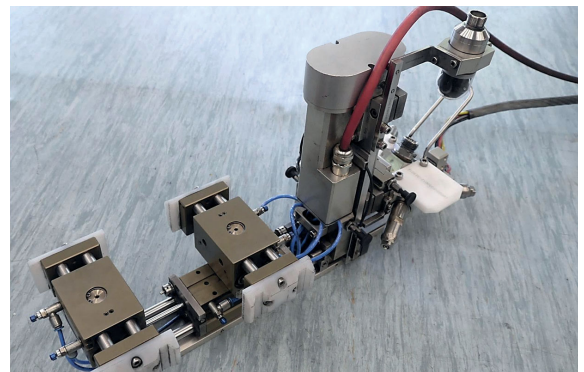
We provide different technologies for efficient hard and soft sludge removal as part of our integrated SG service concept.

- Standard sludge lancing removes deposits and soft sludge by means of hydraulic impact using remotely operated manipulators or static lances.
- Inner bundle lancing is an automated, remote-controlled process designed to clean tube bundle areas and tube plates, freeing them from hard sludge.

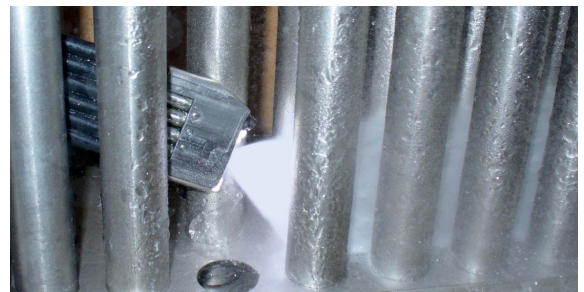
High-pressure water jet stream (200 bar) with continuous movement in vertical and horizontal direction ensures proper removal of soft and hard sludge on top of the tube sheet. The increased/variable height of the nozzle head allows the accessibility of remaining soft sludge behind hard deposits.

The effectiveness of the sludge lancing process can be increased by applying upper bundle flushing resulting in a higher total amount of removed deposits.

For optimized hard sludge removal of hard deposit accumulated of longer periods of time we provide a combined mechanical and chemical cleaning solution. It was first applied in 2017 and produced excellent cleaning results.



New sludge lancing manipulator



Inner bundle lancing

Customer benefits

- Time savings thanks to rapid and highly reliable performance
- Ensures SG integrity
- Maintains required thermal SG performance
- Significant decrease of risk of corrosion, damages and performance losses
- Outage optimization and therefore cost savings
- Support to component lifetime extension programs
- Field service worldwide

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

Technical information

Standard sludge lancing

- Applied from the tube lane in 30°, 90°, 150° to flush the complete tube sheet
- Pneumatic remote-controlled stepping manipulator or static lance
- Automated process control
- Controlled rotating multi-nozzle head
- Nominal operating pressure 220 bar, overall flow rate up to 229 l/min
- Flexible location of process equipment inside or outside the containment

Inner bundle lancing

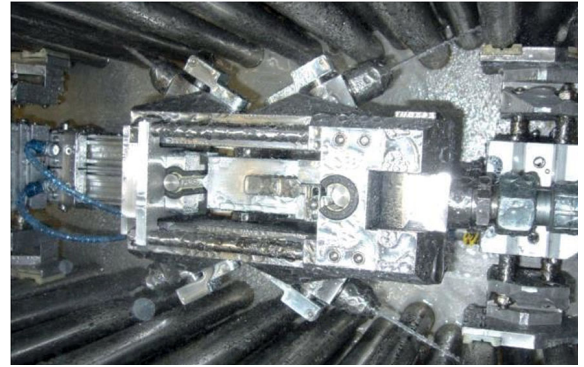
- Automated, remote-controlled operation
- High effective jet impact at tube shadow areas
- Operating pressure at nozzle outlet 220 bar
- Removal of hard sludge from tubes and tube sheet
- Applied in 30°, 90° or 150° directly in the tube bundle

Upper bundle flush

- Multiple setup configurations possible covering various plant designs



Upper bundle flush



Crawler with multi-nozzle head applied on site

Key figures

More than **35** years of experience in SG services

About **850** successful SG secondary side applications worldwide

References

SG secondary side mechanical cleaning is applied regularly as part of our recurrent outage services, but also on specific customer demand.

Reactor types/designs:

- KWU pressurized water reactors (PWR)
- Framatome PWR
- Westinghouse PWR
- CANDU reactors

Nuclear power plants in:

- Europe (Germany, Switzerland, France, Belgium, the Netherlands, Slovenia, Spain, Finland)
- South America (Brazil, Argentina)
- Canada
- USA

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