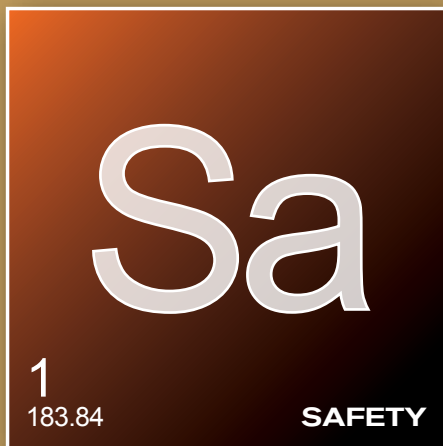


Chemistry & Technical Services



1
183.84

Sa

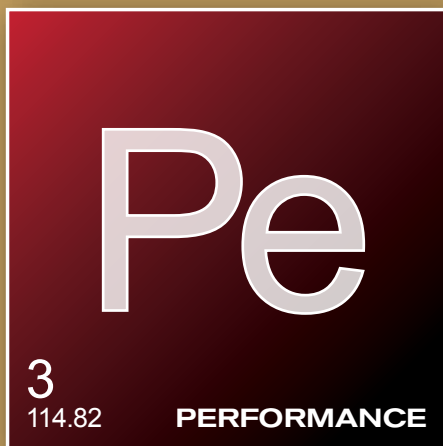
SAFETY



2
126.90

Qa

QUALITY



3
114.82

Pe

PERFORMANCE



4
91.22

Dv

DELIVERY

Proven Expertise, Better Performance
Elemental To Your Success

Excellent Chemistry

The Heart of Plant Reliability and Performance

Ensuring safe and reliable operations is the driving force for the nuclear industry. AREVA's road to excellence begins with a culture of accountability and delivery of cost-effective solutions critical to your success. Tangible results that ensure safety, quality, performance, and delivery are paramount.

We stand ready to help you deliver the Nuclear Promise: advancing safety, reliability, and economic performance to ensure efficient management of your key plant assets. Our seasoned team of experts have painstakingly crafted an unmatched, comprehensive approach to meeting each of your specific chemistry needs.

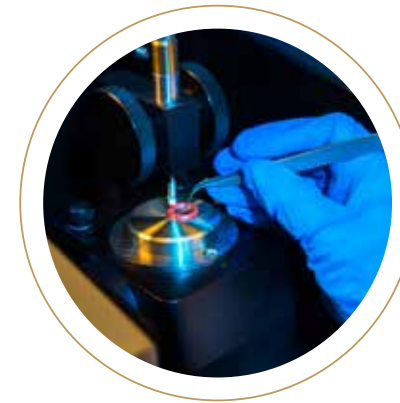


Offering Solutions for a Crucial Challenge

The Electric Power Research Institute (EPRI) estimated in a study released in 2001 that corrosion damage costs the U.S. electric power generating industry \$17.3 billion annually, or about 7.9% of the cost of electricity to consumers. Presently, as much as 50% of all forced outages are attributable to corrosion damage. An estimated 22% (\$3.8 billion) of this cost is considered avoidable. That's why AREVA expanded its Chemistry & Technical Services through construction of our innovative Chemistry and Materials Center (CMC). Where you face corrosion challenges, we deliver comprehensive support and the convenience of one-stop solutions.

You Can Count on AREVA to Deliver Balanced, Precise Chemistry Solutions That:

- Increase safety and efficiency
- Resolve emergent issues quickly
- Reduce plant operating cost
- Address obsolescence and equipment reliability issues
- Improve your plant performance



Quality Control You Can Trust

We maintain the industry's most rigorous quality control standards. The strength of AREVA's responsive global resources delivers proven high-tech results based on substantial R&D. At AREVA, you get to know the people behind the technology. We embrace personal ownership of our projects, and take great pride in what we help customers achieve. Whatever your need may be, we always consider the long-term value for the life of your plant, not just the next project. That's why our relationships and ongoing research lead to predictable results, emphasizing safety every step of the way.

Other chemistry service providers may collect data. But only tested experts like AREVA can accurately interpret the meaning. We expect those who wear the AREVA name to match the promise of a company built on responsiveness, innovation, sustainable development, and open, honest dialogue with your teams.

Consider our comprehensive services for all of your chemistry needs **today and tomorrow.**

Chemistry & Technical Services

- Chemical Cleaning
- Chemistry and Radiochemistry Laboratory Services
- Chemistry and Radiochemistry Training
- Component and System
- Component and System Chemical
- Corrosion Evaluation and Management
- Decontamination Services
- Deposit Analysis and Characterization
- Deposit Minimization Treatment (DMT)
- Fuel Chemistry
- Heat Exchanger Services
- Metallurgical Laboratory Services
- Operational Chemistry Evaluation
- Root Cause and Failure Analysis
- Startup & Shutdown Chemistry and Dose Reduction
- Water Chemistry Consulting Services

Chemistry and Materials Center

Comprehensive Laboratory Support

AREVA's Chemistry and Materials Center (CMC) provides routine, emergent, and specialized chemistry, corrosion, and metallurgical testing and analysis support for operating nuclear power plants. Additionally, the lab supports internal AREVA production, research, and development. The CMC serves as an integral part of AREVA's technical expertise in power plant chemistry, material dedication, and qualification.

Using only the latest equipment and cutting-edge technologies, we can analyze radioactive and non-radioactive samples of solids, liquids, and gases from all locations in PWR and BWR plants. These include but are not limited to:

- Consumable materials
- Cooling water
- Environmental samples
- Foreign materials
- Fuel deposits (crud)
- Reactor coolant
- Reactor water
- Resins
- Secondary plant water
- Steam generator deposits

A One-Stop Chemistry Resource

As your one-stop Chemistry Services resource, the CMC provides key services to AREVA customers in their on-going efforts to reduce corrosion damage to plant components and fuel. We can also provide specialty testing and technical capabilities to address specific customer needs, including regulatory and materials performance issues.

Only the finest, seasoned technical experts in power plant chemistry and corrosion control staff our CMC. Our responsive experts will foster a culture of open, honest dialogue with your teams.

Plus, high-quality, on-time delivery of lab results complements current AREVA engineering solutions for routine and long-term customer needs, whether servicing existing plants or preparing for the design and construction of new plants.

The Industry's Most Innovative Chemistry Services

- Significant facility investment
- 8,000 square feet; two stories
- Houses eight laboratories

Analytical Equipment Capabilities

- Autoclaves
- Corrosion product sampler hardware
- Gas chromatograph (GC)
- Incubator and TCLP system
- Inductively coupled plasma – mass spectrometer (ICP-MS)
- Ion chromatograph (IC)
- Ion selective electrodes
- Particle size counter
- Spectrophotometer
- Stereo microscopes
- Test loops
- Total organ carbon analyzer (TOC)

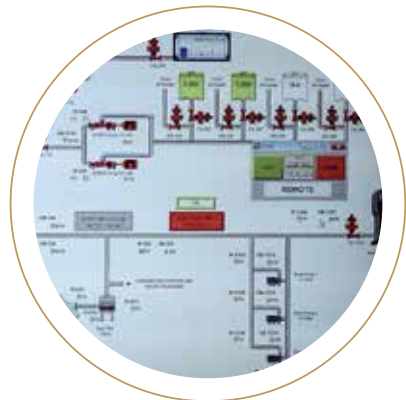
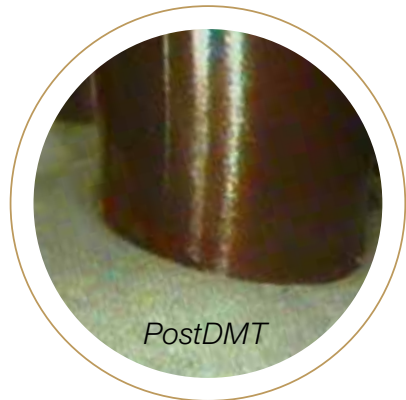


Features and Benefits

- New laboratory provides routine, emergent, and specialized chemistry, corrosion, and metallurgical testing and analysis support.
- We use only the latest equipment and cutting-edge technologies.
- Within the CMC we can analyze radioactive and non-radioactive samples of solids, liquids, and gases from all locations in PWR and BWR plants.
- By combining our CMC with our in-house technical staff, we offer the convenience of a one-stop shop.

Deposit Minimization Treatment (DMT)

A green process providing dry sludge and clean water



The Most Effective Alternative for Steam Generator (SG) Deposit Removal

AREVA's Deposit Minimization Treatment (DMT) family of products lives up to its name. A DMT may be applied with plant heat or AREVA supplied external heat allowing this cleaning technology application to be optimized for any outage schedule. The applications have demonstrated the flexibility to be applied to meet the demands of complex outage scopes and schedules. DMT has demonstrated the ability to remove over 17,500 pounds of deposits from a four loop plant. DMT is not just a cleaning process but includes a waste treatment technology which results in no liquid waste from the application. Our Chemistry and Technical Services (CTS) team is investing in the technology and resources to help prolong your steam generator life, reduce waste, and most importantly, to promote the operating efficiency of your plant.

Fast Reaction Reduces Outage Time and Provides Schedule Margin

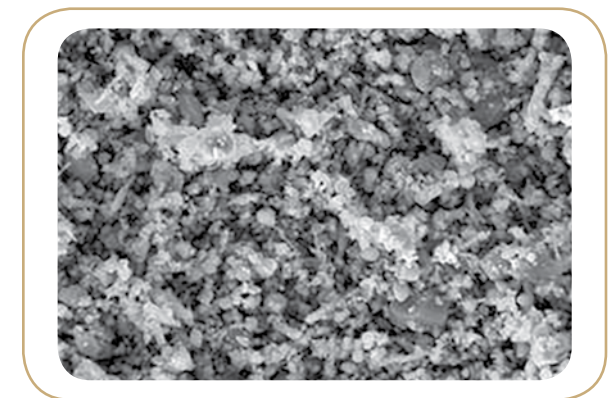
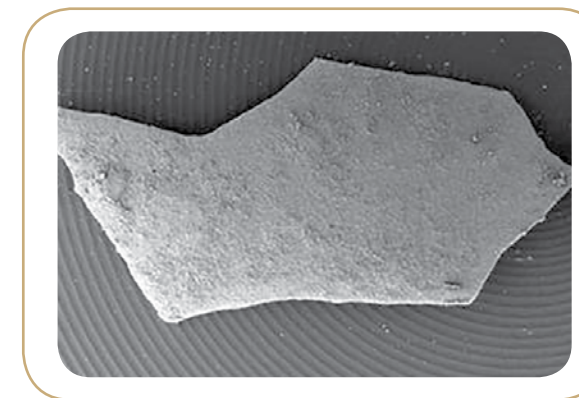
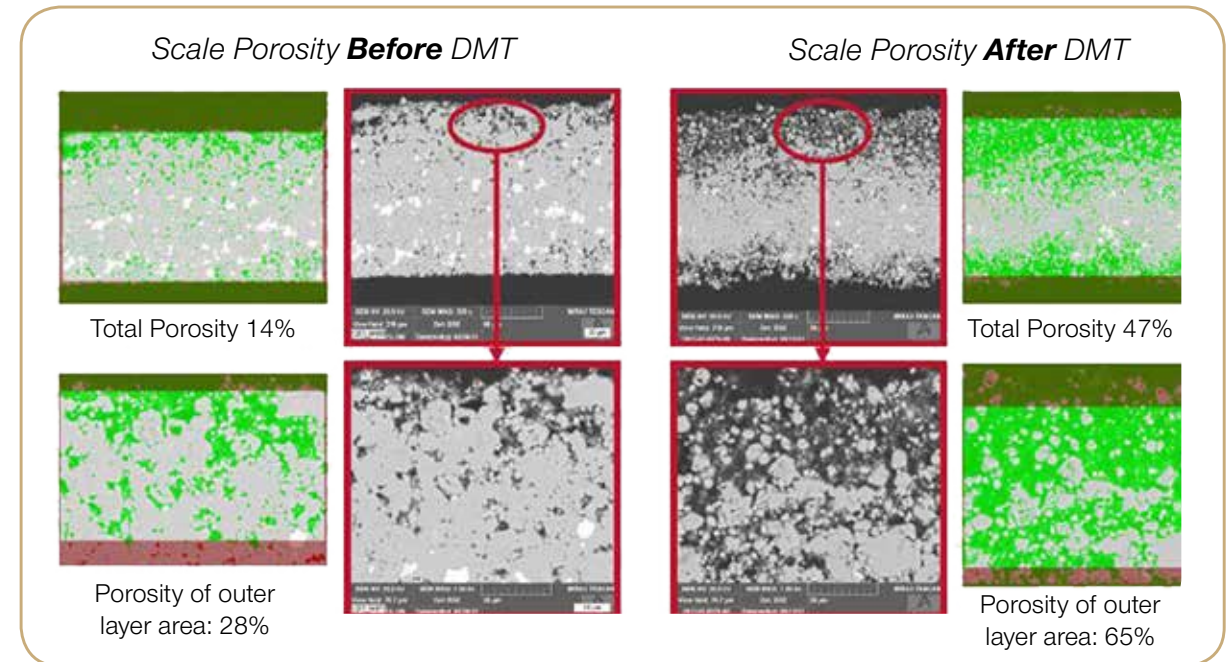
We understand that time is money — especially during an outage. The DMT process was designed with an appreciation for ever-changing outage schedules. Steam generator work scopes often changes on the fly due to inspection findings. DMT is a relatively fast process that doesn't require an inordinate amount of residence time — the chemical reaction is fast, which reduces outage time and provides schedule margin for the flexibility you need during an outage.

An Environmentally Green Alternative Gets the Job Done Right

Our exclusive process can actually help you protect the environment. DMT applies self-inhibiting dissolution chemistry. This means that the small amount of process corrosion allows DMT to be applied multiple times within the steam generator lifetime corrosion allowance. The magnetite removed from the steam generator is reformed into a solid secondary waste with all process water becoming clean water.

DMT gets the job done without generating large volumes of secondary liquid waste. This means fewer headaches for you at the end of the day.

Evaluation of Scale Flake by SEM



Laboratory test with actual plant SG hard sludge scale flakes:

- Over 200% increase in scale porosity
- Over 25% decrease of Vicker's hardness

Features and Benefits

- Effective removal of secondary side deposits
- Prolongs SG life
- Can be applied multiple times within the SG lifetime corrosion allowance
- No secondary liquid waste
- Can meet the demands of complex outage scopes and schedules
- Fast, green & effective

MAESTRO — Life Cycle Management

Detailed technical evaluation and projection of key aspects of steam generator health



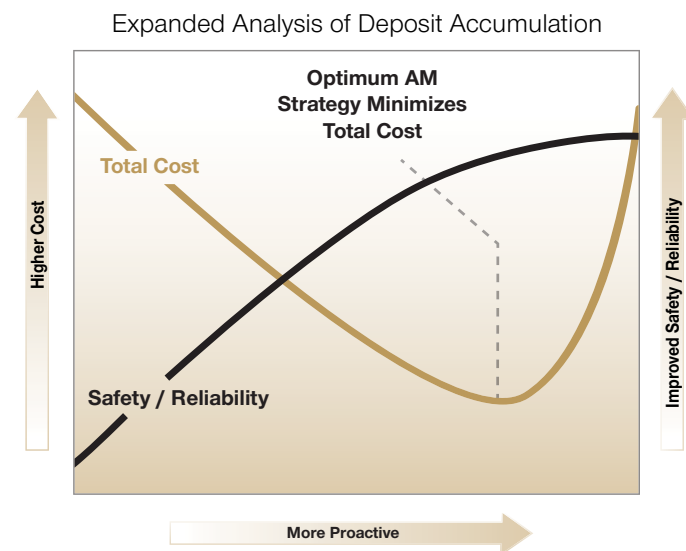
Proven Tools for Steam Generator Maintenance

AREVA is working with customers to manage steam generator (SG) secondary side deposit inventory. MAESTRO is our integrated software tool designed to guide the engineering approach. Combined with deposit mapping analysis to determine the deposition trend or to provide advance information for future maintenance planning, these tools are powerful allies for implementing highly effective SG life cycle management strategies.

Comprehensive Strategies to Enhance Life Cycle Management

Each SG life cycle management strategy is a selected combination of mitigation techniques, which will uniquely affect SG tube deposit evolution and in turn, may affect SG tube plugging, heat transfer effectiveness, SG pressure, and ultimately, plant power production. The MAESTRO software evaluates competing strategies individually, as well as relative to a base case, to quickly identify an optimum strategy in terms of net present value.

Deposit mapping is a non-invasive technique for imaging the deposit accumulation within a steam generator using bobbin coil examination eddy current data. The initial deposit mapping work covered only the accumulation on the tubing free span between the SG tube support plates. In 2008, our expert teams expanded the analysis to include blockage evaluation of deposition within broached tube support plate structures, an important service to maximize safety.

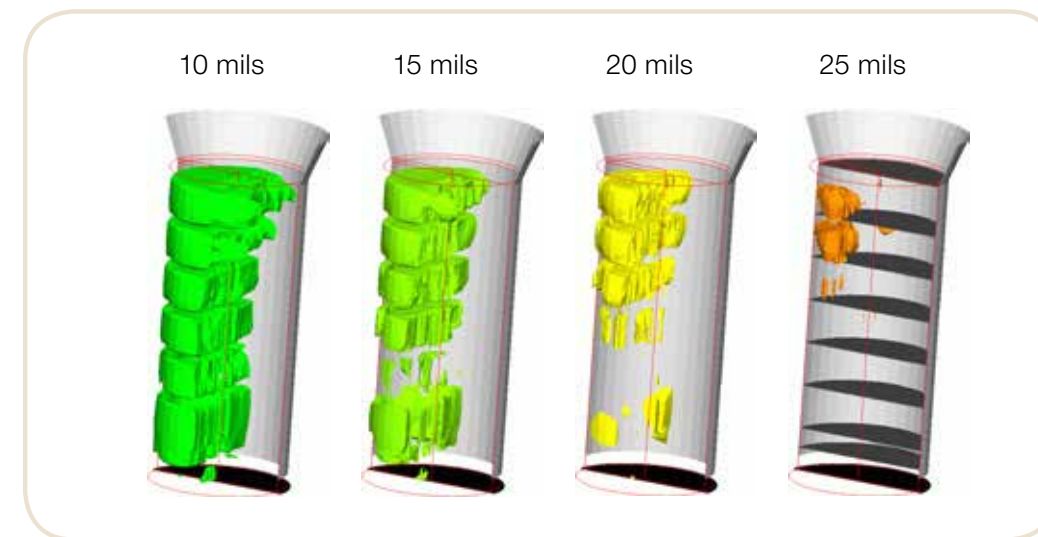


Deposit Mapping

- Secondary side deposit mapping is an MRI for steam generators
- The only method of tracking and trending the distribution of SG deposits throughout the tube bundle
- Provides critical information for effective SG condition management
- A vital tool in the MAESTRO toolbox

Other MAESTRO Tools

- Tube support plate blockage monitoring
- Tube support flow blockage monitoring
- Free span deposit accumulation over time
- Modeled steam pressure
- CNPV relative to alternative case



Features and Benefits

- Provides optimum maintenance strategies for component life
- Uses plant thermal performance data, tube degradation, and other plant data
- Incorporates typical SG maintenance and remediation strategies
- Provides an economic output using a NPV approach
- Identifies the correct time to perform various activities at the least cost and maximum economic benefit
- Provides ability to quantify steam generator loading with Mapping data

Commercial Grade Dedication Equipment & Materials Testing

An essential part of the commercial grade dedication process is verification of material composition. The materials and metallurgy lab uses advanced analysis methods to verify compliance with purchase specifications, and metallography to investigate material properties of manufactured components. Our lab is supported by a full machine shop for sample preparation services. Custom welding services are also available.

Material Analysis

- ALLOY ANALYSIS (AES, LECO GDS500-A)
 - Glow discharge optical atomic emission spectrometry for quantitative materials analysis
- CARBON/SULFUR ANALYSIS (LECO CS230)
 - Inductively coupled combustion/infrared detection for PPM-level sensitivity with as little as one gram of material
- ALLOY SCREENING (XRF) – Non-destructive X-ray fluorescence allows quick identification of material alloy family (steel, aluminum, Inconel, Monel, brass, bronze) for sorting or high-level analysis
- FTIR – Analysis of non-metallic components using Fourier Transform Infrared spectroscopy

Mechanical Testing

- TENSILE/COMPRESSION – Up to 125,000 lbs.-force (yield, ultimate, elongation, and reduction of area)
- HARDNESS – Rockwell B, C, Superficial N; Shore A, D
- MIRCO-HARDNESS – Knoop & Vickers methods

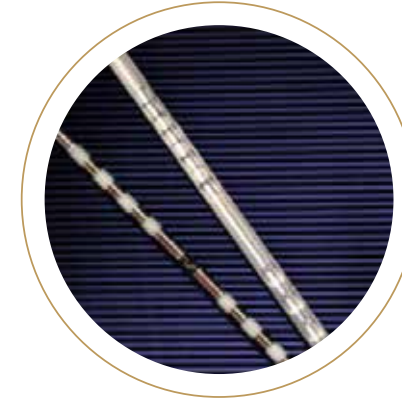
Corrosion Testing

- STATIC AUTOCLAVES – Three 1-gallon static autoclaves allow short-term evaluation of corrosion and material investigations at primary coolant conditions, up to 1500 PSIG and 750°F
- DYNAMIC AUTOCLAVES – Ideal for longer-term investigations of corrosion performance and material performance issues at reactor operating conditions

Metallography

- MOUNTING – Hot-press or cold-set mounts for metallographic preparation depending on specimen and analysis to be performed
- GRAIN STRUCTURE AND SIZE – Physical comparison or computer measurements
- SURFACE EXAMINATION – Investigation of welds and microstructure
- SCANNING ELECTRON MICROSCOPE/EDS – The SEM can acquire images for general imaging of morphology from ~30x to well over 100,000x. The SEM is equipped with two accessories, an Energy Dispersive Spectrometer (EDS) and an electron back-scattered diffraction system. The EDS system can identify the elemental composition of material. The composition can often be quantified to weight percent. The elemental information can be displayed in a large number of formats including graphical spectra, quantitative line scans, elemental distribution mapping, Excel tables for concentrations, etc. The EDS software can also perform “feature analysis” to count and quantify porosity, sizes and compositions of inclusions in material, etc. Back-scattered electron images can also be employed to produce images with contrast based on variations in atomic number across a surface.

Heat Exchanger Services

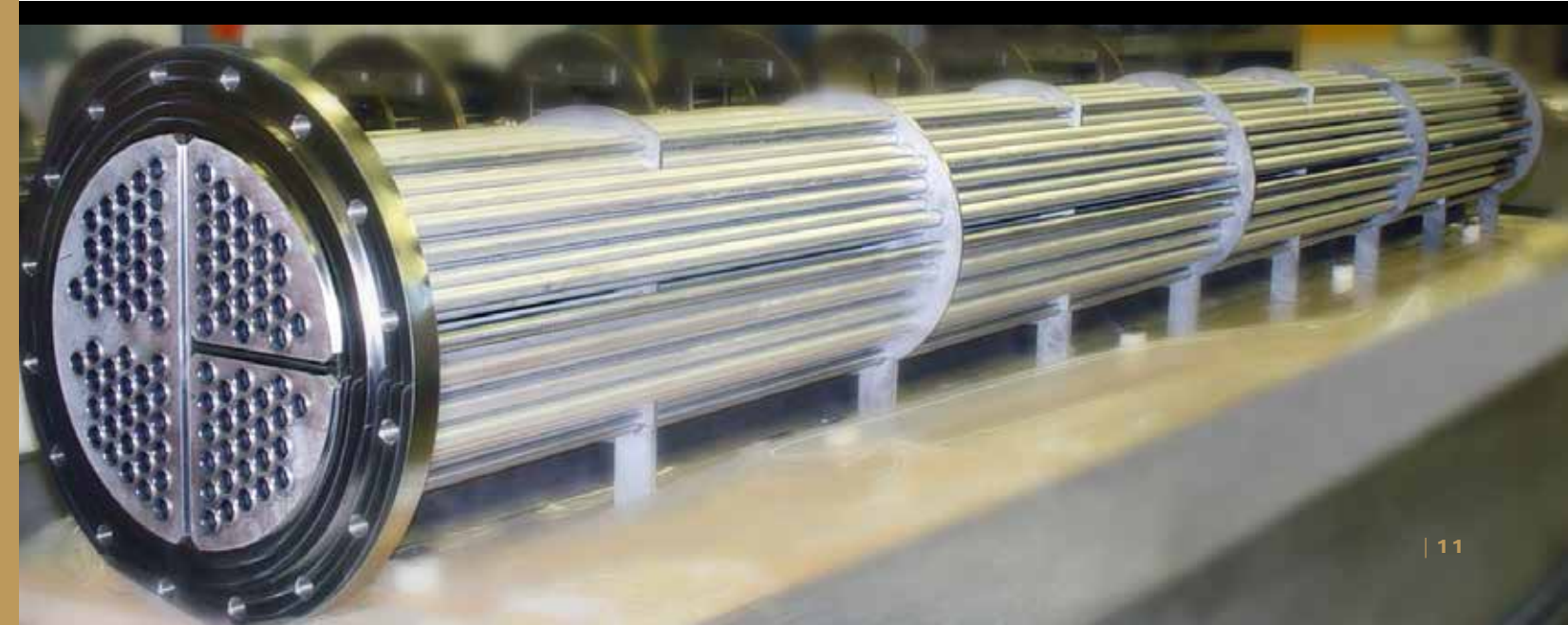


Heat Exchanger Services

For over 20 years AREVA's team of engineers and technicians have focused on the performance and maintenance of BOP Heat Exchangers for the safety, efficiency and operability of plants. Our highly trained, skilled nuclear professionals understand and use human performance tools that result in safely performed, error-free maintenance activities which include: general maintenance tasks, tube inspection and cleaning, plug removal and plugging, stabilizing, bundle replacement, and component retubing.

Heat Exchanger Portfolio

- All Shell-to-Tube heat exchangers
- Condensate and Feedwater systems
- Safety-related heat exchangers
 - RHR
 - Containment spray
 - Emergency diesel generator coolers
 - Component cooling water (CCW)
- Containment heat exchangers





Innovative Solutions — Repair Technology for Heat Exchangers



Want to extend component life and minimize unplanned shutdowns? Consider AREVA's patented expansion repair technology for BOP Heat Exchangers. Our field-proven solutions have helped customers regain lost heat-transfer surface area and effectively extended the life of their components. As a result, the replacement of heat exchangers can be delayed or even postponed indefinitely while maintaining plant reliability. Plus, our responsive teams can help minimize the risk of unplanned shutdowns caused by heat exchanger issues.

Tube End Plate Expansion

Do you have steam leakage through thinning end plates? Tube expansion is repair solution:

- Minimizes steam in-leakage
- Minimizes tube vibration
- More than 36,000 expansions since 1997



Tube Sleeving Repair

Are you experiencing tube leaks and have flaws such as wear, pitting, and cracking that need repair? Tube sleeving is the repair solution:

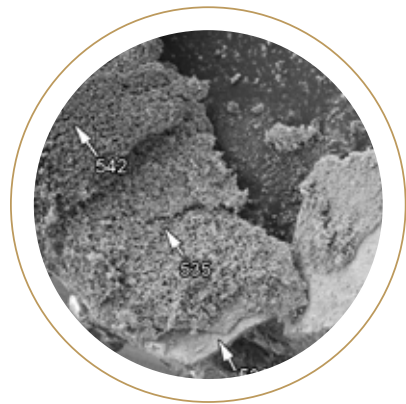
- Minimizes tube leakage
- New pressure and structural boundary for tube
- More than 4,900 sleeves installed since 1993
- Performed anywhere along tube length

Features and Benefits

- Extends the life of your feedwater heaters
- Eliminates forced outages
- Perform repairs at a fraction of replacement costs
- Decreases tube plugging rate
- Balance flow between each stage of heat exchangers by removing plug and sleeving tubes to recover plugged tubes
- Sleeve becomes new pressure and structural boundary for tube

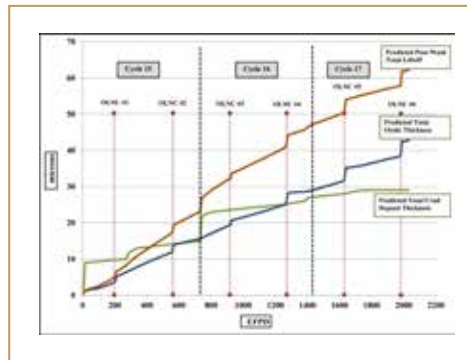


Fuel Chemistry & Crud Risk Assessments



AREVA has developed tools and methods for performing EPRI-defined Level III and Level IV crud risk evaluations. These tools and methods have been successfully applied to support utilities with W, CE and/or B&W plants with AREVA fuel in their efforts to manage the risks for crud-related issues. The techniques have allowed plants to move from situations of high crud risk, where significant crud deposition was measured, to lower, more manageable crud risk conditions, by using the following elements:

- Localized sub-channel and fuel rod resolution in determining the “clean” rod thermal-hydraulic conditions along the full length of each fuel rod.
- A thermal-hydraulic sub-channel code (COBRA-FLX™) benchmarked to evidence of observed in-plant rod surface steaming.
- A fuel deposit interactive chemistry tool (FDIC) for predicting crud thickness, crud ΔT , crud composition/species, based on actual plant chemistry data and case studies for the most likely chemistry for the upcoming cycle.
- FDIC is benchmarked to fuel surveillance and crud samples collected (using a sampling method designed to recover intact crud flakes).



Features and Benefits

- Industry-leading capability for predicting Level III and IV crud risks with the application of AREVA's FDIC chemistry deposition tool.
- FDIC is benchmarked to fuel surveillance and to crud samples collected using a sampling method designed to recover intact crud flakes.
- A sub-channel and fuel rod resolution is achieved for the core using COBRA-FLX™ to obtain the local thermal-hydraulic environment for Level III needs.
- Even higher resolutions (with >103 finer discretization) are achieved with a CFD code-predicted local thermal hydraulic environment for Level IV applications.
- The FDIC code, when using the applicable resolutions of thermal-hydraulic environment, provides a significant leap forward in the industry for predicting the complex nature of crud formation and evolution.
- AREVA's tools can provide the necessary means for an effective crud risk management capability.

Supporting the Industry

BWR

- Boron monitoring
- Chemistry & radiochemistry laboratory services & training
- Chemistry regime and operational changes impact assessment
- Cobalt reduction campaign strategies
- Coolant chemistry data assessment
- Corrosion product behavior and intruded chemicals evaluation
- Crud build-up-related risk assessment and crud scrape analyses
- Deposit and resin analyses
- Gamma spectroscopy data analysis
- Metallurgical examination of irradiated hardware
- Methanol Injection Technology to Reduce IGSCC
- Root cause and failure analysis
- SEM/EDS analysis
- Shimadzu™ X-ray diffractometer
- Startup and shutdown chemistry
- Water chemistry consulting services
- Zinc stearate analysis

PWR

- Benchmark testing service
- Boron monitoring
- Chemical cleaning of nuclear steam generators
- Chemistry & environmental services laboratory
- Chemistry & Radiochemistry laboratory services & training
- Component & system chemical cleaning
- Component and system chemical decontamination
- Consumable materials co-op database
- Corrosion evaluation and management
- Deposit analysis and characterization
- Deposit Minimization Treatment (DMT)
- Gamma spectroscopy data analysis
- Heat exchanger services
- High-efficiency resin analysis service
- Metallurgical laboratory services
- Operational chemistry evaluation
- Portable membrane separation technology
- Portable volume reduction systems
- Preventive maintenance cleaning
- Preventive maintenance optimization
- Root cause and failure analysis
- SEM/EDS analysis
- Shimadzu™ X-ray diffractometer
- Startup and shutdown dose reduction
- Structural electrosleeve
- Thin electrosleeve
- Water chemistry consulting services
- Zinc stearate analysis



AREVA in North America (AREVA Inc.) combines U.S. and Canadian leadership to supply high added-value products and services to support the operation of the commercial nuclear fleet. Globally, AREVA is present throughout the entire nuclear cycle, from uranium mining to used fuel recycling, including nuclear reactor primary circuit design and fabrication, and operating fleet engineering and services. AREVA is recognized by utilities around the world for its expertise, its skills in cutting-edge technologies, and its dedication to the highest level of safety. AREVA Inc.'s 4,100 employees are helping build tomorrow's energy model: supplying ever safer, cleaner and more economical energy to the greatest number of people.

us.aveva.com

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Energy is our future, don't waste it!

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