

# Advanced Scale Conditioning Agents

## Background

The accumulation of deposits in the secondary side of pressurized water reactor steam generators (SGs) increases the potential for accelerated tube degradation. As these deposits harden and form crevices, they can cause conditions that lead to tube corrosion.

In order to improve upon traditional mechanical deposit removal techniques and avoid the potential drawbacks of traditional SG chemical cleaning, advanced scale conditioning agent (ASCA) technology was developed in 2000. ASCAs are dilute cleaning solutions that promote the dissolution of a portion of the overall deposit inventory along with entrained mineral species from the deposit matrix in the secondary side of recirculating SGs.

## Description

Due to the wide variability in the structure and morphology of SG deposits, plant-specific qualification testing is needed to determine the best combination of ASCA formulation and method of treatment prior to application. Three types of ASCA are available for use on specific deposit management projects. They include:

### Full-bundle maintenance cleaning

Full-bundle maintenance cleaning ASCA applications have been used to reduce secondary-side deposits from SGs and improve SG performance.

### Copper-removal ASCA

Copper-removal applications have been successfully used to remove copper from SG secondary side deposits. Copper removal applications have achieved more than 90 percent removal of copper from deposit inventory.

### Top-of-the-tubesheet (TTS) treatment

TTS treatments are used to remove tenacious deposits from the TTS area in order to mitigate corrosion concerns. TTS ASCA applications are often applied with specialized mechanical removal techniques such as ultrasonic energy cleaning.

## Benefits

ASCA technology is designed to provide maximum benefit to the plant while minimizing outage impacts. The following features are included in ASCA technology design:

- Low corrosion allows for many applications over plant life
- Combination iron-copper (Fe-Cu) removal without draining and refilling the SG
- Minimal equipment footprint
- Ability to fit in a short outage window
- Low-cost maintenance option

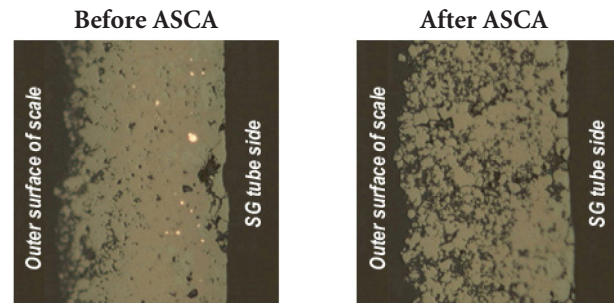
Applying ASCA technology helps extend SG operation, maintain SG cleanliness and enhance SG performance by altering secondary-side deposit morphology.

Application benefits include:

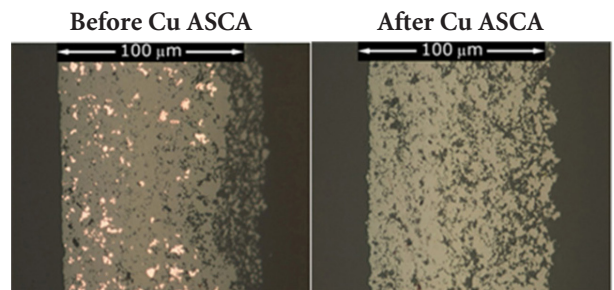
- Immediate and sustained improvements in heat transfer efficiency (decreases in fouling factor and increases in steam pressure)
- Reductions in tube support plate blockage
- Partial dissolution and softening of consolidated TTS sludge

## Experience

The ASCA process is qualified for use in a wide range of SG designs, including Westinghouse, CE, CANDU, B&W, MHI and Framatome. ASCA technology has been independently tested or evaluated by nine international laboratories and organizations. More than 30 ASCA applications have been completed to date including applications in the United States, France, Korea and Japan.



Structural modification of SG tube scale by ASCA treatment



Tube scale before and after copper removal ASCA treatment



Typical ASCA system setup

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