*Nuclear Science and Technology Symposium - SYP2019*
*Helsinki, Finland, 30-31 October 2019*

# PWR Steam Generator Secondary Maintenance Strategy

**Caroline Herraud, Guillaume Zimmer, Geoffroy Gaillard**
Westinghouse Electrique France
86 rue de Paris, 91 401 Orsay, France
herrauc@westinghouse.com, zimmerg@westinghouse.com, gaillag@westinghouse.com

## ABSTRACT

Deposits inside steam generator remains a concern for the utilities in term of safety, performance and steam generator lifetime. Various lancing technics are used as a preventive method to address this issue in European utilities. Typically lancing are conducted as overall, localized or in-bundle lancing. Despite the implementation of these qualified preventive technics, deposit levels sometimes force the utilities to implement a curative technology (mainly hard chemical cleanings).

This strategy is primarily driven by cost and schedule: technics are chosen based on impact to the outage schedule and cost-effectiveness. However, this model could be questioned as the curative technology typically have a high financial and schedule impact on one outage. This paper will present an option to current industry model.

## 1 INTRODUCTION

The industry's challenge is to modernize the current industrial maintenance model to secure the steam generator from a long-term base standpoint. This paper will discuss:

- the current used technologies with link between inspection and cleaning methods,
- a new approach of the maintenance strategy,
- the main principles of the recommended maintenance strategy.

## 2 CURRENT MODEL / TECHNOLOGIES

The similar principles / technologies are used in all European utilities.

### 2.1 Technologies

Inspection are based on:

- EC inspection from primary side,
- Visual inspection from secondary side:
  - Systematic no tube inspection for FME reasons,
  - Systematic 100% in-bundle tube sheet inspection.

Mechanical Cleaning is based on:

- Systematic Overall lancing,
- Systematic Focused area lancing,
- In-bundle lancing if needed.

### 2.2 Model

- Only lancing technologies are used for TTS cleanliness technologies
- Same cleaning program is applied whatever the SG cleanliness is.

## 3 NEW APPROACH

The new approach aims to redefine the current maintenance strategy to avoid curative implementation and removing the outage schedule and financial impact on outages:

- by decreasing, cancelling or at least adapting the less added-value technologies based on SG cleanliness status,
- by making new, stronger preventive/recurrent.

Moreover, this flexible model could lead to decrease the maintenance needs for new SG.

## 4 MAIN PRINCIPLES OF THE RECOMMENDED MAINTENANCE STRATEGY

### 4.1 Technologies

Inspection are based on:

- EC inspection from primary side,
- Visual inspection from secondary side:
    - Systematic no tube inspection for FME reasons,
    - Sampling in-bundle tubesheet inspection to evaluate hard sludge evolution.

Mechanical cleaning:

- Overall lancing: still necessary to extract smooth sludge,
- Focused area lancing: only necessary in the case of hard sludge,
- In-bundle lancing: only necessary in very specific cases,

Chemical cleaning:

- Process qualified before implementation with proven efficiency on tubesheet,
- Solvents applied only on tubesheet,
- In side containment equipment installation,
- Plant heat to be used during the chemical process,
- Injecting/draining by plant pipes.
- Waste management according to local regulation.

### 4.2 Model

- Evaluative Lancing program based on SG cleanliness status,
- Evaluative inspection methodology based on SG cleanliness status,
- Recurrent chemical cleaning each 3-5 outages.

## 5 CONCLUSIONS

Based on this maintenance strategy model on PWR steam generator, the recommendation shall lead to avoid any curative technology implementation, secure the financial model, leverage the risk and maximize the steam generator performance without affecting the outage schedule.

It require full collaboration between utilities and maintenance service vendors to set the best maintenance strategy depending on the steam generator configuration and to define the best way to operate recurrent chemical cleaning.

Such application is already implemented outside Europe (Asia for instance) but European vendors have technologies and full competencies to implement it locally.

## ACKNOWLEDGEMENTS