

Guide Card Wear Inspection and Measurements

Background

Guide card wear is a significant emergent issue in the nuclear industry. Stepping and scrambling contribute to wear, but the main cause is flow-induced vibration. Guide card wear could result in:

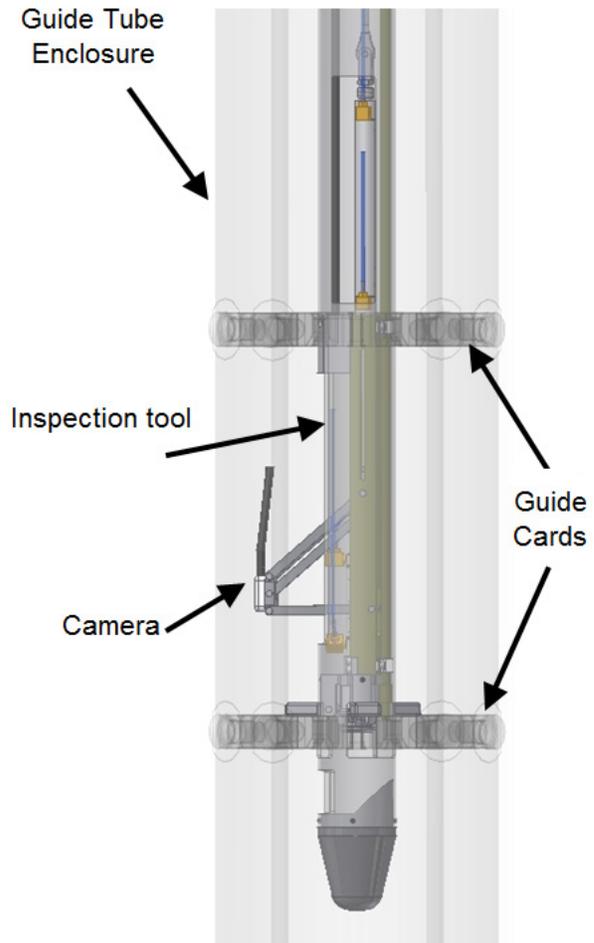
- Plant shutdown and/or outage extension
- Increased SCRAM time that could violate technical specifications
- Potential safety issue (failure of more than one rod cluster control assembly)

The Pressurized Water Reactor Owners Group initiated a Westinghouse program to address the issue of guide card wear in the industry in the engineering report WCAP-17451-P, "Reactor Internals Guide Tube Card Wear – Westinghouse Domestic Fleet Operational Projections." A schedule is generically recommended for plants that have not had guide card wear directly evaluated through an inspection program.

Through the Westinghouse guide card wear measurement (GCWM) program, the Electric Power Research Institute (EPRI) inspection and evaluation guidelines Materials Reliability Program (MRP) MRP-227-A base requirements will be met or exceeded.

Westinghouse can also provide recommendations for subsequent inspections by forecasting data that are relative to the wear criteria and future degradation rates.

It is critical for plants to understand and manage guide card aging. Should excessive wear be discovered, costly guide tube replacements and emergent outage scope might be necessary.



Guide card wear measurement tool

Description

Guide card wear inspection is performed by Westinghouse when the upper internals are in the storage stand with the internals lift rig removed from the upper internals. Although the manipulator bridge is the preferred work platform, an auxiliary work platform can be used.

The GCWM process has two phases:

Phase 1: Video Inspection: Westinghouse developed a lightweight camera delivery system capable of meeting the requirement of EPRI MRP-227-A guidelines for visual examination (VT-3) inspection of all control rod guide tube card ligaments and holes, including the top of the continuous section.

Phase 2: Data Measurement and Analysis: The video data from each guide tube is reviewed, and measurements are then compared with the nominal design dimensions and industry data from previous inspections. A rate of wear is developed for each inspected tube, and a subsequent remaining lifespan for each tube is estimated. Westinghouse will determine the need and provide recommendations for subsequent inspections.

Contingency Scope

The possibility exists that, through the course of guide card wear inspection and measurement, a situation is found in which wear is severe enough that it requires immediate action. As part of the base scope, Westinghouse will perform an engineering evaluation allowing the guide tube to remain in operation for at least one additional fuel cycle. However, if the wear is too severe, this may not be possible, resulting in the need for guide tube relocation. Westinghouse can also offer these services at the time of inspection and measurement, if possible.



Guide card wear observed during guide card wear measurement

Deliverables

- Wear criteria report
- Draft procedures for customer review and approval
- Initial report
- Final report, including:
 - Evaluation of wear measurements (e.g., methodology)
 - Guide card wear behavior/trend
 - Operational reliability assessment for future operation of guide tubes

Benefits

Synergies exist between the GCWM and the guide tube flange weld inspection in regard to shared resources, shared tooling and shared video capture equipment. Completing these scopes together should be considered.

Westinghouse has three complete sets of equipment available (each set includes a primary and backup tool), with one set located in Europe. Trained and experienced crews are ready to perform the services, and can do so in parallel.

Westinghouse uses the industry's leading-edge software technology, providing real-time data analysis to accurately determine the amount of deterioration that has occurred. More importantly, Westinghouse calculates the amount of material remaining, which is beneficial in predicting end-of-life versus generic "go/no go" reporting.

Westinghouse's clear advantage is that its combined state-of-the-art technology and experience are available today.

Westinghouse offers contingency services including engineering evaluations and field services for guide tube relocation or replacement.

Experience

Westinghouse has completed 12 guide card wear inspection and measurements projects to date, including four projects in the United States and eight projects globally. In addition, more projects are being planned. This gives customers the advantage of experienced people who complete these services on time and deliver a mature product – a product that has incorporated lessons learned from previous experiences.