

# A Solution for Aging BWR Plants: Jet Pump Anti-Vibration Solution

By Bret Nelson, GE Hitachi Nuclear Energy.

## Bret Nelson

Bret Nelson has over 25 years' experience working in nuclear power, including construction, testing, and engineering operations support at the Perry Nuclear Power Plant in northeast Ohio, and as a consultant to the nuclear industry. He has been with GE Hitachi for seven years, serving the past three years as manager of the Reactor Services Hardware Design team. Bret holds a BSME from Cleveland State University and a JD from the Capital University School of Law in Ohio.

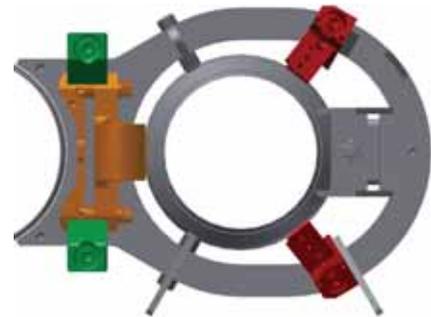
Jet Pump related issues, such as wear and vibration, have increased in frequency and severity since the 1980s due to component aging and increased plant operational performance challenges. As a result, BWR-4 and BWR-5 Jet Pump assemblies are increasingly prone to developing gaps between the restrainer bracket set screws and the inlet mixer, excessive wear of the main wedge and rod, restrainer bracket damage, and slip joint flow-induced vibrations.

During the spring 2013 refueling outage season, GE Hitachi Nuclear Energy (GEH) has begun installing its innovative Jet Pump Anti-Vibration Solution (JP AVS) that has been tested by the Electrical Power Research Institute (EPRI) to fix these difficult problems and provide upgrades for BWR 4 and 5 plants. The JP AVS, coupled with GEH Slip Joint Clamps, will offer a complete solution to all Jet Pump vibration problems by addressing the cause rather than the symptoms of flow induced vibration (FIV).

GE Hitachi is the first to market this innovative product, following a comprehensive and concerted effort, through causal analysis and testing, to find a robust and effective solution to increasing wear among jet pumps in the BWR fleet.

As a result of the increasing FIV, the existing set screw and main wedge system for maintaining the required three-point contact at the Jet Pump restrainer bracket was found to be insufficient for

susceptible Jet Pumps. To eliminate this problem, the new anti-vibration upgrade at the restrainer bracket takes advantage



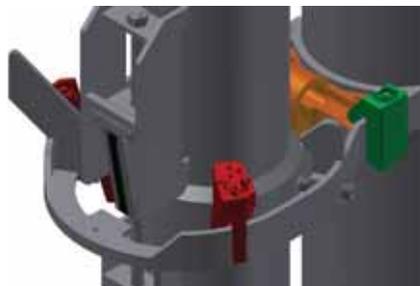
**JP AVS Installed on Jet Pump Restrainer Bracket showing 3 Point Contact (Top-Down View).**

of hydraulic loads, while positively maintaining the required three-point contact.

The new anti-vibration upgrade at the restrainer bracket has undergone successful full-scale testing at the new EPRI facility in Princeton, New Jersey as well as thorough vibration testing at Wyle Labs in Huntsville, Alabama.

As a result of the EPRI testing, the new GEH anti-vibration upgrade at the restrainer bracket was demonstrated to preclude slip joint leakage instability for most plant operating conditions, even with a severe slip joint gap. Test results by EPRI show that with application of the restrainer bracket upgrade and slip joint clamp, initiation of slip joint leakage instability could only occur in areas that are well outside any plant operating region. "We are pleased to offer this innovative and tested solution to our customers," said Manny Klein, Jet Pump Modifications Product Line Leader with GE Hitachi.

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**JP AVS installed on the Jet Pump Restrainer Bracket.**