

Fuel Transfer Tube Bolt Reduction

Background

Most fuel transfer systems were originally furnished with a blind flange closure on the reactor end of the transfer tube. This flange is attached to the tube by 20 bolts, which have to be removed and reinstalled for each refueling.

The reinstallation is particularly time consuming since the bolts must be tightened to a prescribed torque in a specified sequence to provide a leakproof seal. It usually takes two people approximately one hour to remove the flange, and about two hours to reinstall it. These operations are performed in an environment that could have as high as three rem per hour, after each refueling.

Description

The fuel transfer tube blind flange closure is a containment boundary and is a Safety Class 2 component. As such, it is subject to the rules of American Society of Mechanical Engineers (ASME) for Class MC containment vessels. An analysis and design report is required for each plant to provide that the design stresses for the bolts are within the allowable stresses. Fuel transfer tube assembly drawings are revised to reflect design changes. A safety evaluation of this design change required by U.S. Nuclear Regulatory Commission (NRC) 10CFR50.59 is prepared and a Final Safety Analysis Report (FSAR) change written to incorporate the bolt reduction.

In addition to providing documentation to support the bolt reduction, locator pins are used to aid the initial alignment of the blind flange to the bolting flange. The locator pins are short enough to allow for clearance of the blind flange between the fuel transfer system tracks and locator pins, as well as the pins installed permanently in two of the unused bolt holes.

Benefits

Calculations indicate that a minimum of four bolts can be used with quad rings while still generating sufficient preload to compress the seals and resist hydraulic and seismic forces. To reduce personnel radiation exposures, Westinghouse reduced the number of bolts required to secure the blind flange on the fuel transfer tube. Tests verified the leak-tightness of these seals while using only four bolts.

Deliverables

Westinghouse will deliver:

- One set of locator pins (two pins, total)
- Replacement blind flange designed for quad ring seal application (provided as required)
- ASME Code Design Report for bolt reduction, including seismic evaluation
- Safety evaluation checklist for the modification
- Revised fuel transfer tube assembly drawing
- Revised fuel transfer system assembly drawing (if required)
- FSAR mark-ups for the bolt reduction
- Revised fuel transfer system technical manual inserts

Experience

Nuclear power plants where the Westinghouse fuel transfer tube bolt reduction is used include: Beaver Valley, Braidwood, Byron, Comanche Peak, Indian Point, Millstone, North Anna, Palisades, Salem, St. Lucie, Turkey Point, Watts Bar and Wolf Creek.