

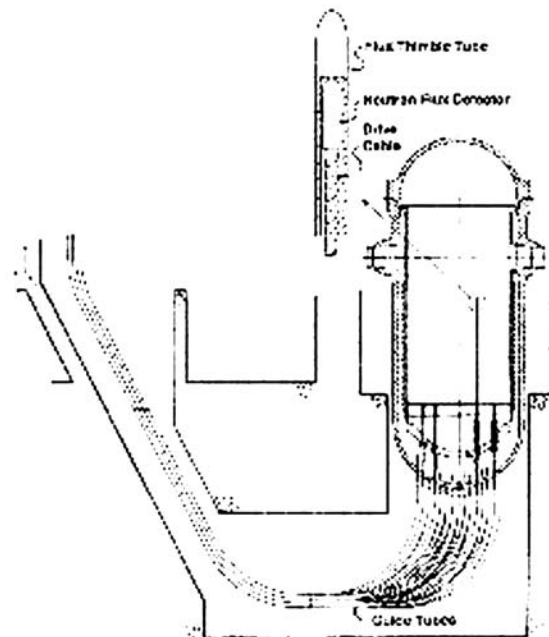
Chrome-Plated Flux Thimbles

Engineering
Services

Background

Instances of flux thimble tube wear and leakage observed in operating reactors have been attributed to flow-induced vibrations in the lower internals support column area. As a result, the NRC has issued Bulletin BL-88-09, *Thimble Tube Thinning in Westinghouse Reactors*, which instructs utilities to establish and implement inspection programs to periodically confirm thimble tube integrity. In response, Westinghouse has developed a thimble tube design upgrade in addition to appropriate maintenance to increase the thimble tube life and the integrity during plant operation.

The design upgrade consists of applying a thin layer of chrome-plating in the region of possible maximum wear due to flow-induced vibration. This region is located between the bottom of the fuel nozzle and the instrument support column in the lower reactor internals. The chrome-plated flux thimbles are available in the original design size and larger diameter sizes ranging from 0.3-inch outside diameter (OD) to 0.385-inch OD. Installation of chrome-plated flux thimble tubes does not require any other plant modifications, including those to the incore detector/detector drive system.



Typical flux thimble tube and related hardware

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Benefits

- Reduces and extends the life of flux thimble tubes by a factor of two compared with the conventional flux thimble tubes.
- Extends the interval of eddy current inspection from the conventional flux thimble, which occurs at least every other or third refueling outage.
- Reduces maintenance cost with a longer thimble replacement interval.
- Saves as-low-as-is-reasonably-achievable (ALARA) dose with a longer interval of flux thimble tubes replacement.
- Saves space in the spent fuel pool due to reduced flux thimbles replacement.

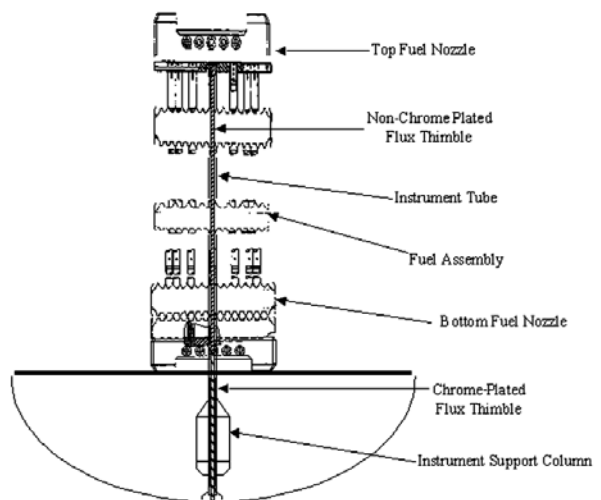
Description

The flux thimble tube is chrome-plated in the region where the possible wear occurs. These regions are in the instrument support columns in the reactor internals and the fuel nozzles of fuel assemblies. The starting point of chrome-plating is at the bottom fuel nozzle and will extend up to the entrance of the instrument support column, which is near the bottom of the reactor vessel. The chrome-plating material is pure chrome with a low-cobalt content.

Experience

The following Westinghouse plants have installed chrome-plated flux thimbles, either fully or partially:

- Farley Units 1 & 2
- D.C. Cook Units 1 & 2
- South Texas Units 1 & 2 (partial)
- Wolf Creek Unit 1 (partial)
- R. E. Ginna (partial)
- Angra Unit 1
- Asco Units 1 & 2
- Almaraz Units 1 & 2
- Diablo Canyon Units 1 & 2 (partial)
- Milestone Unit 3 (NEU) - (partial)



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