Non-LOCA Technology Transfer

Background

With more than 30 years of extensive nuclear steam supply system (NSSS) non-loss-of coolant accident (LOCA) safety analysis experience, Westinghouse is at the forefront of developing and maintaining state-of-theart methods. Westinghouse now offers a non-LOCA safety analysis methodology and technical transfer package that incorporates the RETRAN-02 computer code with Westinghouse software (FACTRAN, TWINKLE, OPTOAX), along with a set of analysis methods approved by the U.S. Nuclear Regulatory Commission (NRC).

Description

The Westinghouse non-LOCA technology transfer includes the following code packages:

RETRAN

RETRAN-02 is the reactor coolant system (RCS) transient analysis computer code maintained by Computer Simulation & Analysis Inc. (CSA) for the Electrical Power Research Institute (EPRI). It has point kinetics capability as well as the ability to model twophase flow and detailed steam generator geometry. The NRC has reviewed and approved non-LOCA safety analysis methods that use Westinghouse's RETRAN model.

FACTRAN

FACTRAN is a digital computer code that calculates the transient temperature distribution in a cross section of a metal-clad UO2 fuel rod and the transient heat flux at the surface of the clad, using the nuclear power and time-dependent coolant parameters (pressure, flow, temperature and density) as input.

OPTOAX

The OPTOAX code is used to calculate overtemperature delta-T and overpower delta-T reactor trip setpoints.

TWINKLE

TWINKLE is a multidimensional, spatial neutron kinetics digital computer code patterned after steadystate codes presently used for reactor core design.

IGOR

IGOR is an input preprocessor designed specifically for use with a Westinghouse-developed RETRAN plant model. IGOR automates the development of a plantspecific, steady-state RETRAN input file and reduces the effort required to make RETRAN input modifications.

XTRACTR

XTRACTR is a Westinghouse-developed post-processor for the RETRAN code that has the capability to:

- Extract minor edit data from a RETRAN output file that can be read by NSAPLOT
- Summarize information for each minor edit extracted from the RETRAN output file
- Summarize all reactor trips activated in a RETRAN run
- Summarize departure from nuclear boiling ratio statepoint data in a separate file

NSAPLOT

The Westinghouse NSAPLOT explores large amounts of data in the form of x-y plots. NSAPLOT supports many common output devices, including X11 Windows and postscript.

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Benefits

The benefits of this technology transfer include:

- Access to the same NRC-approved methods that Westinghouse safety analysts use
- Improved knowledge of non-LOCA safety analysis technology
- Methods to determine the effects of plant modifications
- Tools to determine impact of reactor trip setpoint changes
- Ability to verify NRC 10CFR50.59 safety evaluations

Deliverables

The deliverables for a typical non-LOCA technology

transfer suite include:

- Executable version of all codes licensed (or a secure remote access path)
- Copies of all Westinghouse safety analysis standards (applicable to the codes licensed)
- Plant-specific base decks (for each of the codes purchased)
- Plant-specific data files (created by IGOR)
- Training (either at the customer's site or a Westinghouse facility)
- Safety analysis standard manual
- Copies of applicable topical reports
- Consultation (100 hours)
- Maintenance (annual updates of codes and methods)
- Included with Westinghouse's non-LOCA technology transfer package is a formal 10-day training course that covers IGOR and input generation training; RETRAN overview and a discussion of the Westinghouse model;

- FACTRAN, OPTOAX and TWINKLE codes and their application; specific accident analysis methods; and reload safety evaluation methodology.

Experience

The following plants, utilities and companies have licensed a Westinghouse non-LOCA technology transfer package:

- Braidwood
- Korea Nuclear Fuel Co.
- Byron
- North Anna
- D.C. Cook
- South Texas
- Diablo Canyon
- Surry
- Farley