Ex. 55&A

FOR TRAINING USE ONLY

NUCLEAR POWER PREPARATORY TRAINING

GPU 2250

CORE PERFORMANCE

4

a course for

METROPOLITAN EDISON COMPANY

via Video Tape

by

NUS CORPORATION

Rockville, Maryland

310-2

1051

Printed in the United States of America

4. HEAT TRANSFER AND HEAT GENERATION

A. General

(1) The study of heat transfer is concerned with the details of the rate of flow of heat energy between bodies. It has been stated that heat will flow between two bodies if one is at a higher temperature, but for design purposes it is also important to know how fast the process will occur. The three basic categories of heat transfer are:

- conduction
- convection
- radiation

(2) Conduction is direct transference of heat by molecular impact. When a part of a metal bar is heated, molecules at the point being heated vibrate more and more rapidly, collide more vigorously with their neighbors, and transmit some of their energy to them. A good example of conduction is the flow of heat up a spoon from the coffee in your cup to your fingers.

(3) Heat transfer by convection is the transfer of thermal energy by the motion of a fluid that is being heated. There are two general categories of convection, called natural convection and forced convection. Natural convection takes place because the density of the heated fluid is less than that surrounding it and as a result it rises. This can be seen on an automobile on a hot summer day. The air touching the metal surface is heated by conduction and convection currents are set up, resulting in a transfer of heat away from the surface. Forced convection occurs when the fluid motion is caused by some factor other than the density difference, such as pumps or fans. For forced convection the effect of the different fluid densities usually has little significance. A good example of convection is the operation of a coffee percolator, which runs on natural circulation.

results in a decrease of steam generator volume for making steam and, finally, superheating. The result is that less superheat will occur and the steam outlet temperature will be lower.

- Decreasing feedwater temperature causes steam generator outlet temperature to drop.

What happens to the steam outlet temperature if the plant load is reduced in a controlled manner from 100% to 50%? When load is reduced, the feedwater flow will decrease significantly. The effect of this is that the same heat source volume is available to heat considerably less secondary process fluid. This results in more space being available for superheating and a resulting higher steam outlet temperature.

- Load or feedwater flow reductions result in an increase in the steam generator outlet temperature, except at low power levels.

The reactor coolant in a PWR system is kept under pressure to prevent bulk boiling in the core. In the case of an abnormal transient, where this pressure is lost and some steam is generated in the core, how will we know it? We will see a large increase in level in the pressurizer until pressure is built back up above the saturation value corresponding to the temperature in the core. The steam bubbles will then condense, and the level will drop back down close to its normal value.

Problem

The secondary side of a once-through steam generator has a net value of 3500 ft^3. At the time of a plant trip, the following operational characteristics applied to the steam generator: