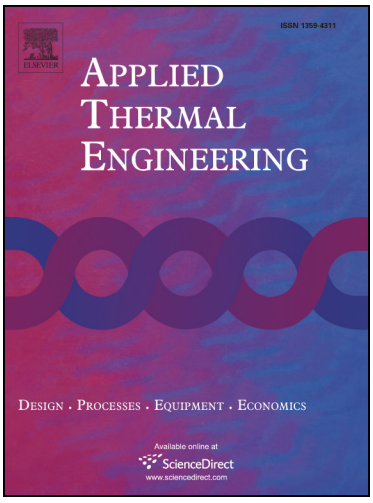

Simulation studies on natural circulation phenomena during an SBO accident

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SIMULATION STUDIES ON NATURAL CIRCULATION PHENOMENA DURING AN SBO ACCIDENT

ABSTRACT

Natural circulation flow capability for removing decay core power has been demonstrated, and several studies have focused on taking advantage of this fact. This work studies the sequence of events that occur during a station blackout accident, in which natural circulation is the dominant flow pattern in the primary system. To this end, the Test A1.1 carried out in ATLAS facility is analyzed and a TRACE5 model is developed paying special attention on the modeling of heat losses. This phenomenon is very influential in the flow capacity and this is demonstrated through the correlation $G \sim (Q-q_{loss})^m$ between the net power $Q-q_{loss}$ and the mass flow G, that has been established from simulations under steady-state conditions. The Test A1.1 reproduction shows the TRACE5 code adequacy to investigate natural circulation phenomena, which are difficult to control in a facility. In addition, the heat loss modeling technique using constant heat transfer coefficients is substantiated.

Keywords: Natural circulation, heat losses, station blackout, ATLAS.

1. INTRODUCTION

Facing the impossibility of having real data of thermal-hydraulic parameters in a power plant during an accident, integral test facilities (ITF) have been built in order to reproduce their response. The main objective of these facilities is verifying safety systems and protocols, as well as validating various thermal-hydraulic codes, for which programmed tests are conducted.

ATLAS (Advanced Thermal-Hydraulic Test Loop for Accident Simulation) is a laboratory destined to simulate accident effects in the APR1400 and the OPR1000, its reference reactors. Since 2007, this