PASI TEST FACILITY

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INTRODUCTION (1/2)

INTEGRAL TEST FACILITIES
- Rewet-I (1976)
- Rewet-II (1980)
- REWET-MARIA (1986)
- VEERA (1987)
- PACTEL (1989)
- PWR PACTEL (2009)
- MOTEL (under construction)
INTRODUCTION (2/2)

SEPARATE EFFECT TEST FACILITIES

- BWR 90+ core catcher
- EPR core catcher
- SWR 1000 fast boron injection system
- SWR 1000 scram tank
- PPOOLEX
Review on passive heat removal systems in NPPs in Finland

Selected system: passive containment cooling system PHRS-C of AES-2006

Goal is to detect issues that could disturb the operation of a passive system or prevent it from functioning as designed
Heat exchangers in the dome part of the containment
Emergency heat removal water tanks outside the containment
Four identical and independent subsystems
Each subsystem includes four heat exchanger loops
One heat exchanger loop is modelled
PASSIVE HEAT REMOVAL TEST FACILITY - PASI

- Maximum pressure: 5 bar
- Maximum temperature: 170 °C
- Heat exchanger height: 2.8 m
- Heat exchange tubes: 15
- Heat exchanger tube size: Ø38 x 3
- Riser pipe size: Ø114,3 x 2,6
- Downcomer size: Ø88,9 x 3
SCALING

- Model of one AES-2006 PHRS-C system heat removal loop
- Simulation of natural circulation
- Model heat transfer as accurately as possible
- Maintain relative gravitational and frictional pressure losses
- Height scale 1:2 (laboratory space restrictions)
FACILITY PARTS - PRESSURE VESSEL SIMULATING CONTAINMENT CONDITIONS

- Not a scaled down version of any containment building
- Rated for the pressure of 5 bar and the fluid temperature of 170 °C
- Hot collector, riser pipeline inlet and the main parts of the heat exchange tube bundle are inside the vessel
- Steam injection system
- Condensate water draining system
- Aerosol injection system can be added to the system in future
FACILITY PARTS - HEAT EXCHANGER

- 15 heat exchange tubes and cold and hot collector drums
- Mainly inside the vessel simulating containment conditions
- Cold collector and the inlets of the heat exchange tubes are below the vessel
  - possible needs for future instrumentation
Pressure, differential pressure, flow transducers, and K-type thermocouples

Facility includes capillary piping to house fiber-optic transducers for longitudinal temperature distribution measurements
CHARACTERIZING TESTS

- Pressure and heat losses
- Natural circulation and general behavior
  - transfers heat to the water pool efficiently
  - steady operation on single-phase flow
  - flow oscillations on two-phase flow
CONCLUSIONS

- **INTEGRA PROJECT**
  - Carefully designed experiments are the most reliable way to obtain fundamental understanding and reliable data of the phenomena
  - Data can be used in the development and validation of computer codes for the safety analyses of nuclear power plants

- **PASI TEST FACILITY**
  - Goal is to detect issues that could disturb the operation of a passive system or prevent it from functioning as designed
  - PASI facility enables solving passive containment cooling system related problems that occurs in the Finnish NPPs at short notice