

1&2

RCP

**Small Break LOCA Analysis for RCP Trip Strategy of Ulchin 1&2
Emergency Operating Procedure**

150

103-16

1&2

가

3 inch
20 가

Abstract

A series of quantitative analyses were performed for Ulchin 1&2 small break loss-of-coolant accident to support technically the validity of Reactor Coolant Pump (RCP) trip criteria presented in the Emergency Operating Guideline (EOP). Based on the analyses results, the effect of RCP trip timing on the core uncover and the margin for operator action time was evaluated. Limiting break location and size were found to be hot leg break and 3 inch in effective diameter. In addition, it was concluded that appropriate RCP trip timing is 20 minutes after the RCP trip condition is reached.

1.

TMI-2 (Three Mile Island Unit 2)

[1,2]. ,

가 . ,
TMI-2

IE-Bulletin 79-06[1]
가

• 2 (TMI-
가)

• 가

,
Generic Letter[3] 가

가

,
가

,
가

, , 가 ,
가

가

1&2

A.1.1
10 °C)

($\Delta T_{SAT} <$

가

가,

가

2.

RELAP5/MOD3.2

1&2

1 1

가

- 100 %
- HHSI (High Head Safety Injection) 1
(Minimum Safeguard Assumption)
-
-

1&2

Framatome Type

3 Loop

가
가

3 inch 가

, 3 inch

2 inch, 4 inch

가

가

가

가

3.

3.1

가

3 inch

가 . 가

RELAP5/MOD3.2

level)

(mixture level)

가

2 7

(collapsed

가

2
1000 ,

, 1100

loop seal clearance

가

가

mass balance

4 5

loop seal clearance

가

6

loop seal clearance

가

(3)

가

7

, loop seal clearance

가 clearance

collapsed level

가

cross-over leg

가 가

가

가

3.2

가

가

2 inch

4 inch

8

11

2, 3, 4

inch

2, 3, 4 inch

loop seal clearance

8

가

9

11

A, B, C

1) A :

2) B : 가

3) C :
가

가

B

가

가 . 2 inch
 가
 inch ,
 B A 3, 4

3.3

3.2
 3 inch 4 inch
 $\Delta T_{SAT} < 10 \text{ }^\circ\text{C}$
 3 inch 4 inch
 hot rod 가 3 inch
 가 cold side hot side

35
 가 가 22 가
 1204 $^\circ\text{C}$ 13
 25
 가
 3 inch 가 4 inch
 3 inch
 , 10 , 15
 3 inch 5
 3 inch
 (14 15).

4.

1&2 A.1.1
 $\Delta T_{SAT} < 10 \text{ }^\circ\text{C}$
 가,

가 .

3 inch loop seal

clearance 가

가

가 가

clearance 가 loop seal

inch 25 3

1204 °C

loop seal clearance 가 가

가 가

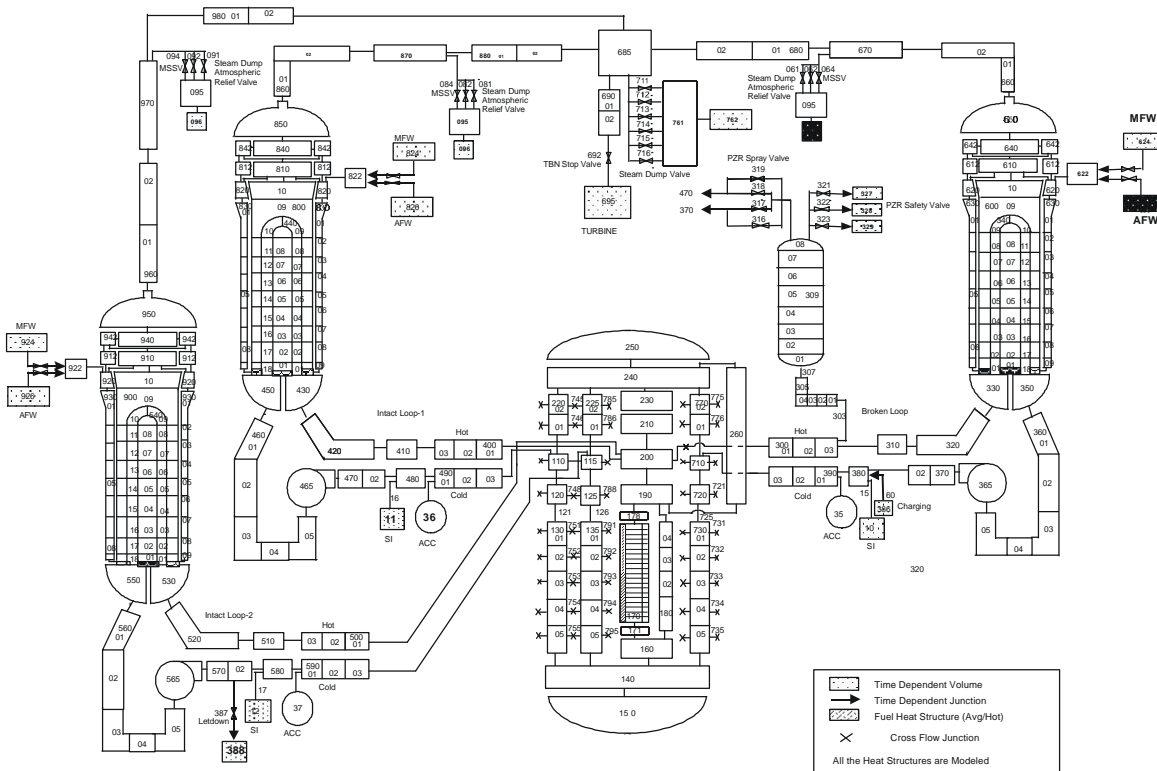
1250 (20) 가

1&2

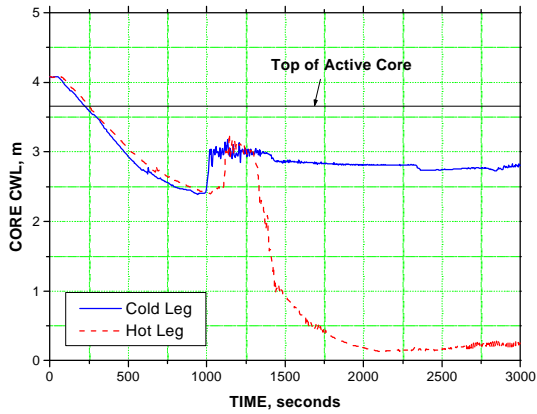
1. Nuclear Incident at Three Mile Island, U.S. NRC IE Bulletin 79-06C (1979).
2. NUREG-0933, Item II.K.3.5, "Automatic Trip of Reactor Coolant Pumps," (1983).
3. Resolution of TMI Action Item II.K.3.5, Automatic Trip of RCPs, U.S. NRC Generic Letter 83-10 (1983)

1.

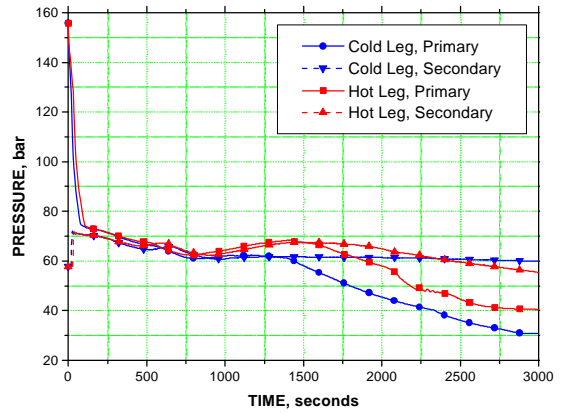
	(MWt)	2775
가	(bar)	155
가	(%)	62.7
	(kg/sec)	4754.1
	(%)	6
	(°C)	304.6
	(bar)	58
	(%)	44
	(kg/sec)	504.3
	(°C)	219.5



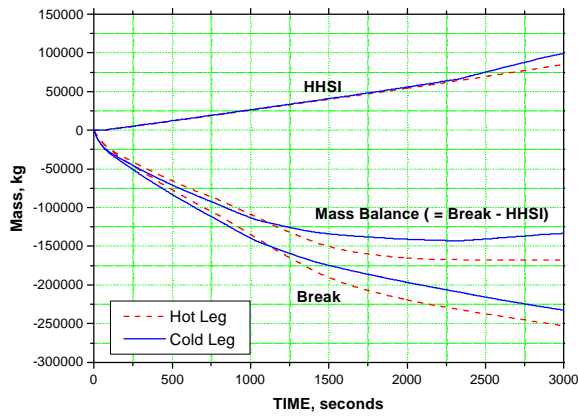
1. 1&2



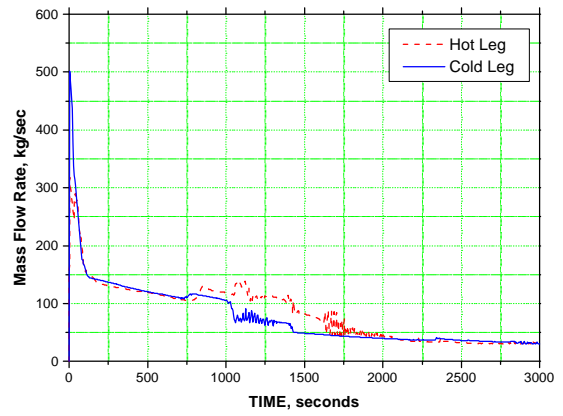
2. Core Collapsed Water Level Variations (3" SBLOCA, 1 Train HHSI Available)



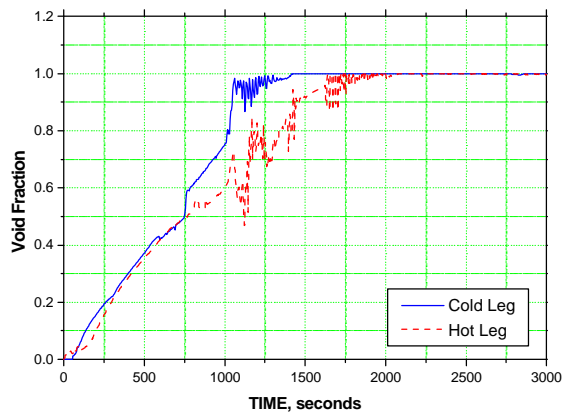
3. Primary and Secondary Pressures Variations (3" SBLOCA, 1 Train HHSI Available)



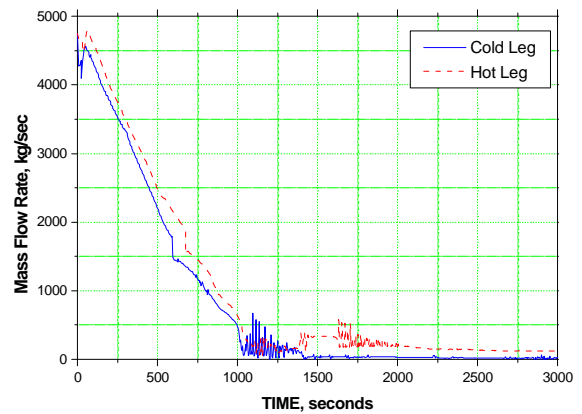
4. Integrated Break Flow, HHSI Flow and Total Mass Balance Variations (3" SBLOCA, 1 Train HHSI Available)



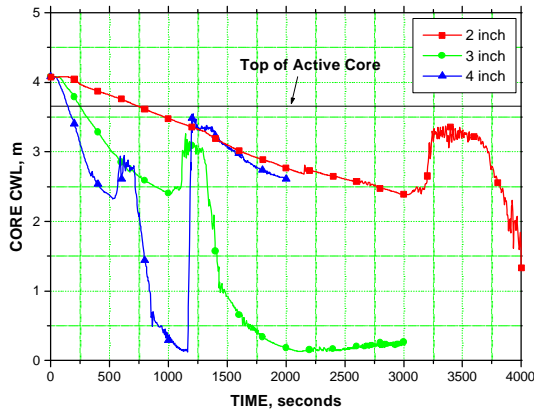
5. Break Flow Rate Variations (3" SBLOCA, 1 Train HHSI Available)



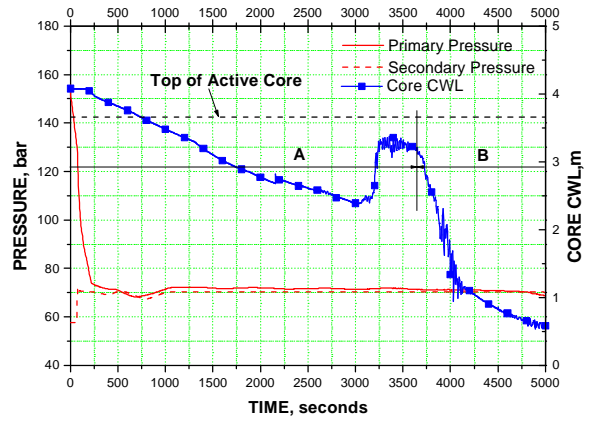
6. Vapor Void Fraction at Break Variations (3" SBLOCA, 1 Train HHSI Available)



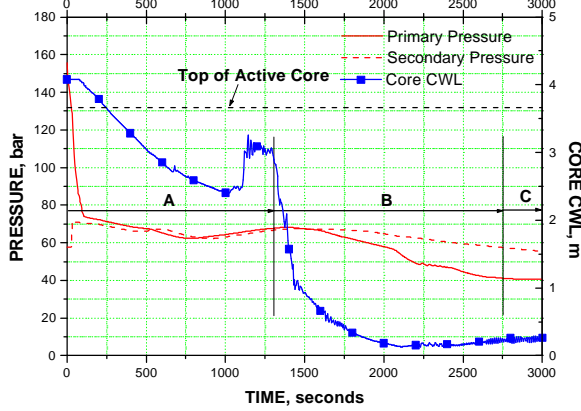
7. Broken Loop Hot Leg Flow Rate Variations (3" SBLOCA, 1 Train HHSI Available)



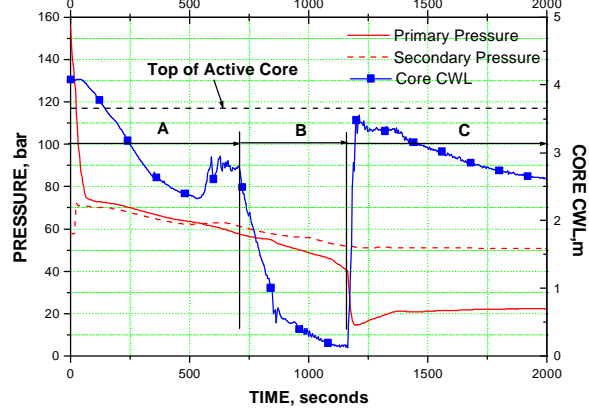
8. Core Collapsed Water Level Variations (Hot Leg SBLOCA, Continued RCP Operation)



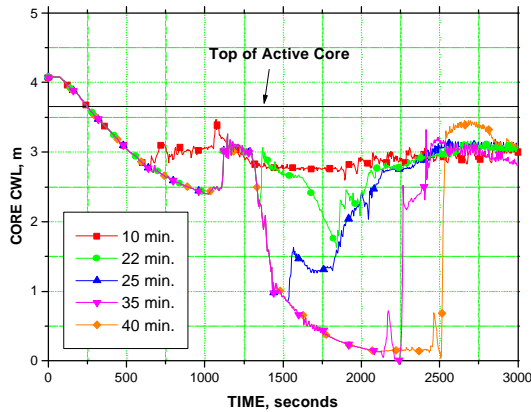
9. Primary and Secondary Pressures, and Collapsed Water Level Variations (2" Hot Leg SBLOCA, Continued RCP Operation)



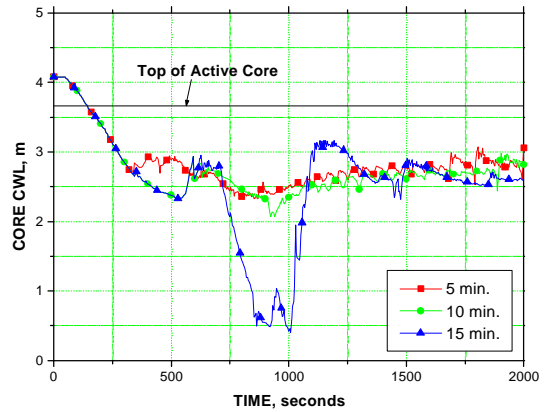
10. Primary and Secondary Pressures, and Collapsed Water Level Variations (3" Hot Leg SBLOCA, Continued RCP Operation)



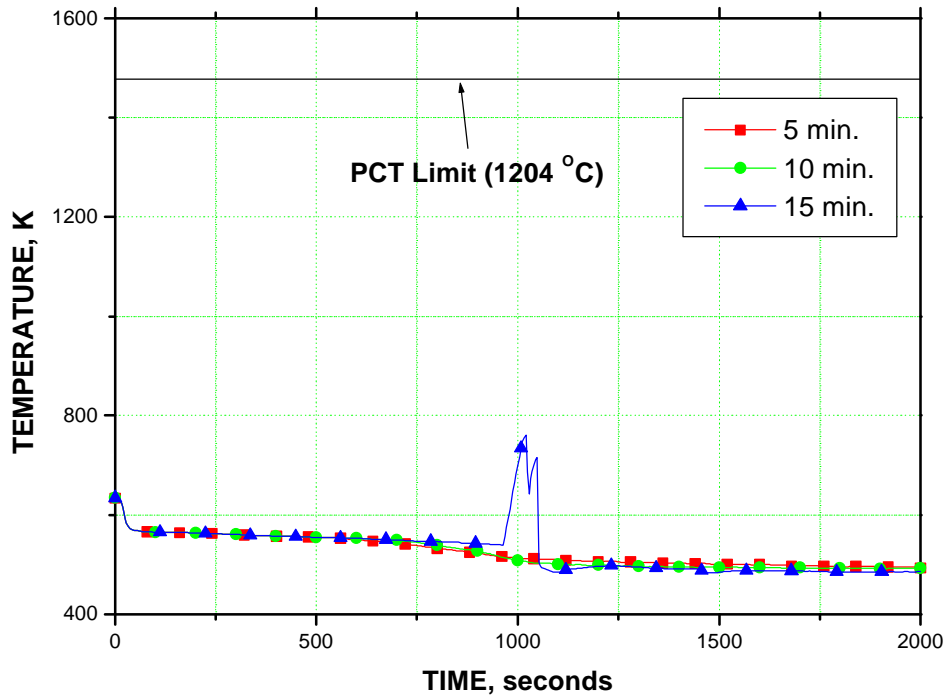
11. Primary and Secondary Pressures, and Collapsed Water Level Variations (4" Hot Leg SBLOCA, Continued RCP Operation)



12. Core Collapsed Water Level Variations for Various RCP Trip Time (3" Hot Leg SBLOCA, RCP Trip)



14. Core Collapsed Water Level Variations for Various RCP Trip Time (4" Hot Leg SBLOCA, Continued RCP Operating)



15. Peak Clad Temperature Variations for Various RCP Trip Time (4" Hot Leg SBLOCA, Continued RCP Operation)