

ISAAC 가

Core Nodalization Model Evaluation in ISAAC Code

150

ISAAC
 380 12 (6 , 3x3 Core
 Pass) 16 , 20 24
)
 가

Abstract

A sensitivity study on core nodalization using the ISAAC computer code is performed. In the study, 380 horizontal fuel channels in the Wolsong plant are nodalized into 12 (6 channels per loop, 3x3 Core Pass), 16 (8 channels per loop, 4x4), 20 (10 channels per loop, 5x5), and 24 (12 channels per loop, 6x6) representative channels. Detailed nodalization effects on fuel channel behavior and accident progression are analyzed. For reference accidents, LOAH (loss of active heat sinks) and large LOCA (loss of coolant accident) are selected as representing high and low pressure sequences, respectively. According to the results from core nodalization sensitivity study, the original 12 channels approach with 3x3 core passes (per loop) is evaluated to be sufficient as an optimal scheme because detailed nodalization methods have no large effect on fuel thermal-hydraulic behavior, total accident progression and fission product behavior.

1. ISAAC

1990 2/3/4 2 PSA CANDU
 (KAERI) FAI (Fauske & Associates, Inc.)가 1
 ISAAC [1]
 가가

가 (Nodalization) ,

ISAAC 가

PSA [2] . ISAAC 2/3/4 2

(loop) 가

(Loop Isolation Valve) 가

(Liquid Relief Valve)가 (Degasser

Condenser Tank) , ISAAC

Factor), 37 (Peaking

channel) (representative

가

(Calandria Tube)/ (Pressure Tube)/ (Fuel Rod)

가 CO₂ 가

12 (Fuel Bundle) ,

2 (mesh) ,

< .1> 380 12 (6 , 3x3

Core Pass)

(compartment) ,

< .2>

12 : 1) (basement), 2) ,

3) (F/M 107), 4) (F/M 108), 5) , 6) (access

area), 7) , 8) , 9) , 10) Degasser Condenser Tank, 11)

(Endshield) 1, 12)

2.

18

(rupture disk)

(volume)

4

(End Shield)

2

(calandria tubesheet)

(ECCS),

(containment spray system),

(local air cooler)

/ /

가

(MAAP)

(=12

)

가

380

12 (6 , 3x3 Core Pass), 16 (8 , 4x4 Core Pass), 20

(10 , 5x5 Core Pass) 24 (12 , 6x6 Core Pass)

가

2.

(class IV

, LOAH)

((Reactor Outlet Header)

(=0.2594 m²) , large LOCA)

가

가

가

가

, < .1>

(=1.007)

, 6x6

, Compaq

3x3
 .
 가
 4x4 5x5 가 10% 3x3 6x6
 가

4.

380 12 (6 , 3x3 Core Pass) 16 (8 , 4x4 Core Pass), 20 (10 , 5x5 Core Pass) 24 (12 , 6x6 Core Pass)

가 Csl, TeO₂ 가 12 가

1. (1995), 가 2 PSA ISAAC
2. (1997), 가 2 가, TR.93NJ10.97.67-2.

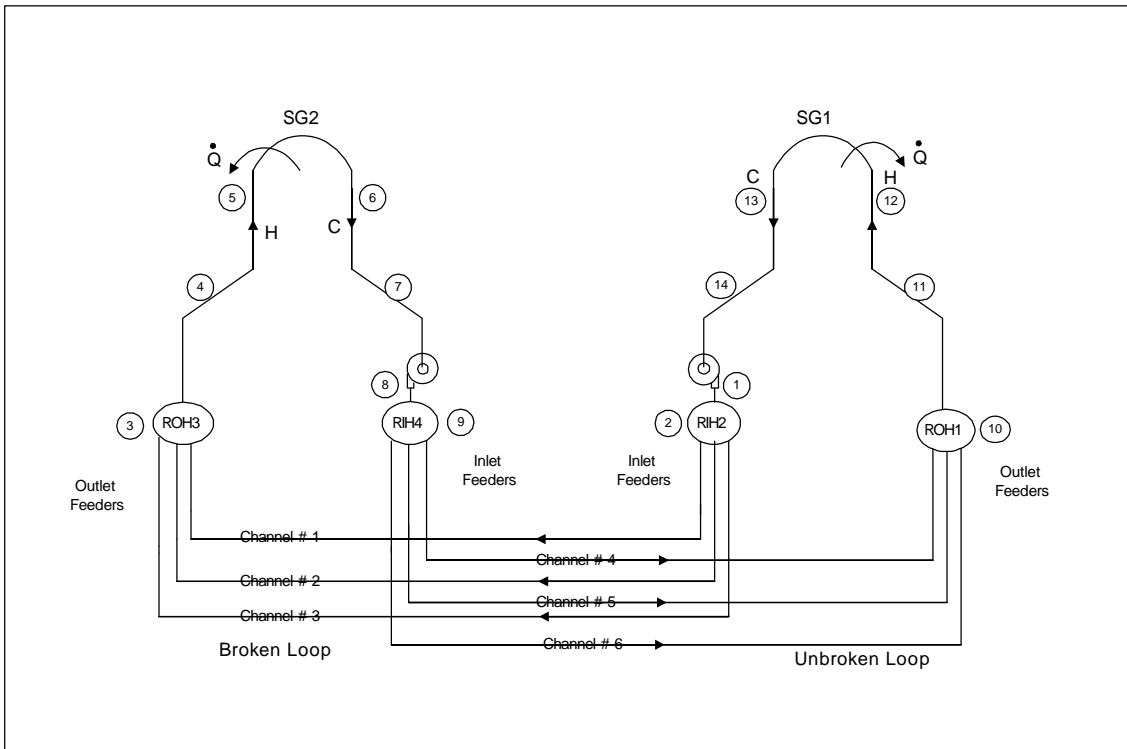
	3x3			4x4			5x5			6x6		
	APF			APF			APF			APF		
	0.879	(1)	6.542	0.879	(1)	6.542	0.879	(1)	6.542	0.872	(1)	6.542
	1.048	(4)	5.016	1.020	(5)	5.844	0.986	(6)	5.457	0.879	(7)	6.098
	1.079	(2)	4.244	1.048	(2)	5.147	1.017	(2)	4.372	1.048	(2)	5.654
	1.091	(5)	3.382	1.079	(6)	4.449	1.048	(7)	3.287	1.074	(8)	5.210
	1.074	(3)	2.520	1.091	(3)	3.752	1.079	(3)	2.202	1.079	(3)	4.766
	0.872	(6)	1.659	1.074	(7)	3.054	1.091	(8)	5.999	1.091	(9)	4.322
				1.074	(4)	2.357	1.074	(4)	4.914	1.091	(4)	3.879
				0.994	(8)	1.659	1.033	(9)	3.829	1.079	(10)	3.435
				0.872			0.992	(5)	2.744	1.074	(5)	2.991
							0.872	(10)	1.659	1.048	(11)	2.547
										0.879	(6)	2.103
										0.872	(12)	1.659
	1.007			1.007			1.007			1.007		

) (Broken Loop, LOCA가
 RIH2 ROH3 loop)
 (Unbroken Loop, LOCA가 ROH1 RIH4
 loop) 가 , 3x3 ,
 1,2,3 Broken Loop , 4,5,6 Unbroken Loop ,
 1,4,2,5,3,6 .

		[()]			
		3x3	4x4	5x5	6x6
LOAH	Loop 1/2	22553 (=6.26)	22985 (=6.38)	22642 (=6.29)	21700 (=6.03)
		148560 (=41.3)	147175 (=40.9)	147672 (=41.0)	146926 (=40.8)
LOCA	Loop 1	9150 (=2.54)	12020 (=3.34)	12014 (=3.34)	9224 (=2.56)
	Loop 2	11166 (=3.10)	11533 (=3.20)	11559 (=3.21)	11293 (=3.14)
		143310 (=39.8)	143536 (=39.9)	144048 (=40.0)	143459 (=39.8)

(/ /) FP
(72)

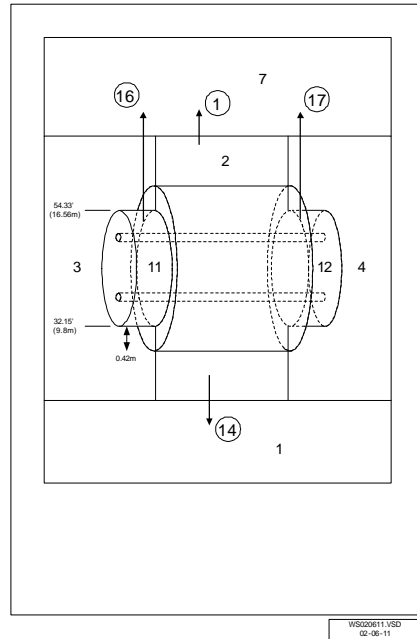
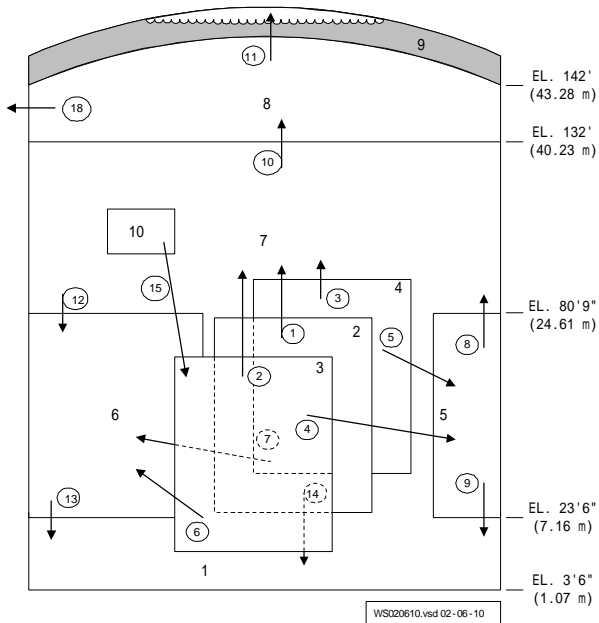
		[%]			
		3x3	4x4	5x5	6x6
LOAH	CsI	39.0	40.5	40.8	39.2
	TeO ₂	71.1	69.3	69.2	70.4
	Te	20.9	22.6	22.7	21.8
	H3	95.8	95.8	95.8	96.0
LOCA	CsI	32.2	29.8	29.5	32.0
	TeO ₂	27.8	25.5	25.1	27.7
	Te	0	0	0	0
	H3	94.9	94.8	95.0	94.8

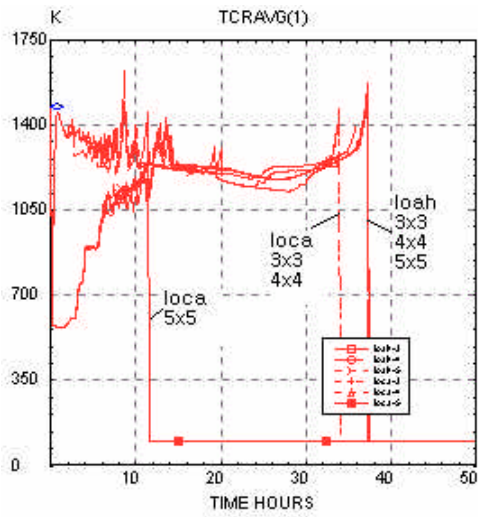


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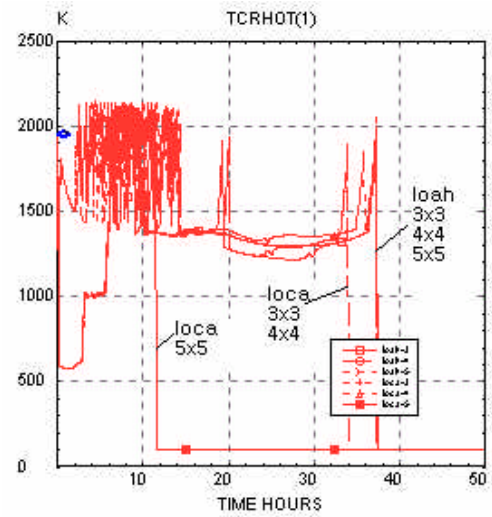
1 3X3

ISAAC

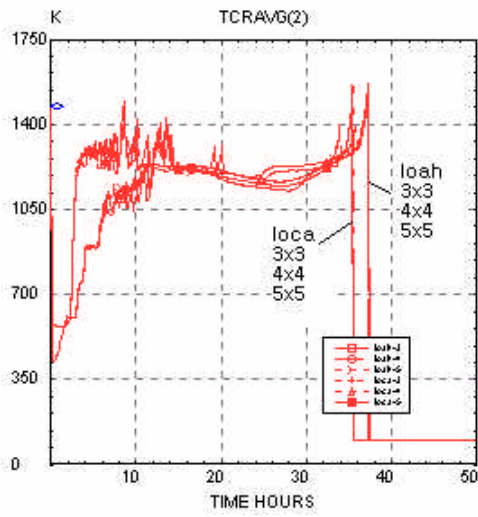




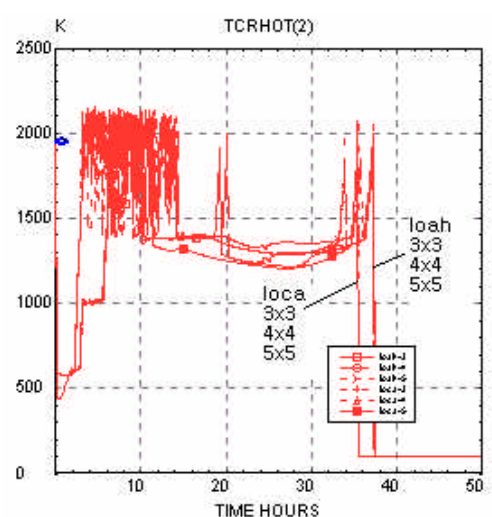
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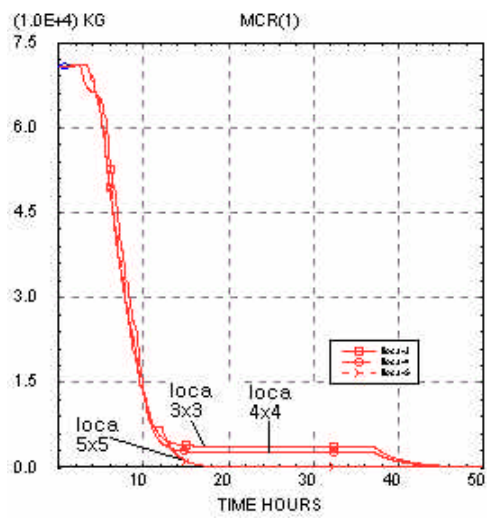
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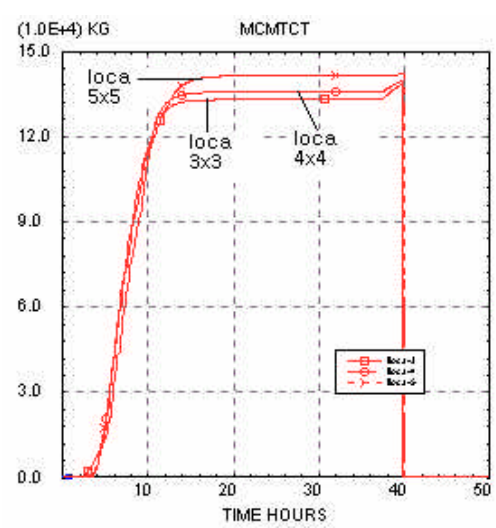
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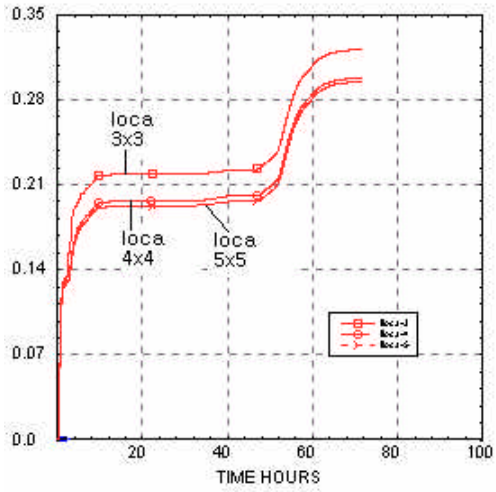
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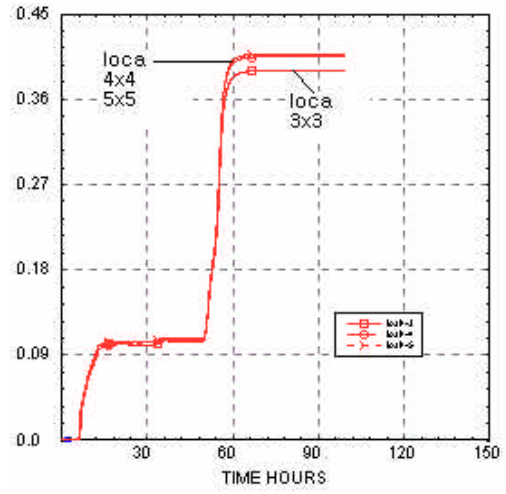
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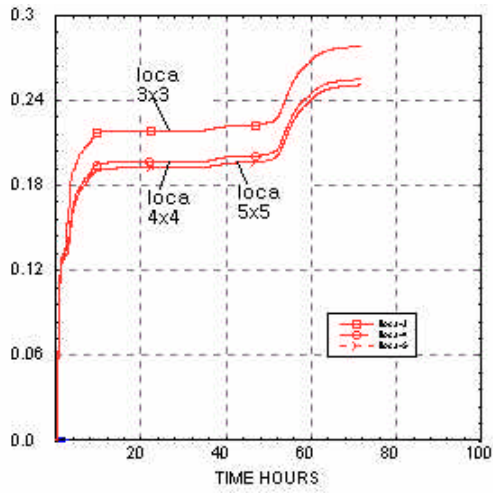
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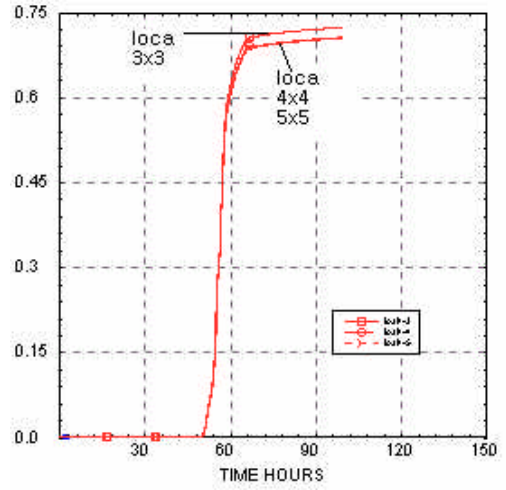
9 LOCA CsI



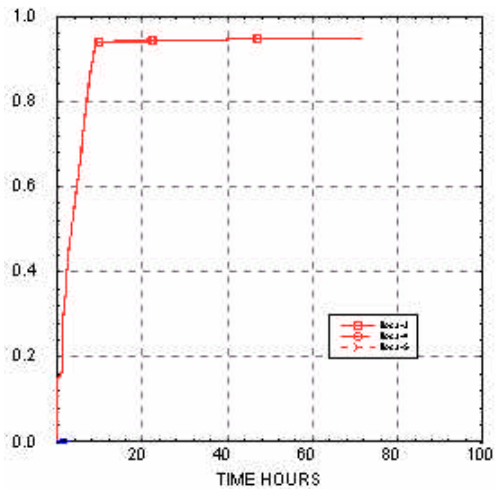
10 LOAH CsI



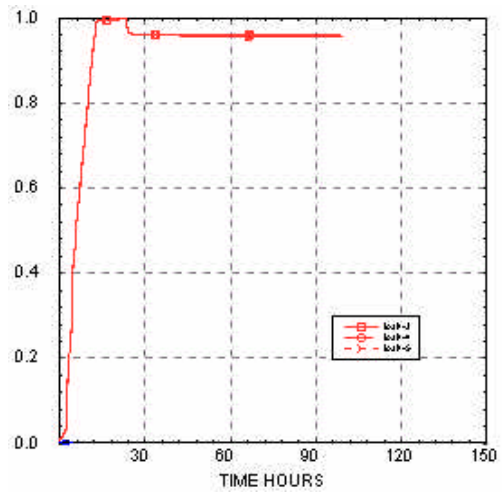
11 LOCA TeO₂



12 LOAH TeO₂



13 LOCA H₃



14 LOAH H₃