

'2000

RELAP5/MOD3.2.2

Improvement of RELAP5/MOD3.2.2 Flow Regime and Development of Fuel Heat Transfer Model for Thermal Hydraulic Safety Analysis of CANDU Plant

150

19

가

RELAP5/MOD3

RELAP5/MOD3.2.2

non LOCA

RELAP5/MOD3/CANDU

LOCA

AECL

RELAP5/MOD3.2.2 gamma

RELAP5/MOD3/CANDU

RELAP5/MOD3/CANDU+

LOCA

CANDU

Abstract

Thermal-hydraulic models of RELAP5/MOD3, current auditing tool for LWR licensing, have been improved to develop an auditing code for CANDU. It was attempted to extend the auditing area to CANDU LOCA event by improving RELAP5/MOD3/CANDU version, which had been already developed from RELAP5/MOD3.2.2 in order to audit non-LOCA events in CANDU plant. Major improving areas

(superficial velocity : j_g) 가 10 m/sec

30 m/sec

가

RELAP5

Taitel & Dukler

37

CANDU

(critical velocity)

(hydraulic equivalent diameter)

$$\left(\frac{2}{3} \right)$$

CANDU

37

1984

Hanna 가

CATHENA

[3].

$$V_{crit} = [g \rho^* / \rho_g \rho_f \{ \rho_f (F_f / \alpha_f - F_f^*) - \rho_g (F_g / \alpha_g - F_g^*) \}]^{1/2} \quad (1)$$

$$F_k = [y_i - (-1)^k / A \alpha_k \int_{y_k}^{y_i} y \bullet f(y) dy] \quad (2)$$

$$F_k^* = \partial F_k / \partial \alpha_k \quad (3)$$

$$\rho^* = \alpha_g \rho_f + (1 - \alpha_g) \rho_g$$

$$y_i = -$$

$$f(y) = y$$

$$k = \text{identification (g f)}$$

(2)

가

37

가

α_g

CANDU

(3.7)

CANDU

(2) (3)

3

CANDU

Hanna

Taitel & Dukler

Taitel & Dukler

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Taitel & Dukler

RELAP5/MOD3.2.2

가 . AECL 1981 MR-2 [4]
 (liquid superficial velocity: j_f) j_f 가 0.085 m/sec
 10 m/sec 가

가 . RELAP5/MOD3.2.2
 가 CANDU
 “CANCHAN” component 가 .

2.2 CANDU

CANDU
 (j_f, j_g)
 . 4 PIPE component
 CANCHAN component .
 CANCHAN component CANDU 가
 PIPE component .
 5 AECL MR-2 [4] CANCHAN component

3. CANDU

3.1 RELAP5

RELAP5 ,
 2 .
 $(r-\theta)^2$
 $(r-z)^2$. CANDU
 37

가 . RELAP5/MOD3

r- θ
 RELAP

가

rod wetted rod

6 가

8

Dry Rod i

(static quality) 1.0

wet rod j 0.0

가

RELAP5/MOD3.2.2 가

가 CANDU

가

3.2 CANDU

7 CANDU

10.69 Mpa

10 cm/sec

18 19

200 kw x 37 rod

가 10 가

가

가

가

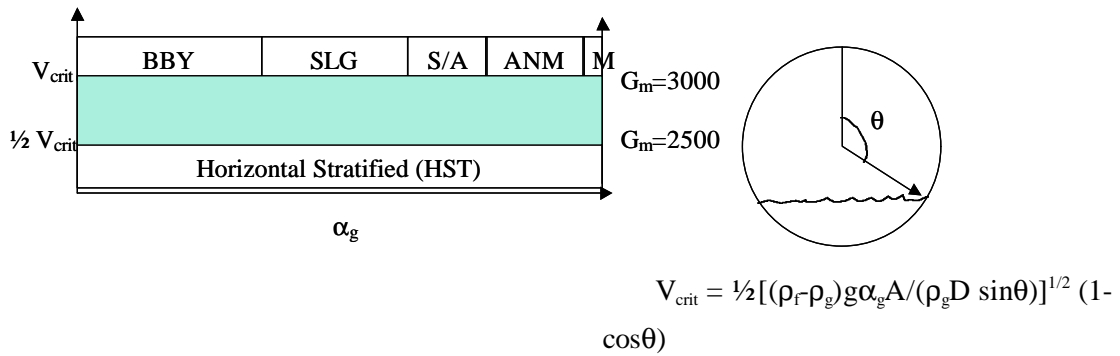
9

10 가

CANDU 가

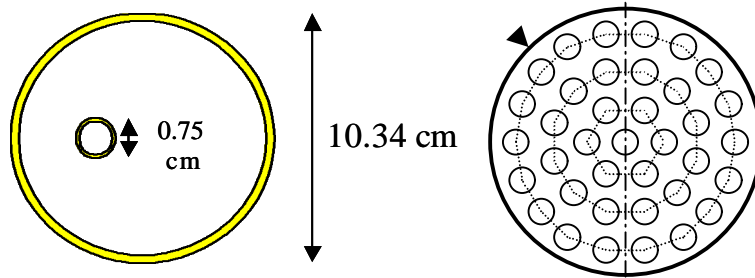
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1.	Piston Flow Regime , Horizontal Flow Regime	LOCA
2.) Liquid/Vapor ² (-	LOCA
3.		General
4.	Graphite conductance	LOCA
5.	CANDU	General
6.	Bounding Moody /Henry Fauske	General
7.	D ₂ O 37 bundle CHF Lookup Table	General
8.	Digital Sampling	Non LOCA
9.	Header Degasser Condenser Spray	LOCA General
10.	(He, N ₂)	LOCA



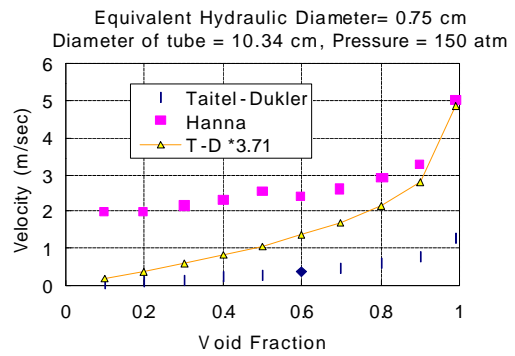
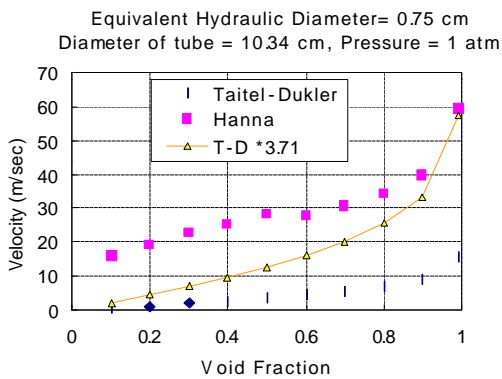
1. RELAP5/MOD3.2.2 gamma

Taitel&Dukler



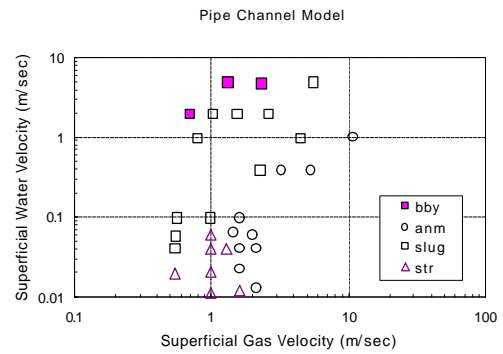
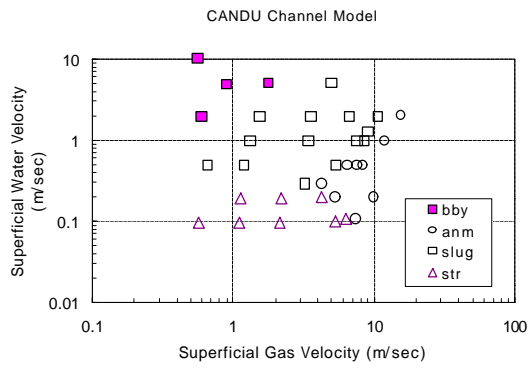
T-D Criteria : $V_{crit}^{PT} / V_{crit}^{DH} = (D_{PT}/D_H)^{1/2} = (10/0.75)^{1/2} = 3.71$

2. CANDU



3.

CANDU



4. CANDU (: CANCHAN component) , RELAP5/MOD3.2.2 (: PIPE)

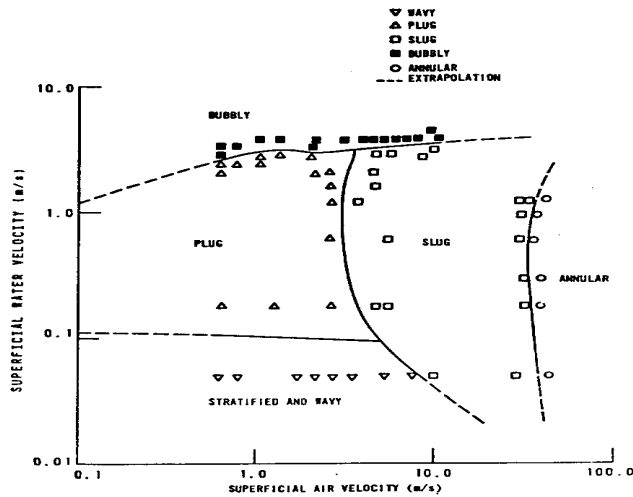
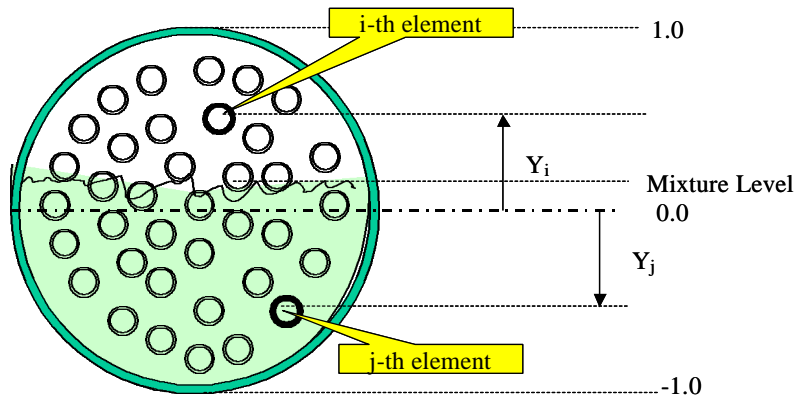
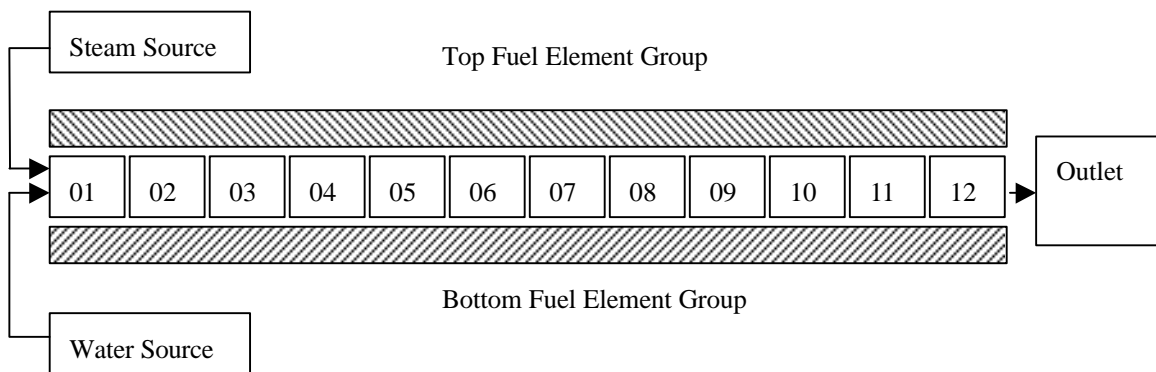


Figure 8 — Flow regime map for an interior subchannel 11.5 cm upstream of an end plate.

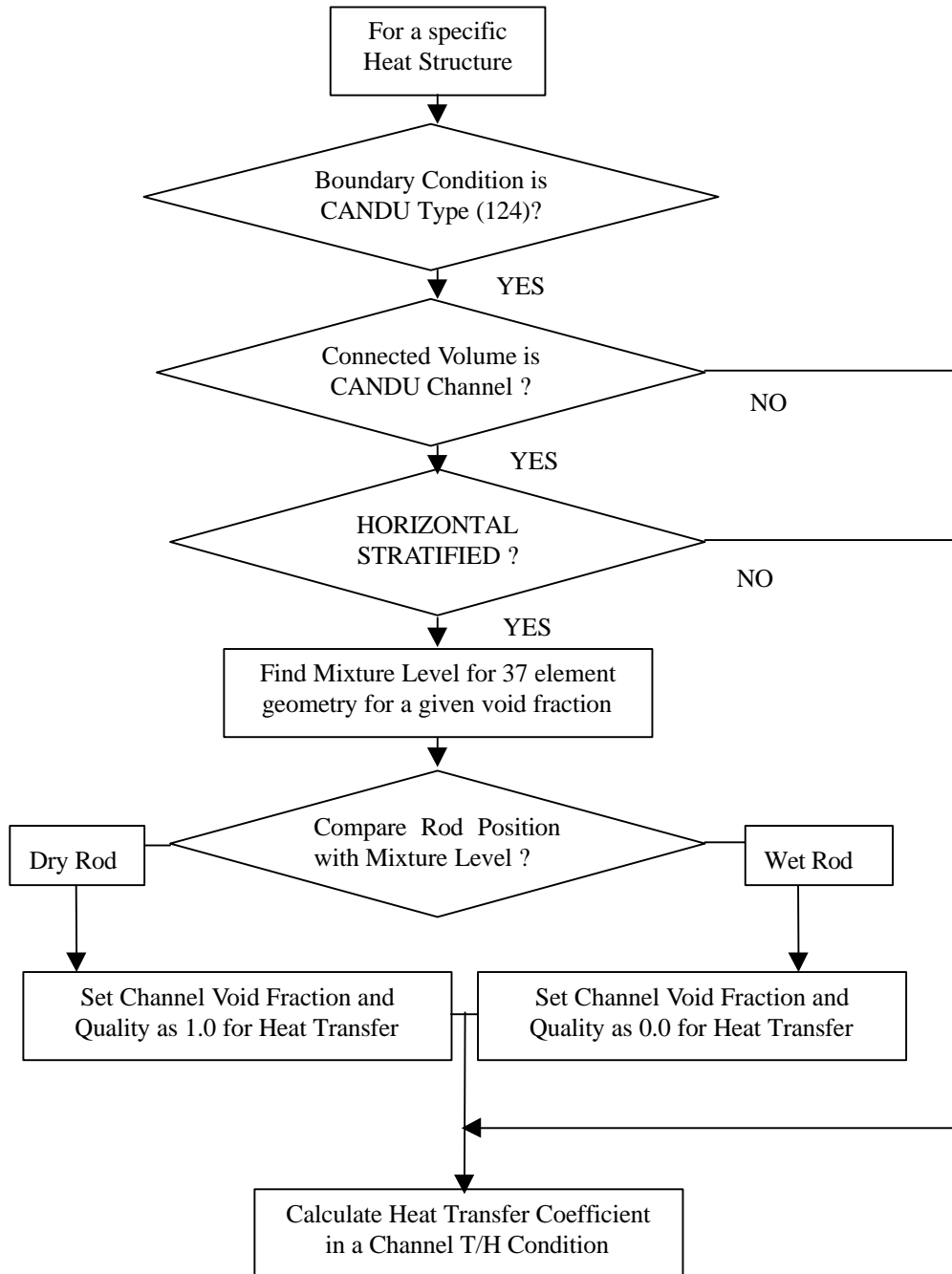
5. AECL MR-2



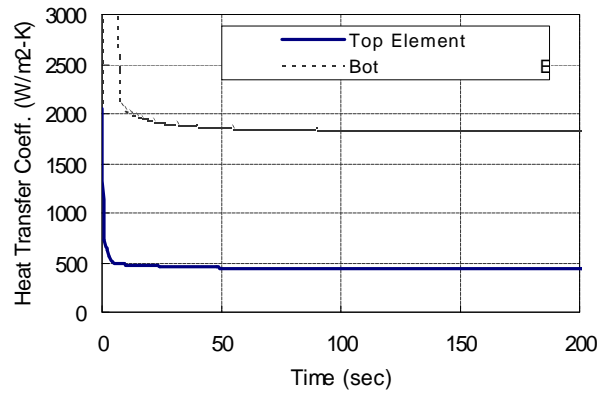
6. (i-th or j-th element)



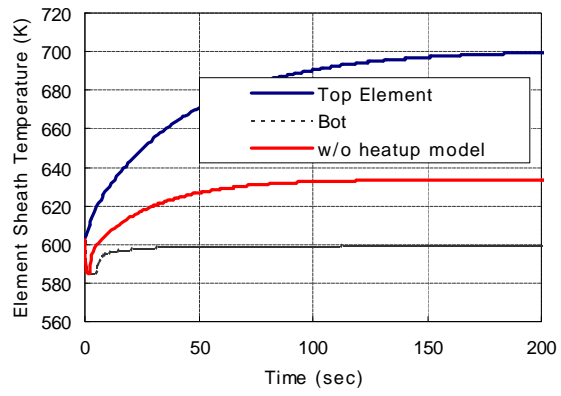
7. CANDU



8. CANDU



9.



10. (CANDU)