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순환우라늄 핵연료다발의 ASSERT-PV V2R8M1 코드 입력자료 모형

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제출문

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본 보고서를 "중수로용 순환우라늄 핵연료기술개발" 과제 수행중 수행된 기술보고서로 제출합니다.

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2001년 2월

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순환우라늄 핵연료다발의
ASSERT-PV V2R8M1 코드 입력자료 모형

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요 약

본 보고서는 ASSERT-PV V2R8M1 코드를 이용하여 CANDU 용 개량핵연료다발의 하나로 개발되고 있는 CANFLEX-RU (RUFIC) 핵연료다발의 부수로 해석을 수행할 경우 그 적용성 검토 및 해석을 위해 필요한 입력자료 모형 개발 보고서로 작성되었다. 본 ASSERT는 KAERI/AECL의 JRDC 협정에 의해 캐나다 AECL로부터 binary file 형태로 입수되었다.

ASSERT 코드는 COBRA-IVi 코드와는 달리 CANDU-6 용 핵연료다발의 부수로 방법에 의한 열수력 해석을 위해 개발되었으며, 43개 핵연료봉을 갖는 CANDU 다발에 적용될 수 있도록 수정되었다. 따라서, ASSERT 코드를 RUFIC 핵연료 채널에 적용하는데 있어서 문제가 없으며, 이에 따라 ASSERT 코드를 순환우라늄 핵연료다발 적용시 요구되는 RUFIC 핵연료의 ASSERT 입력자료 모형을 제시하였다. 또한, ASSERT는 입력자료를 준비할 경우 사용자가 원하는 바에 따라 자신의 모형식을 이용할 수 있도록 되어 있으므로 사용자의 사용 방법에 따라 결과가 상이할 수 있다. 따라서, 본 보고서를 작성하므로써 입력자료의 근거와 사용의 정확성 및 계산 결과에 대한 신뢰성을 얻고자 함이었다.

ABSTRACT

This report describes the input modelling for subchannel analysis of CANFLEX-RU (RUFIC) fuel bundle which has been developed for an advanced fuel bundle of CANDU-6 reactor, using ASSERT-PV V2R8M1 code. Execution file of ASSERT-PV V2R8M1 code was recently transferred from AECL under JRDC agreement between KAERI and AECL.

ASSERT-PV V2R8M1 which is quite different from COBRA-IV-i code has been developed for thermalhydraulic analysis of CANDU-6 fuel channel by subchannel analysis method and updated so that 43-element CANDU fuel geometry can be applied. Hence, ASSERT code can be applied to the subchannel analysis of RUFIC fuel bundle. The present report was prepared for ASSERT input modelling of RUFIC fuel bundle. Since the ASSERT results highly depend on user's input modelling, the calculation results may be quite different among the user's input models. The objective of the present report is the preparation of detail description of the background information for input data and gives credibility of the calculation results.

1. 서론

본 보고서는 ASSERT-PV V2R8M1 코드[1]를 CANDU 용 순환우라늄 핵연료다발 (CANFLEX-RU 혹은 RUFIC 다발)에 적용하는 경우 요구되는 입력자료 모형을 제시하였다. ASSERT 코드는 COBRA-IV-i[2]를 근간으로 하여 1980년대 초부터 캐나다의 AECL에서 CANDU 원자로와 같이 수평 채널내 다발이 장전된 경우의 단상 및 이상류 유동 및 열전달을 해석하기 위해 개발해 왔다. ASSERT 코드는 COBRA 코드와 근본적으로 다른 측면은 먼저, 유동장내에 열적으로 비평형 상태의 축방향 및 횡방향 상대속도(drift flux)를 계산할 수 있도록 하였다. 이에 따라, 열적으로 평형상태에 있는 균일 모형에서 (equal-velocity/equal-temperature) 개량된 drift-flux 모형(unequal-velocity/unequal-temperature)을 이용할 수 있도록 함으로써 평형 및 비평형 상태의 액체 및 기체상에 대한 열전달을 해석할 수 있도록 하였다. 또한, ASSERT 코드는 정상운전 조건에 대한 모사 뿐만아니라 LORC(Loss of Regulation Condition) 경우와, 드라이아웃이 발생하는 데까지 유동장을 모사할 수 있도록 되어 있다. 최근에 ASSERT-PV V2R8M1으로 개선되면서 부수로간의 기하학적 연결 방법에 대한 수정을 함으로써 43-핵연료다발 (CANFLEX) 모사가 가능하도록 하였으며, 43-핵연료다발에 대한 해석을 위한 입력 및 출력 자료 증가를 수용할 수 있도록 하였다.

본 보고서는 이러한 ASSERT-PV 코드를 순환우라늄에 적용할 경우 요구되는 기하학적 입력자료 뿐만아니라, 축 및 반경방향 출력분포, 압력손실계수 자료 등에 대한 입력 모형 보고서로 작성되었다. ASSERT 코드는 입력자료를 준비할 경우 사용자가 원하는 모형식을 이용할 수 있도록 되어 있으므로 사용자의 사용 모형에 따라 결과가 상이할 수 있다. 다음 항에서는 ASSERT 코드에서 필요로 하는 RUFIC 핵연료다발과 관련된 입력자료의 계산 방법 및 결과, 그리고 이용된 모형에 대해 기술하였다. 기술된 내용의 순서는 코드 입력자료의 순서에 따르도록 하였다.

본 계산을 위해 선택된 계산대상 채널은 버턴이 부착된 순환우라늄 핵연료다발 장전 CANDU 채널이었으며, 냉각유체는 중수를 고려하였다. 생산된 입력자료는 Appendix I에 첨부하였으며, 그 계산결과는 Appendix II에 첨부하였다.

2. 계산 모형

2.1 물성치 계산

필요한 열역학적 및 전달물성치 자료들은 포화상태에서의 값으로 주어진다. ASSERT 코드는 "NPACK" property routine (HLWP property package)이 포함되어 있으므로 이를 이용할 수 있으나 입력으로 물성치를 넣어줄 수도 있다. 포화물성치 입력시 코드에서 요구되는 물성치들은 압력(MPa), 온도 (^oC), 액체 비체적(m^3/kg), 기체 비체적(m^3/kg), 액체 엔탈피(kJ.kg), 기체 엔탈피(kJ/kg), 액체 점성계수(kg/ms), 액체 열전도도(W/m'K) 및 표면장력(N/m) 등이다. 본 계산 시에는 HLWP를 이용하였다.(group 1, N4=1), 이 경우 물성치를 입력자료로 넣어주는 것보다 계산시간은 길어지게 된다. 또한, 축방향 각 절점에서의 물성치를 계산할 때 계통압력을 이용하여 계산하거나, 국소 압력을 이용하여 계산 할 수 있으며, 본 모형에서는 국소압력을 이용하여 계산하였다. (group 1, N5=0)

2.2 열전달 및 압력손실계수 모형

부수로내에서의 열전달 계산시 액체 및 기체에 대해 열적 평형 상태를 고려하는 경우와 비평형 상태를 고려할 수 있는데 본 모형에서는 액상에 대해서는 비평형을 (group 2, N1=1), 기상에 대해서는 열적 평형 상태를(group 2, N2=0) 고려하였다.

2.2.1 단상류 압력손실계수 모형

마찰 압력손실계수로는 층류 및 난류에 대한 마찰손실계수가 주어지도록 되어 있다. (group 2.0) 층류 유동에 대한 압력손실계수 모형으로 사용자가 기본 Reynolds 수의 함수형태에 계수를 입력으로 넣어 주도록 되어 있다. 본 계산에서는 다음 식의 계수를 이용하였다. (group 2, N5=1)

$$f = aRe^b + c$$

여기서, a는 64, b는 -1 그리고 c는 0 이다.

그리고, 부수로에서의 난류유동시의 마찰손실계수를 계산하여야 하며, 이를 위해 난류의 경우에 대해서는 Colebrook-White의 implicit 모형을 고려하였다.(group 2, N2=2)

2.2.2 이상류 마찰 압력손실증배계수 모형

ASSERT-PV 코드에는 이상류 마찰 압력손실 증배계수 모형으로 8가지 중 한가지를 선택할 수 있으며, RUFIC 핵연료에 대한 모형에는 CANDU 핵연료다발 형상에 대해 가장

많이 사용되는 Friedel 상관식을 선택하였으며[3], 본 상관식은 다음과 같다. (group 2, No 3=6)

$$\phi_{LO}^2 = A + \frac{3.21X^{0.78}(1-X)^{0.224}\left(\frac{\rho_f}{\rho_g}\right)^{0.91}\left(\frac{\mu_g}{\mu_f}\right)^{0.19}\left(1-\frac{\mu_g}{\mu_f}\right)^{0.7}}{Fr_{TP}^{0.0454}\,We_{TP}^{0.035}}$$

여기서,

$$A = (1-X)^2 + X^2\left(\frac{\rho_f f_g}{\rho_g f_f}\right)$$

$$Fr_{TF} = \frac{G^2}{\rho_{TP}^2 gD}$$

$$We_{TP} = \frac{G^2 D}{\rho_{TP}\sigma}$$

$$\rho_{TP} = \left[\frac{X}{\rho_g} + \frac{(1-X)}{\rho_f}\right]^{-1}$$

X : quality

Fr : Froud number

We : Weber number

G : Mass flux

D : diameter

2.2.3 마찰손실계수의 가열 벽면 영향

핵연료 채널에는 열유속이 있는 고체 벽면이 있는 지점(예:핵연료봉 표면)과 없는 지점(예: 압력관)이 존재하는데 가열벽면에 대한 수정계수를 이용할 수 있다. ASSERT-PV 코드에서는 Tong's model[4]을 이용하도록 되어 있으며, 그 상관식은 다음과 같다.

$$\frac{f}{f_o} = 1 + \frac{P_h}{P_w}\left[\left(\frac{\mu_w}{\mu_b}\right)^{0.6} - 1\right]$$

여기서 P_h 및 P_w는 각각 핵연료채널의 가열길이 및 유체와의 접수길이를 나타낸다. μ_b는 유체의 체적온도(bulk temperature)에서의 점성계수이며, μ_w는 다음 식으로 계산된 고체 벽면 유체온도에서의 유체의 점성계수이다.

$$T_w = T_b + \frac{q'}{P_h \cdot h}$$

여기서 열전달계수 h 는 Dittus-Boelter 상관식을 사용한다.

$$\frac{hD}{K} = 0.023\left(\frac{GD}{\mu}\right)^{0.8}\left(\frac{C_p\mu}{K}\right)^{0.4}$$

본 해석에서는 수렴시의 어려움으로 인해 가열 벽면의 영향을 고려하지 않았다.(group 2, N4=1)

2.2.4 열전달계수 모형

핵연료봉과 냉각수간의 열전달을 계산시 이에 대한 상관식이 필요하며, 본 모형에서는 봉과 냉각수간의 열전달계수 계산식을 다음의 Dittus-Boelter 상관식을 이용하였다. (group 2, N6 = 0)

$$\frac{hD}{K} = 0.023\left(\frac{GD}{\mu}\right)^{0.8}\left(\frac{C_p\mu}{K}\right)^{0.4}$$

2.2.5 횡방향 운동량 방정식의 중력 영향

부수로에서의 횡방향 운동량 방정식에서는 중력항이 나타나는데 본 모형에서는 중력의 영향을 고려하였다. (group 2, N7 = 1)

2.2.6 축 및 횡방향 상대속도

축 및 횡방향 상대속도를 고려하였으며, 축방향 속도 계수(group 2의 N8 = 1, AUR 변수)는 0.0이고, 횡방향 속도 계수(group 2의 N9 = 2, AVR 변수)에는 두 개의 상수가 요구되는데 1.5 및 2.0이었다.

2.2.7 이상류 형상 압력손실증배계수 모형

이상류 형상 압력손실 증배계수 모형으로는 균일 혼합류 모형을 이용하였다. (group 2, N10 = 0)

2.3 축방향 열유속 분포

RUFIC 핵연료다발의 핵연료 채널내 축방향 열유속 분포는 핵적 계산으로부터 얻어지며, 각 채널마다 열유속 분포가 조금씩 다르다. 본 모형에서는 RUFIC 핵연료다발에 대한 핵적 예비해석 자료를 이용하여[5] 최소 임계채널출력을 갖는 채널인 P-8의 축방향 열유속 분포를 이용하였다. (group 3)

2.4 기하학적 구조

핵연료다발의 부수로별 기하학적구조에 대해서는 group 4에서 처리하며, 부수로 형태, 유동 면적, 접수길이, 가열길이, 인접수로 번호, 인접부수로 사이의 간격, 부수로 무게중심간 거리, 부수로간 무게중심간 가상 연결선의 각도(수직일 경우 0) 등에 대한 자료가 요구된다. 특히, 무게중심간 거리와 가상연결선의 각도는 지배방정식을 푸는데 중요한 자료가 되므로 이에 대한 정확한 계산 입력자료가 요구된다.

본 계산 대상 핵연료다발은 RUFIC 핵연료다발이었으며, 원자로에 장전된 상태를 모사하게 되므로 다발 중심과 압력관 중심이 일치되지 않고 편심이 발생한다. 따라서, 최소 대칭단면은 180도 대칭 단면이 되지만 전체 부수로를 모사하였다. Figure 1에 RUFIC 핵연료다발의 단면과 각 부수로들의 형상 및 번호를 나타내었다. Figure 1에서의 각 부수로의 면적, 부수로 면적 중심(Centroid), 봉간 간격 및 부수로간에 이루어지는 각도(offset angle)에 대해 CANGEO 프로그램[6]을 이용하여 계산하였으며, 부수로간 이루어지는 가상선의 각도는 수직선을 0도로 하여 계산하였다. 또한 핵연료다발의 중심이 압력관 중심에서 아래쪽으로 편심되며, 그 편심은 압력관의 크립 발생률에 따라 달라지고 0 % 크립의 경우 편심은 0.65 mm (압력관 직경 : 103.38 mm), 3.1 % 크립의 경우 편심은 2.275 mm (압력관 직경 : 106.63 mm), 5.1 % 크립의 경우 편심은 3.275 mm (압력관 직경 : 108.67 mm)이다. 12개 다발이 장전된 한 개 채널의 총 길이는 5.9436 m (card group 9.3의 Z변수)이었다. 또한 유동방향은 수평 유동으로 THETA 값은 0.0 (수직유동인 경우 : 0, card group 9.3의 THETA 변수)이었다. CANGEO 프로그램을 이용해 각 node 번호에 대해 계산된 기하학적인 자료를 Table 2에 요약하였다.

2.5 축방향 각 지점에서의 부수로 유동면적

ASSERT 코드는 해석시 필요한 경우 축방향 임의의 지점에 대해 부수로 면적이 바뀌어지는 것을 모사할 수 있다. 이를 위해서는 부수로 면적이 바뀌는 지점의 축방향 위치(입구에서의 출구까지 거리에 대한 상대 위치)와 면적 변화가 발생하는 부수로의 개수(group 5, N1) 및 축방향 지점의 개수(group 5, N2)가 요구된다. 그리고, 부수로 면적의 변화에 대한 입력은 공칭 부수로 면적에 대한 비 ($AFACT = A_i / A_{nominal}$)로 나타낸다. 본 모형에서는 부수로 면적이 일정한 것으로 고려하였다. (group 5 입력 선택하지 않음)

2.6 부착물 및 다발 이음매 형상손실계수

RUFIC 핵연료다발의 외형은 CANFLEX 다발과 동일하며 부착물의 위치 및 형상도 동일하다. 이들 부착물 지점에서의 압력손실계수 (일명 : 형상손실계수)는 참고문헌 [7]에 제

시된 손실계수를 이용하였고, 각 부품별로 채널 전체길이에 대한 입구에서의 축방향 상대적 위치 및 손실계수는 Table 3에 요약하였다. 여기서, 채널 입구 및 출구부분에서의 손실계수는 다발 이음매(junction)에서의 손실계수와 동일한 값을 이용하였으며, 각 부수로별로 동일한 압력손실계수를 이용하였다. (group 7 입력자료)

2.7 핵연료봉 출력 분률 및 임계열유속

핵연료봉의 기하학적 자료에 대해서는 핵연료봉의 형상, 봉 번호, 직경, 봉의 반경방향 출력비, 임의의 봉 주변 봉번호, 임의의 봉에서 주변 부수로로의 출력분률 등이 요구된다. 그리고, 핵연료봉의 온도 계산이 요구되는 경우 핵연료 피복관 및 핵연료심에 대한 물성치가 필요하며, 본 모형에서는 고려하지 않았다. (group 8, N3 = 0)

2.7.1 반경방향 출력 분포

RUFIC 핵연료다발에 대한 반경방향 출력 분포는 핵적 계산으로부터 얻어지며, 연소도가 달라짐에 따라 분포가 달라진다. 본 모형에서는 RUFIC 핵연료다발의 반경방향 열유속 분포가 가장 급격한 초기 연소도에 대한 값을 이용하였고[5], Table 4와 같다.

2.7.2 각 부수로의 출력분률

각 부수로로 전달되는 출력은 그 부수로에 속해 있는 핵연료봉으로부터 출력값의 총합이 되므로 이에 대한 출력분률이 필요하며, 이 값은 부수로내에 점유되고 있는 핵연료봉 면적(각도)에 비례한다. 이에 대한 결과를 Table 5에 요약하였다.

2.7.3 CHF 상관식

부수로 해석에서는 임계열유속 평가시 각 부수로에 대해 계산을 수행하므로 부수로 형상을 등가 수력직경으로 가정한 원형관에 대한 임계열유속 상관식의 적용이 가능하다. 지금까지의 수많은 임계열유속 상관식들 중 table lookup method[8]가 가장 잘 예측하는 것으로 알려져 있으며, AEESRT-PV 코드에서는 group 8.0의 N4 option 카드에 제시된 11가지의 모형식들 중 table lookup method를 선택하였다. 임계열유속 계산시 필요한 경우 임계열유속 수정계수를 이용할 수 있으며 (group 8의 N11 = 1 인 경우), 임계열유속 수정계수들로는 다음과 같다.

- 직경에 대한 수정계수 (group 8.2, NCK1)
- 봉간간격에 대한 수정계수 (group 8.2, NCK2)

- 수평유동에 대한 수정계수 : 유동성층화 고려시 (group 8.2, NCK3)
- 임계열유속 향상 수정계수 : 이 모형을 이용하는 경우 group 7.2의 부품에 대한 손실계수 및 임계열유속 향상계수에 대한 자료가 요구됨 (group 8.2, NCK 4)
- BLA 방법 적용시의 임계열유속 수정계수 (group 8.2, NCK 5)

본 모형에서는 임계열유속 수정계수를 이용하지 않았다. (group 8의 N11 = 0)

2.8 계산 제어자료 및 축방향 절점수

2.8.1 출력 제어 자료

계산 결과 제어 자료로 출력자료를 제어하는 부분에서는 시간 구간 및 축방향 모든 자료를 출력하는 방법과 축방향 매 N1 절점 및 시간구간 N2에서의 자료를 출력하는 경우가 있다. (group 9의 N1 및 N2 선택).

2.8.2 축방향 절점 자료

계산하고자 하는 축방향 절점에 대해서는 축방향 균일 절점수를 이용하는 경우와 비균일 절점수를 이용하는 경우가 있으며, 본 모형에서는 균일 절점수를 이용하였다. (group 9, N6 = 0)

2.8.3 축방향 출력 분포의 수정인자

축방향 출력에 대한 자료는 group 3의 축방향 열속 분포에서 정해지며, 여기서는 임의의 축방향 위치에서의 출력급등과 같이 축방향 출력이 바뀔 경우 이에 대해 축방향 각 절점에서의 출력분포를 수정할 수가 있으며, 각 절점에서의 수정인자를 입력할 수 있다. 이 경우에는 group 9.6 항에 대한 자료를 입력해야 한다. 본 모형에서는 전술한 2.3 항의 축방향 열속 분포를 이용하였다.(group 9, N7 = 0)

2.8.4 축 및 횡방향 운동량 방정식의 관성항 고려

축방향 운동량 방정식의 관성항을 고려하게 되며, 이 경우 group 9의 N8=1 로 두게 되며, 횡방향 관성항을 고려하는 경우 N9 = 1로 둔다.

2.8.5 과도 상태 계산

과도 상태시의 계산이 가능하며 이 경우 group 9.2의 과도상태 시간 구간을 입력한다. 본 모형에서는 정상상태만 고려하였다.

2.8.6 그밖의 기하학적 자료 및 계수

핵연료 채널의 총 길이(Z)는 설계치인 594.36 cm로 두었으며, 축방향 절점수는 150개, 핵연료 채널 설치 각도는 90도로 CANDU 원자로의 수평 채널로 고려하였다. 횡방향 유동에 의한 손실계수는 default 값인 0.5로 두었으며, 횡방향 운동량 relaxation parameter은 default 값인 1.0 (no relaxation)으로, 축방향 운동량 relaxation parameter은 default 값인 1.0 (no relaxation)으로, 밀도 relaxation parameter는 default 값인 1.0 (no relaxation), 엔탈피 relaxation parameter은 default 값인 1.0 (no relaxation)으로 두었다.

2.9 열 및 기포 혼합에 대한 자료

열 및 기포 혼합에 대한 상관식을 이용할 수 있으나 본 모형에서는 이들 모형을 고려하지 않았다.

2.9.1 열혼합 상관식

열 혼합에 대한 모형은 두가지를 선택할 수 있으며, power-law 상관식과 Rogers-Rosehart 상관식을 이용할 수 있다. 매끄러운 핵연료다발에 일반적으로 많이 적용되는 식으로 Rogers-Rosehart 모형을 이용할 수 있다. (group 10 N1 = 1).

2.9.2 기포 확산 계수

기포 확산계수 모형은 ASSERT-PV에서는 power-law 상관식이 주로 이용된다. (group 10 N2 = 1).

2.10 운전자료

입구 및 출구 유동조건 자료로 입구압력, 입구온도 및 입구질량유속 및 평균열유속이 필요하며, 본 계산에서 적용한 경우는 CANDU 원자로의 설계치 값을 이용하였으며, 다음과 같다.

출구 압력 : 10.0 MPa

입구 온도 : 256.0 ℃

입구 질량유속 : 5.5350 kg/㎡s

평균 열유속 : 1.02838 MW/㎡

2.11 수렴관련 자료

본 해석에 이용된 정상상태 혹은 과도상태시의 해를 구하기 위한 계산시 수렴과 관련된 인자들에 대한 입력자료는 ASSERT 코드의 default 값을 대부분 이용하였으며, 다음과 같다.

- 에너지 방정식의 해를 위한 최대 반복회수 (IELIMT) : 10
- 내부 반복계산을 위한 최대 반복회수 (MAXINR) : 20
- 외부 반복계산을 위한 최대 반복회수 (NTRIES) : 20
- 압력재 평형을 위한 내부 반복회수 (IREBAL) : 매 4번
- 엔탈피의 최대 상대 오차 (HERROR) : 10-8
- 유량 계산에 대한 허용오차 (EERROR) : 10-4
- 질량보존 방정식의 residal 상대 오차 (MERROR) : 10-5
- 횡방향 운동량 방정식의 residual 상대오차 (TERROR) : 10-5
- 축방향 운동량 방정식의 residual 상대오차 (AXEROR) : 10-5
- 횡류량 저항인자(KIJ) : 0.5
- 횡방향 운동량 방정식의 relaxation 인자 (WRELAX) : 1.0 (no relaxation)
- 축방향 운동량 방정식의 relaxation 인자 (FRELAX) : 1.0 (no relaxation)
- 밀도 relaxation 인자 (RRELAX) : 1.0 (no relaxation)
- 엔탈피 relaxation 인자 (HRELAX) : 1.0 (no relaxation)

3. 계산 결과 및 검토

전술한 입력자료 모형들을 이용하여 버턴이 부착된 CANFLEX 다발에 대해 입력자료를 생산하였으며, Appendix I에 첨부하였다. 계산대상 핵연료 채널의 부수로로 나누어진 형상은 Figure 1과 같다. CANDU 원자로의 경우 핵연료다발이 수평으로 장전되므로 핵연료다발 중심과 압력관 중심 사이의 편심때문에 180 대칭이 최소 대칭구조로 되지만 본 계산에서는 전 부수로에 대해 계산을 수행하였다. 이때 CANFLEX 다발의 전체 부수로 개수는 70개가 되며, 전체 핵연료봉 개수는 43개가 된다.

Appendix I의 입력자료를 이용하여 계산된 결과를 Appendix II에 수록하였다. ASSERT 코드의 출력 자료는 크게 네가지 부분으로 나누어진다. 첫째 입력자료의 출력부분, 둘째 핵연료다발 평균 유동변수들의 계산결과, 셋째 각 부수로에 대한 유동변수들에 대한 계산결과, 임계열유속에 대한 결과 등이다. ASSERT 코드에 의해 계산된 각각의 유동변수 결과들을 Figure 2에서 Figure 19에 나타내었다.

Figure 2에 각 부수로별 유동면적을 나타내었다. 중심부수로 1번에서 7번까지는 모두 삼각부수로이었으며, 내부부수로 8번에서 21번까지는 사각부수로 및 삼각부수로가 교대로 배치되고, 중간부수로는 22번에서 49번까지로 사각부수로후 세 개의 삼각부수로가 교대로 배열된다. 외곽부수로는 50번에서 70번까지 벽면부수로로 배열된다. 부수로 유동 면적이 가장 적은 부수로는 내부부수로의 삼각부수로이며, 외곽부수로의 가장 하부부수로의 경우도 유동면적이 낮은 지역이었다.

Figure 3에는 Figure 1의 부수로 1번 압력을 기준으로 했을 때 각 부수로별 상대 압력분포를 나타내었다. RUFIC 핵연료다발 중심을 기준으로 상부 부수로가 하부 부수로 보다 상대 압력이 높은 것으로 나타났으며, 중심부수로(부수로 1번에서 7번까지)의 경우 부수로 1번과 7번보다 아래쪽에 위치한 부수로 2번에서 4번으로 아래로 내려갈수록 압력이 높으며, 다시 부수로 4번에서 7번으로 올라갈수록 압력이 낮아졌다. 이러한 경향은 내부부수로(부수로 8번에서 21번까지)에서도 같은 경향으로 나타났으며, 중간부수로(부수로 22번에서 49번까지) 및 외곽부수로(부수로 50번에서 70번까지)의 경우에도 동일한 경향으로 나타났다.

Figure 4에는 냉각재의 온도와 액체 및 기체 혼합밀도를 채널출구 지점에서의 부수로별로 나타내었다. 전체 부수로 냉각재 평균 온도는 313 ℃이며, 외곽부수로를 제외한 대부분 부수로들은 냉각재 평균온도보다 조금씩 높았으나 외곽부수로는 평균온도보다 상당히 낮았으며, 특히, 외곽 상부부수로의 경우에 냉각재 온도가 평균온도보다 약 3 ~ 4 ℃ 까지 낮았다. 냉각재 혼합밀도는 352 kg/㎥이며, 중심 부수로 및 하부부수로들의 밀도가 낮았으며, 중

력의 방향과는 반대로 나타났다. 이는 압력관내에 위치한 핵연료다발의 중력에 의한 편심 때문에 외곽 하부부수로들의 유동면적이 상부쪽보다 상당히 작아 하부부수로들의 유량이 상부부수로의 유량보다 적어지며 이로 인해 다발 중심선에서 하부쪽으로의 부수로들에서 밀도가 낮아진 것으로 판단된다.

Figure 5에는 채널 출구에서의 부수로별 유동 비평형 건도 및 질량평형 건도(열역학적 건도)를 나타내었다. 출구 건도는 하부 부수로에서 가장 높은 것으로 나타났으며, 상부 부수로로 갈수록 낮아졌다. 최고건도 부수로 번호는 13, 14, 15 및 35번 부수로이었다. 이는 이들 부수로의 혼합밀도, 상대 압력이 낮았기 때문이며, 외곽부수로의 상부부수로 건도가 가장 낮은 이유는 외곽 상부부수로들의 유동 면적이 크기 때문이다.

Figure 6에는 채널출구에서 부수로별 기포율과 유동 엔탈피를 나타내었다. 기포율이 높은 경우 엔탈피도 높고, 최고 높은 기포율 혹은 엔탈피를 갖는 부수로는 13, 14, 15 및 35번 부수로이었으며, Figure 5의 건도와 같은 경향을 나타내었다.

Figure 7에는 질량유량 및 질량유속을 나타내었다. 유량이 높은 부수로가 질량유속이 높았다. 최소유량 부수로는 내부부수로 13번 및 15번이었으며, 최소 질량유속 부수로는 외곽부수로 60번이었다. 최고 질량유량 및 질량유속 부수로는 외곽부수로 50번 및 70번이었다.

Figure 8에는 각 부수로 유속을 나타내었다. 유속이 가장 높은 부수로는 내부부수로 14번이었으며, 중간부수로 33번 및 37번도 유속이 높았다. 외곽부수로의 유속은 다른 부수로에 비해 상대적으로 낮게 나타났다.

Figure 9에서 Figure 11에는 다발평균 축방향 유동특성을 나타내었다. Figure 9에는 채널의 유량 및 질량 유속을 나타내었다. 채널 유량은 23 kg/s 이었으며, 질량유속은 5.5 kg/m2s 이었다.

Figure 10에는 채널 입구에서 축방향 압력분포를 나타내었다. 고려된 유동 조건에서 채널 전체 압력강하는 약 493 kPa이 발생하였다. 축방향 압력의 급강하가 발생하는 부분이 존재하며, 이는 다발 이음매에서의 큰 압력강하 손실 때문이다.

Figure 11에는 액체 및 증기상태의 냉각재 축방향 온도분포를 나타내었다. 액체의 온도는 입구에서 출구에 가까워짐에 따라 온도가 증가하다가 출구 쪽 약 세 번째 다발에서 최고 온도 약 313 ℃에 도달되었다가 낮아진다. 이는 축방향으로 코사인 형태의 출력분포로 인해 입구에서 출구 쪽으로 가까워질수록 온도가 증가하다가 냉각재가 포화상태에 도달된 후에는 압력 감소에 따라 포화온도가 떨어지기 때문이며, 또한, 온도곡선이 매끄럽지 않는 이유는 다발 이음매 및 부착물에서의 압력강하가 다르기 때문이다. 증기의 온도는 입구 쪽에서 가장 높고 출구 쪽에서 가장 낮다. 이는 축방향 압력 강하가 일어나므로 포화온도가 낮아지기

때문에 증기의 온도가 낮아진다. 입구에서 축방향으로 40 cm 떨어진 지점에서 증기온도가 0.7 ℃ 섭동이 있었으며, 110 cm 떨어진 지점에서 다시 0.7 ℃ 정도 증기온도가 강하하였다. 이는 계산상의 오차로 보인다.

Figure 12에는 유동 엔탈피 및 기포율을 나타내었다. 엔탈피 및 기포율이 단조증가를 하며, 입구에서 120 cm 떨어진 지점에서 기포가 발생하기 시작하여 출구에서 최고 기포율이 53 %가 되었다.

Figure 13에는 냉각재의 축방향 건도분포를 나타내었으며, 출구에 가까워질수록 건도가 증가하였다. 입구에서 250 cm 떨어진 지점에서 다발 평균 유동 비평형 건도가 발생하기 시작하였으며, 다발평균 최대 유동 비평형 건도는 약 11 %이다. 입구에서 370 cm 떨어진 지점에서 평형건도가 영보다 커져 출구에서 최대 평형 건도는 12 % 이었으며, 입구에서의 과냉각도는 26 % 이었다.

Figure 14에는 유속 분포를 나타내었다. 유속이 6 m/s에서 서서히 증가하다가 급격히 증가하며 최대 14 m/s에 도달하며, 냉각재가 포화상태에 도달된 후에는 액체 및 증기 혼합밀도가 급격히 감소하기 때문에 유속이 급격히 증가하게 된다.

Figure 15에는 축방향 열유속 정규분포와 최소 임계출력비를 나타내었다. 축방향 열속분포가 영인 지점은 다발간 이음매 부분을 나타내며, 최소 임계열유속은 입구에서 축방향 430 cm 떨어진 지점이며, 9 번째 다발의 마지막 버턴이 존재하는 지점 부근에 해당하였다. 또한 반경방향으로는 35번 핵연료봉의 37번 부수로에서 최소 임계출력비가 존재하였다.

Figure 16에서 Figure 19까지는 축방향 각 절점에서의 부수로간 횡류 분포를 나타내고 있다. 횡류량은 W(i,j)로 나타내었고 W(i,j)가 양의 값이 될 때는 i-부수로에서 j-부수로로 횡류가 유출된다는 것을 의미하며, 음이 될 때는 이와 반대로 유입되는 것을 나타낸다. Figure 16에서는 2번 부수로에서 10번 부수로 및 3번 부수로와의 횡류량을 나타내고 있으며, 10번 부수로로부터 2번 부수로로 횡류가 유입되는 경우 2번 부수로에서 3번 부수로로 횡류가 유출이 되는 것을 알 수 있다. Figure 17은 부수로 3번에서의 축방향 횡류 분포를 나타내고 있다. 4번 부수로 및 12번 부수로에서 횡류 방향이 같다는 것은 3번 부수로에 인접된 2번 부수로 및 4번 부수로로의 횡류 방향이 다르다는 것을 의미한다. 즉 4번 및 12번 부수로에서 3번 부수로로 횡류가 유입될 때 3번 부수로에서 2번 및 4번 부수로로 횡류가 유출되게 된다. Figure 18은 4번 부수로 및 48번 부수로의 횡류를 나타내고 있으며, Figure 19에서는 1번 부수로 및 5번 부수로의 횡류를 나타내고 있다.

4. 결론

본 입력자료 모형 보고서를 통해 CANFLEX 다발의 ASSERT 코드에 의한 부수로 해석에 필요한 여러 가지 입력자료의 모형식 및 자료의 근거를 제시하였다. 본 입력자료 생산시 주의해야 할 점은 COBRA-IV-i 코드와는 달리 축방향 혹은 부수로간의 지배방정식의 형태가 드리프트 플럭스 모형 혹은 2-유체 모형을 이용하고, 중력을 영향이 고려되고 있으므로 부수로간의 무게중심간 거리, 각 핵연료봉의 수직에 대해 어긋나 있는 이격 각도에 대한 정확한 입력자료를 요한다. 이들 기하학적 입력자료는 당소에서 개발된 CANGEO 코드를 이용하여 작성하였다. RUFIC 핵연료다발에 대해 본 보고서에서 제시된 모형들을 이용하여 부수로 해석을 수행하였으며, 그 결과를 요약하면 다음과 같다.

부수로별 계산된 결과를 보면 부수로별 상대 압력 하부부수로 보다 상부부수로가 높았으며, 및 엔탈피, 건도 및 기포율 분포는 하부 부수로가 높은 것으로 나타남으로써 중력의 방향과는 반대로 나타났다. 이는 압력관내에 위치한 핵연료다발의 중력에 의한 편심 때문에 외곽 하부부수로들의 유동면적이 상부쪽보다 상당히 작아 하부부수로들의 유량이 상부부수로의 유량보다 적어지며 이로 인해 다발 중심선에서 하부쪽 부수로들의 엔탈피 분포가 높아졌기 때문인 것으로 판단된다.

부수로 단면의 내부 및 외부 부수로별의 온도 분포를 보면, 전체 부수로 냉각재 평균 온도는 313 ℃이며, 외곽부수로를 제외한 대부분 부수로들은 냉각재 평균온도보다 조금씩 높았으나 외곽부수로는 평균온도보다 3 ~ 4 ℃로 상당히 낮게 나타났다. 또한, 최고 건도를 나타내는 부수로 번호는 채널 단면의 하부쪽 부수로에서 나타났으며, 이는 이들 부수로의 혼합밀도, 상대 압력이 낮았기 때문이다.

다음으로 핵연료채널 단면 평균 축방향 유동특성에서 축방향 압력분포를 볼 때 고려된 유동 조건에서 채널 전체 압력강하는 약 493 kPa이 발생하였고, 축방향 압력의 급강하가 발생하는 부분이 존재하였으며, 이는 다발 이음매에서의 큰 압력강하 손실 때문이다. 축방향 액체 및 증기상태의 냉각재 축방향 온도분포는 입구에서 출구에 가까워짐에 따라 온도가 증가하다가 출구 쪽 약 세 번째 다발에서 최고 온도 약 313 ℃에 도달되었다가 다시 강하하며, 이는 축방향으로 코사인 형태의 출력분포로 인해 입구에서 출구 쪽으로 가까워질수록 온도가 증가하다가 냉각재가 포화상태에 도달된 후에는 압력 감소에 따라 포화온도가 떨어졌기 때문이며, 또한, 온도곡선이 매끄럽지 않는 이유는 다발 이음매 및 부착물에서의 압력강하가 다르기 때문이다. 냉각재의 축방향 건도분포를 나타내었으며, 출구에 가까워질수록 건도가 증가하였으며, 입구에서 250 cm 떨어진 지점에서 다발 평균 유동 비평형 건도가 발

생하기 시작하였다. 축방향 열유속 정규분포와 최소 임계출력비를 볼 때 최소 임계열유속은 입구에서 축방향 430 cm 떨어진 지점이며, 9 번째 다발의 마지막 버턴이 존재하는 지점 부근에 해당하였다. 또한 반경방향으로는 35번 핵연료봉의 37번 부수로에서 최소 임계출력비가 존재하였다.

본 ASSERT 코드에 의한 부수로 해석 입력자료 모형은 RUFIC 핵연료다발의 부수로 상세 해석에 이용될 수 있으며, RUFIC 핵연료다발의 압력손실계수, 축 및 반경방향 열유속 분포 등의 열수력적 정확한 입력 자료가 주어진다면 기존 37-핵연료봉다발 혹은 CANFLEX-NU 다발과의 부수로 측면에서의 상호 비교 분석이 가능할 것으로 보인다.

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Table 1. Properties of Heavy Water (from HLWP Package in ASSERT code)

P	T	v_f	v_g	h_f	h_g	μ	K	σ
MPa	℃	m^3/kg	m^3/kg	kJ/kg	kJ/kg	N/m	$W/m\cdot℃$	N/m
0.001	9.63	0.000904	117.28798	24.62	2333.59	0.001759	0.582753	0.073350
0.002	20.03	0.000905	60.52671	68.74	2350.86	0.001294	0.598051	0.071850
0.004	31.34	0.000907	31.41717	116.70	2369.75	0.000961	0.612420	0.070117
0.005	35.27	0.000908	25.48753	133.04	2376.14	0.000873	0.616880	0.069492
0.006	38.52	0.000909	21.48881	146.66	2381.51	0.000810	0.620360	0.068968
0.008	43.70	0.000910	16.39434	169.04	2390.25	0.000734	0.625522	0.068121
0.010	47.94	0.000912	13.27883	186.93	2397.27	0.000680	0.629414	0.067415
0.020	62.15	0.000918	6.91164	246.61	2420.13	0.000538	0.640297	0.064974
0.040	77.62	0.000926	3.60967	311.91	2445.07	0.000432	0.648509	0.062208
0.050	83.15	0.000929	2.92806	335.07	2453.45	0.000402	0.650563	0.061195
0.060	87.78	0.000932	2.46821	354.21	2460.48	0.000380	0.651938	0.060338
0.080	95.10	0.000937	1.88425	384.44	2471.85	0.000349	0.653486	0.058965
0.100	101.05	0.000941	1.52692	409.49	2480.87	0.000327	0.654189	0.057835
0.200	121.57	0.000957	0.79466	495.54	2509.98	0.000267	0.652956	0.053844
0.300	134.56	0.000968	0.54384	549.02	2527.08	0.000239	0.649388	0.051247
0.400	144.53	0.000978	0.41593	590.40	2539.36	0.000220	0.645258	0.049215
0.500	152.67	0.000986	0.33749	624.55	2548.85	0.000207	0.641024	0.047532
0.600	159.73	0.000993	0.28397	654.25	2556.25	0.000197	0.636742	0.046056
0.700	165.93	0.001000	0.24515	680.22	2562.19	0.000189	0.632530	0.044746
0.800	171.39	0.001006	0.21571	703.08	2567.26	0.000182	0.628477	0.043583
0.900	176.23	0.001012	0.19260	723.42	2571.61	0.000177	0.624614	0.042542
1.000	180.59	0.001017	0.17398	741.83	2575.35	0.000172	0.620930	0.041598
1.500	198.58	0.001042	0.11737	819.16	2588.02	0.000155	0.603700	0.037643
2.000	212.62	0.001062	0.08857	880.36	2594.65	0.000144	0.588072	0.034491
2.500	224.32	0.001081	0.07108	931.86	2597.88	0.000136	0.573632	0.031820
3.000	234.19	0.001099	0.05930	975.76	2598.93	0.000129	0.560511	0.029544
3.500	242.65	0.001116	0.05080	1014.08	2598.42	0.000125	0.548600	0.027576
4.000	250.14	0.001132	0.04436	1048.83	2596.73	0.000121	0.537563	0.025826
4.500	257.08	0.001147	0.03929	1081.53	2594.12	0.000117	0.526924	0.024200
5.000	263.52	0.001163	0.03520	1112.03	2590.74	0.000114	0.516690	0.022689
5.500	269.47	0.001178	0.03180	1140.65	2586.69	0.000112	0.506928	0.021291
6.000	275.03	0.001193	0.02895	1167.76	2582.08	0.000109	0.497577	0.019989
6.500	280.28	0.001208	0.02650	1193.75	2576.94	0.000107	0.488514	0.018761
7.000	285.27	0.001223	0.02439	1218.74	2571.33	0.000105	0.479678	0.017597
7.500	290.03	0.001238	0.02255	1242.81	2565.27	0.000104	0.471080	0.016494
8.000	294.56	0.001253	0.02093	1266.03	2558.81	0.000102	0.462728	0.015450
8.500	298.88	0.001268	0.01950	1288.45	2551.96	0.000100	0.454628	0.014462
9.000	302.99	0.001284	0.01821	1310.16	2544.72	0.000099	0.446781	0.013528
9.500	306.91	0.001300	0.01705	1331.23	2537.08	0.000098	0.439186	0.012644
10.000	310.66	0.001316	0.01601	1351.71	2529.05	0.000097	0.431840	0.011809
10.500	314.23	0.001332	0.01505	1371.69	2520.60	0.000095	0.424736	0.011019
11.000	317.66	0.001349	0.01418	1391.23	2511.76	0.000094	0.417865	0.010271
11.500	320.93	0.001366	0.01337	1410.40	2502.49	0.000093	0.411216	0.009563
12.000	324.08	0.001384	0.01263	1429.27	2492.82	0.000093	0.404775	0.008891
12.500	327.11	0.001403	0.01194	1447.92	2482.72	0.000092	0.398525	0.008252
13.000	330.03	0.001422	0.01130	1466.40	2472.20	0.000091	0.392448	0.007644
13.500	332.86	0.001442	0.01071	1484.80	2461.26	0.000090	0.386522	0.007064
14.000	335.61	0.001463	0.01015	1503.17	2449.82	0.000089	0.380724	0.006508
14.500	338.28	0.001485	0.00962	1521.60	2437.82	0.000089	0.375027	0.005975
15.000	340.90	0.001508	0.00912	1540.08	2425.19	0.000088	0.369405	0.005462
15.500	343.47	0.001532	0.00865	1558.62	2411.86	0.000087	0.363826	0.004967
16.000	346.00	0.001558	0.00820	1577.31	2397.76	0.000087	0.358267	0.004487
16.500	348.47	0.001585	0.00777	1596.20	2382.81	0.000086	0.352803	0.004027
17.000	350.87	0.001615	0.00736	1615.31	2366.96	0.000086	0.347450	0.003589
17.500	353.21	0.001647	0.00696	1634.68	2350.07	0.000085	0.342205	0.003170
18.000	355.49	0.001683	0.00657	1654.66	2331.84	0.000085	0.337062	0.002770
18.500	357.72	0.001723	0.00619	1675.58	2311.95	0.000084	0.332016	0.002388
19.000	359.90	0.001768	0.00582	1697.78	2290.08	0.000084	0.327059	0.002024
19.500	362.02	0.001821	0.00544	1721.60	2265.38	0.000083	0.322185	0.001676
20.000	364.11	0.001885	0.00505	1747.49	2236.60	0.000083	0.317386	0.001345

Table 2. Geometry of RUFIC Bundle Calculated by CANGEO Code

FULL CHANNEL OF RUFIC BUNDLE WITH 3.1 % CREPT P/T (UNIT:mm)	
***** GEOMETRY BASIC INPUT **********	
SYMMETRIC ANGLE	: 360
ANGLE OF UPPER SYMMETRIC BOUNDARY LINE	: 90
TOTAL NUMBER OF RODS	: 43
TOTAL NUMBER OF SUBCHANNELS	: 70
TOTAL NUMBER OF RINGS	: 4
PRESSURE TUBE DIAMETER	: 106.63
X-ECCENTRICITY	: 0
Y-ECCENTRICITY	: 3.295
RING NUMBER	: 1
RING RADIUS	: 0
RELATIVE RING POWER RATIO	: 0.977
NUMBER OF RODS AT 1-RING	: 1
ACTUAL NUMBER OF RODS AT 1-RING	: 1
ROD DIAMETER OF 1-RING	: 13.5
FIRST ROD OFFSET ANGLE AT 1-RING	: 0
RING NUMBER	: 2
RING RADIUS	: 17.34
RELATIVE RING POWER RATIO	: 1.032
NUMBER OF RODS AT 2-RING	: 7
ACTUAL NUMBER OF RODS AT 2-RING	: 7
ROD DIAMETER OF 2-RING	: 13.5
FIRST ROD OFFSET ANGLE AT 2-RING	: 0
RING NUMBER	: 3
RING RADIUS	: 30.75
RELATIVE RING POWER RATIO	: 0.861
NUMBER OF RODS AT 3-RING	: 14
ACTUAL NUMBER OF RODS AT 3-RING	: 14
ROD DIAMETER OF 3-RING	: 11.5
FIRST ROD OFFSET ANGLE AT 3-RING	: 12.85714
RING NUMBER	: 4
RING RADIUS	: 43.84
RELATIVE RING POWER RATIO	: 1.083
NUMBER OF RODS AT 4-RING	: 21
ACTUAL NUMBER OF RODS AT 4-RING	: 21
ROD DIAMETER OF 4-RING	: 11.5
FIRST ROD OFFSET ANGLE AT 4-RING	: 0
CALCULATION FUEL GEOMETRY	
FUEL ROD AREA	: 4780.52227 mm2
SUBCHANNEL AREA	: 4149.42089 mm2
HEATED PERIMETER	: 1603.78305 mm
WETTED PERIMETER	: 1938.77107 mm
HYDRAULIC DIAMETER	: 8.56093 mm
CALCULATION ERROR OF RESULTS(RELATIVE ERROR,%)	
ERROR OF TOTAL SUBCHANNEL AREA	: 2.5121E-6
ERROR OF ROD AREA OCCUPIED	: 3.4951E-8

Table 3. Relative Axial Locations and Loss Coefficients of Each Appendage and Junction of RUFIC Bundle

Bundle Serial Number	Relative Axial Location of Appendages and Junctions (Location/Total Length)					
Bundle 1	.0091	.0743	.0209	.0624	.0417	.0000
Bundle 2	.0924	.1576	.1043	.1457	.1250	.1667
Bundle 3	.1757	.2409	.1876	.2291	.2083	.2500
Bundle 4	.2591	.3243	.2709	.3124	.2917	.3333
Bundle 5	.3424	.4076	.3543	.3957	.3750	.4167
Bundle 6	.4257	.4909	.4376	.4791	.4583	.5000
Bundle 7	.5091	.5743	.5209	.5624	.5417	.5833
Bundle 8	.5924	.6576	.6043	.6457	.6250	.6667
Bundle 9	.6757	.7409	.6876	.7291	.7083	.7500
Bundle 10	.7591	.8243	.7709	.8124	.7917	.8333
Bundle 11	.8424	.9076	.8543	.8957	.8750	.9167
Bundle 12	.9257	.9909	.9376	.9791	.9583	1.000
Loss Coefficient, K	Bearing-Pad Plane		Button Plane		Spacer Plane	Junction Fully Aligned
	0.00006		0.0707		0.1325	0.3586

Table 4. Ring Power Ratio of a RUFIC Bundle

Ring Identification	Center Ring	Inner Ring	Intermediate Ring	Outer Ring
Radial Power Factor	0.977	1.032	0.861	1.083

Table 5. Rod Power Fraction in a Subchannel

RN	DR	Radial	LR	PHI	LR	PHI	LR	PHI	LR	PHI	LR	PHI	LR	PHI	LR	PHI
	inch			frac		frac		frac		frac		frac		frac		fract
1	1.350	0.916	1	0.143	2	0.143	3	0.143	4	0.143	5	0.143	6	0.143	7	0.143
2	1.350	0.956	1	0.179	7	0.179	20	0.242	21	0.158	8	0.242				
3	1.350	0.956	1	0.179	8	0.242	9	0.158	10	0.242	2	0.179				
4	1.350	0.956	2	0.179	10	0.242	11	0.158	12	0.242	3	0.179				
5	1.350	0.956	3	0.179	12	0.242	13	0.158	14	0.242	4	0.179				
6	1.350	0.956	4	0.179	14	0.242	15	0.158	16	0.242	5	0.179				
7	1.350	0.956	5	0.179	16	0.242	17	0.158	18	0.242	6	0.179				
8	1.350	0.956	6	0.179	18	0.242	19	0.158	20	0.242	7	0.179				
9	1.150	0.895	8	0.258	21	0.171	49	0.177	22	0.148	23	0.246				
10	1.150	0.895	8	0.258	23	0.246	24	0.148	25	0.177	9	0.171				
11	1.150	0.895	9	0.171	25	0.177	26	0.148	27	0.246	10	0.258				
12	1.150	0.895	10	0.258	27	0.246	28	0.148	29	0.177	11	0.171				
13	1.150	0.895	11	0.171	29	0.177	30	0.148	31	0.246	12	0.258				
14	1.150	0.895	12	0.258	31	0.246	32	0.148	33	0.177	13	0.171				
15	1.150	0.895	13	0.171	33	0.177	34	0.148	35	0.246	14	0.258				
16	1.150	0.895	14	0.258	35	0.246	36	0.148	37	0.177	15	0.171				
17	1.150	0.895	15	0.171	37	0.177	38	0.148	39	0.246	16	0.258				
18	1.150	0.895	16	0.258	39	0.246	40	0.148	41	0.177	17	0.171				
19	1.150	0.895	17	0.171	41	0.177	42	0.148	43	0.246	18	0.258				
20	1.150	0.895	18	0.258	43	0.246	44	0.148	45	0.177	19	0.171				
21	1.150	0.895	19	0.171	45	0.177	46	0.148	47	0.246	20	0.258				
22	1.150	0.895	20	0.258	47	0.246	48	0.148	49	0.177	21	0.171				
23	1.150	1.092	48	0.153	70	0.274	50	0.274	22	0.153	49	0.146				
24	1.150	1.092	22	0.199	50	0.275	51	0.273	23	0.254						
25	1.150	1.092	23	0.254	51	0.275	52	0.272	24	0.199						
26	1.150	1.092	24	0.153	52	0.276	53	0.272	26	0.153	52	0.276				
27	1.150	1.092	26	0.199	53	0.276	54	0.271	27	0.254						
28	1.150	1.092	27	0.254	54	0.277	55	0.271	28	0.199						
29	1.150	1.092	28	0.153	55	0.277	56	0.271	30	0.153	29	0.146				
30	1.150	1.092	30	0.199	56	0.276	57	0.271	31	0.254						
31	1.150	1.092	31	0.254	57	0.276	58	0.272	32	0.199						
32	1.150	1.092	32	0.153	58	0.275	59	0.273	34	0.153	33	0.146				
33	1.150	1.092	34	0.199	59	0.274	60	0.273	35	0.254						
34	1.150	1.092	35	0.254	60	0.273	61	0.274	36	0.199						
35	1.150	1.092	36	0.153	61	0.273	62	0.275	38	0.153	37	0.146				
36	1.150	1.092	38	0.199	62	0.272	63	0.276	39	0.254						
37	1.150	1.092	39	0.254	63	0.271	64	0.276	40	0.199						
38	1.150	1.092	40	0.153	64	0.271	65	0.277	42	0.153	41	0.146				
39	1.150	1.092	42	0.199	65	0.271	66	0.277	43	0.254						
40	1.150	1.092	43	0.254	66	0.271	67	0.276	44	0.199						
41	1.150	1.092	44	0.153	67	0.272	68	0.276	46	0.153	45	0.146				
42	1.150	1.092	46	0.199	68	0.272	69	0.275	47	0.254						
43	1.150	1.092	47	0.254	69	0.273	70	0.275	48	0.199						

RN : Rod number

DR : Rod diameter

RADIAL : Radial power factor rod (i) as a fraction of the average rod power

LR : Identification numbers of subchannels surrounding rod

PHI : Fraction of the total rod power input to adjacent subchannel

fract : Fraction

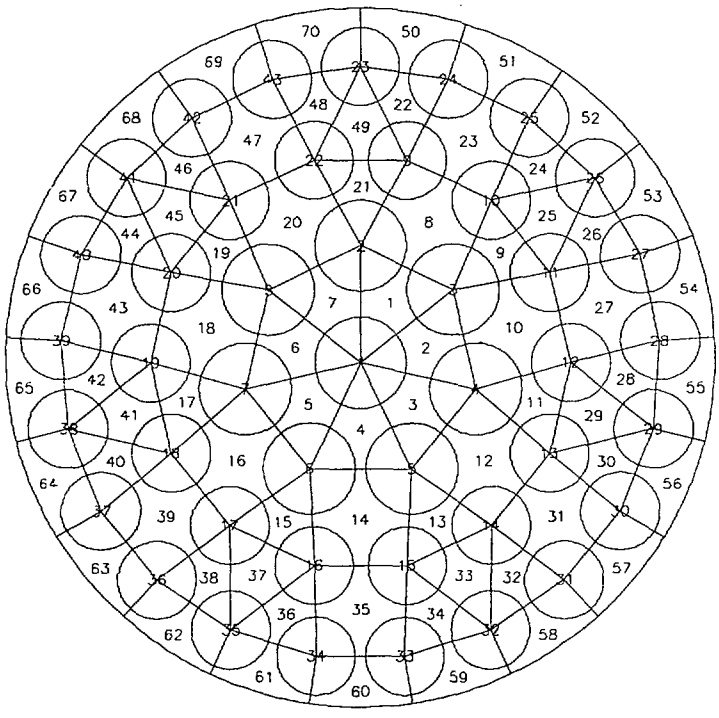

Figure 1. Subchannel and Rod Number of RUFIC Bundle for ASSERT Calculation

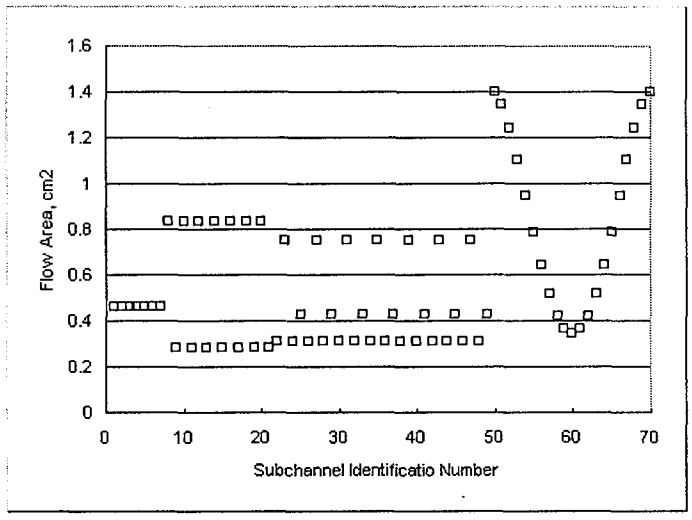

Figure 2. Subchannel Flow Area Distribution

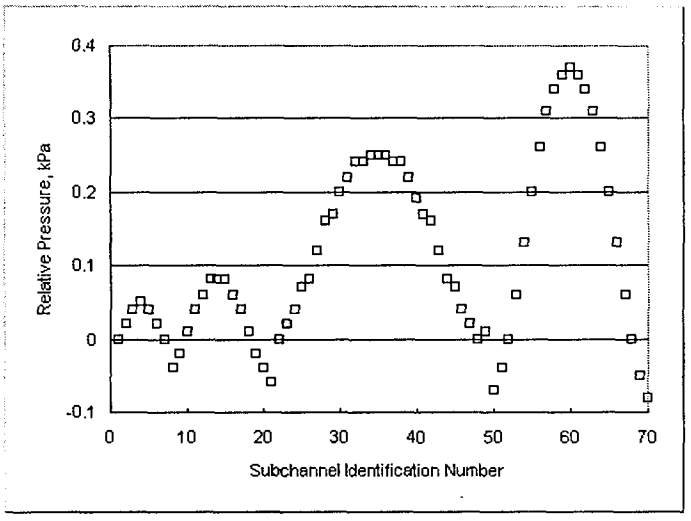

Figure 3. Subchannel Relative Pressure Distribution

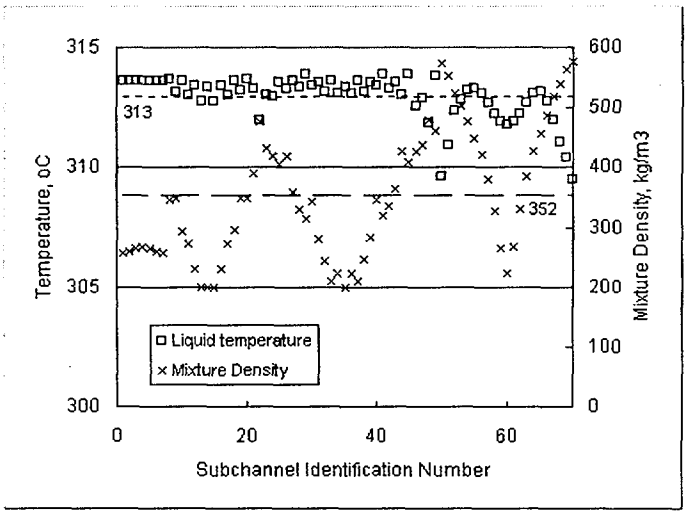

Figure 4. Subchannel Liquid Temperature and Mixture Density Distribution

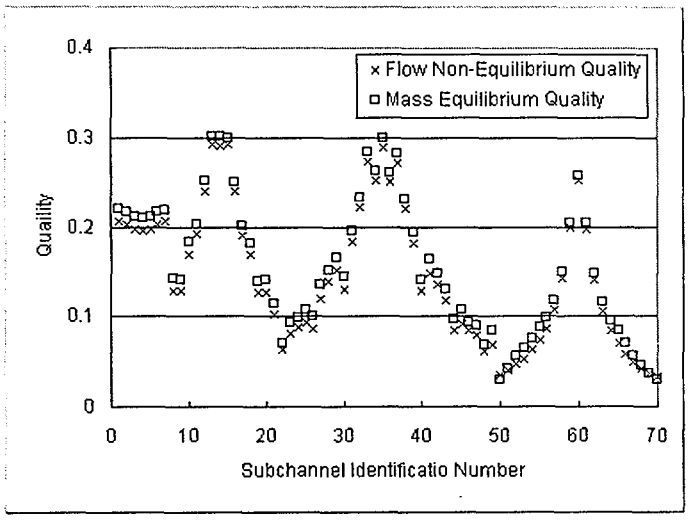

Figure 5. Subchannel Non-equilibrium and Thermodynamic Quality Distribution

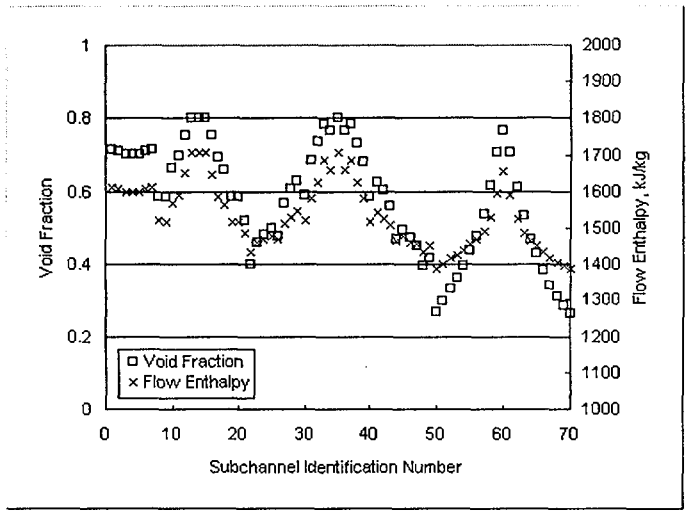

Figure 6. Subchannel Void Faction and Flow Enthalpy Distribution

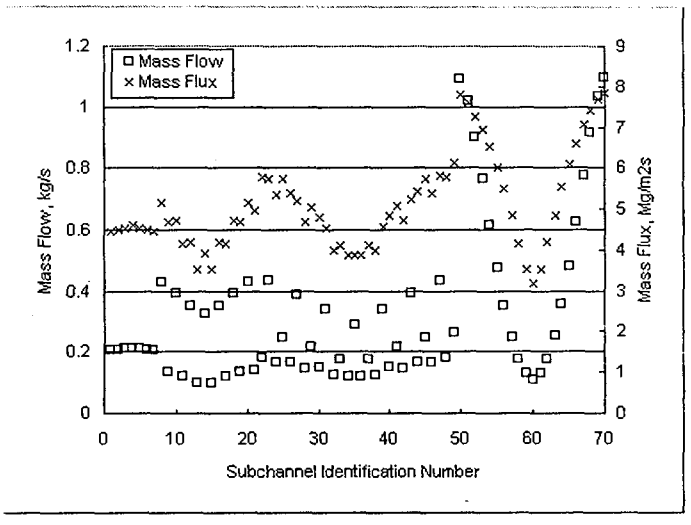

Figure 7. Subchannel Flow Rate and Mass Flux Distribution

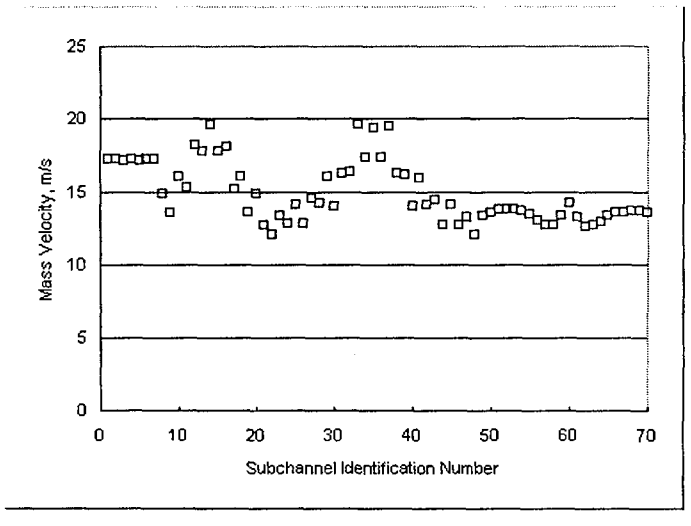

Figure 8. Subchannel Velocity Distribution

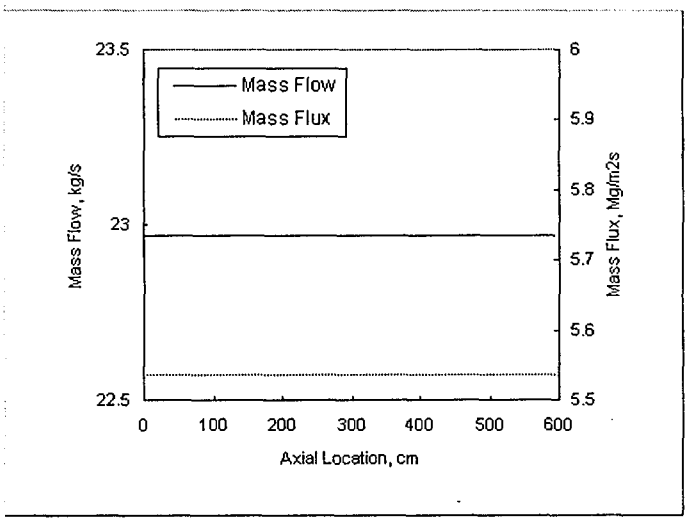

Figure 9. Bundle Averaged Flow Rate and Mass Flux

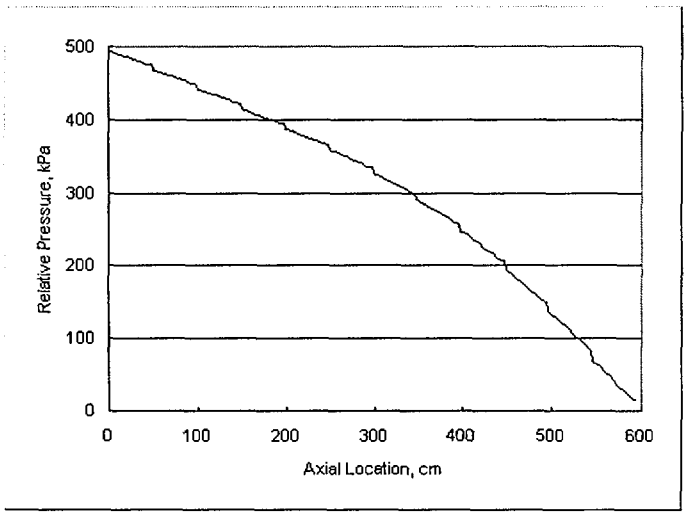

Figure 10. Axial Relative Pressure Distribution

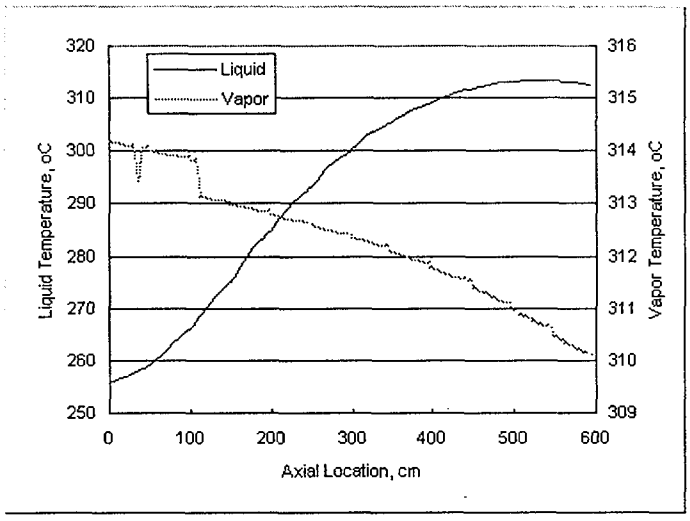

Figure 11. Axial Liquid and Vapor Temperature Distribution

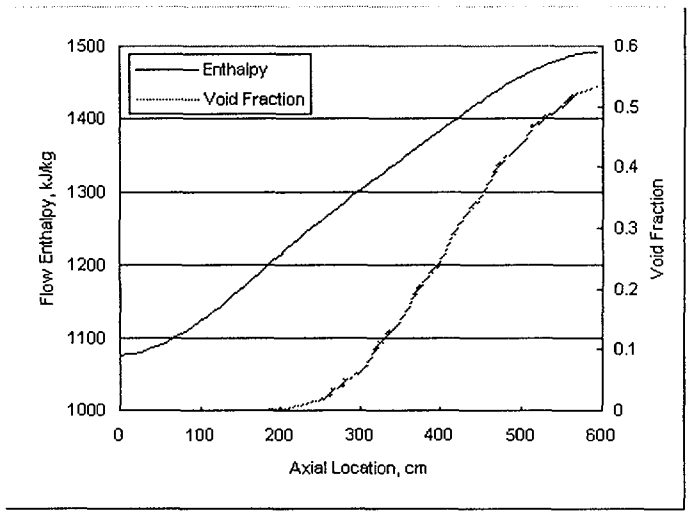

Figure 12. Axial Enthalpy and Void Fraction Distribution

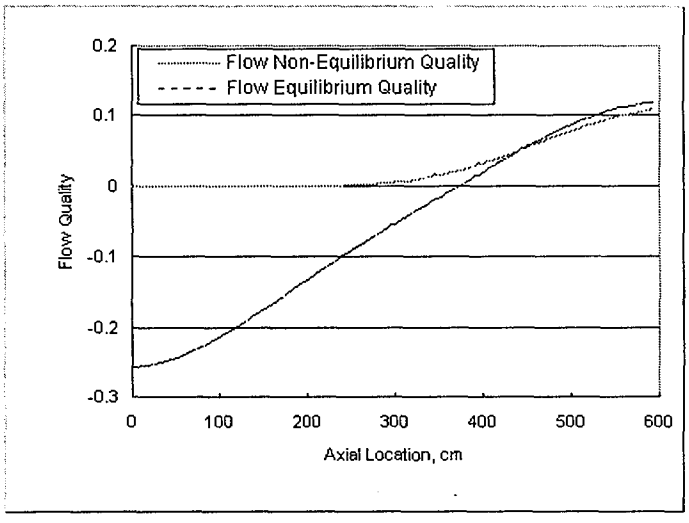

Figure 13. Axial Flow Non-Equilibrium and Equilibrium Quality Distribution

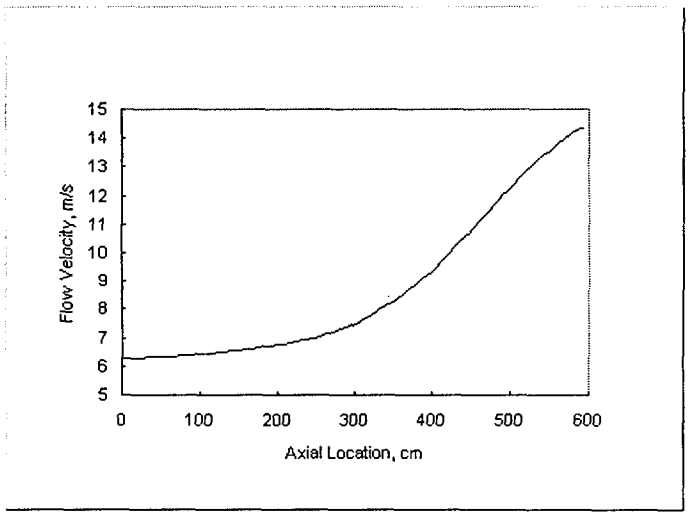

Figure 14. Axial Bundle Averaged Velocity Distribution

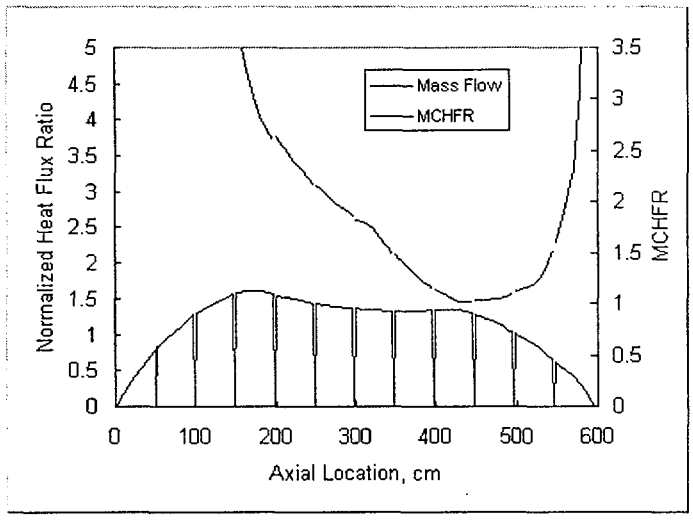

Figure 15. Axial Heat Flux and MCHFR Distribution

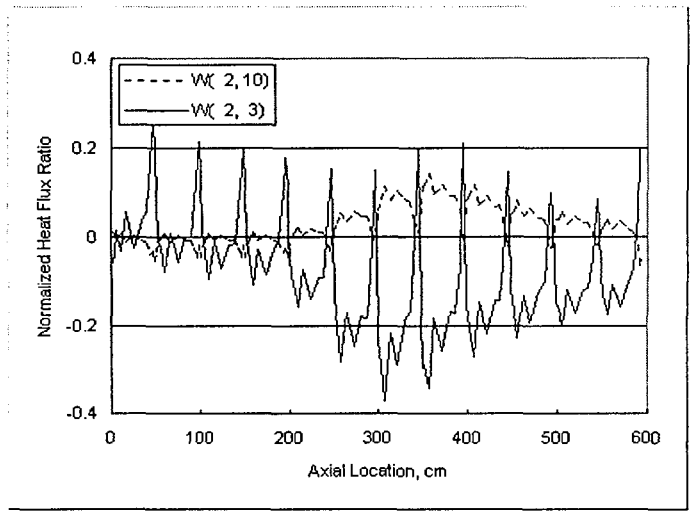

Figure 16. Axial Crossflow Distribution in Subchannel Number 2

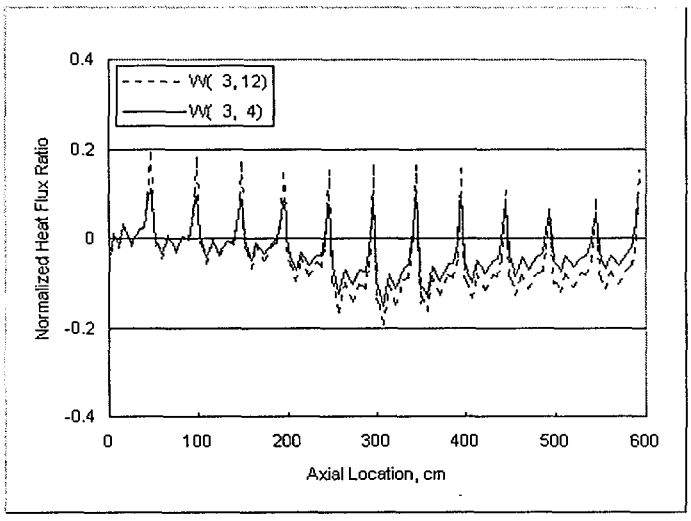

Figure 17. Axial Crossflow Distribution in Subchannel Number 3

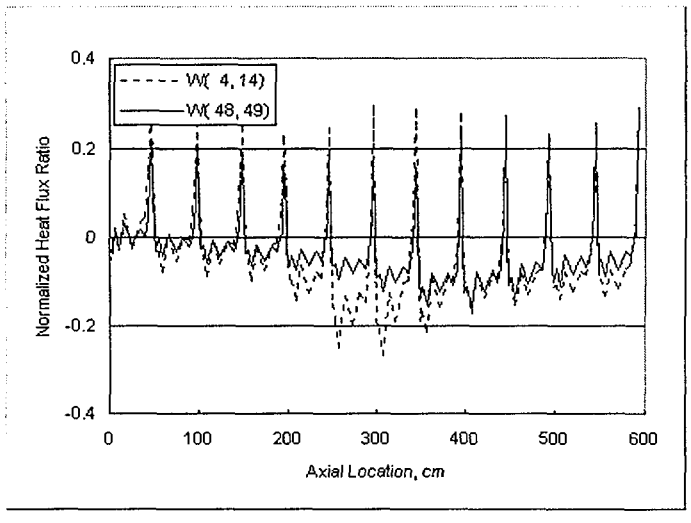

Figure 18. Axial Crossflow Distribution in Subchannel Number 4 and 48

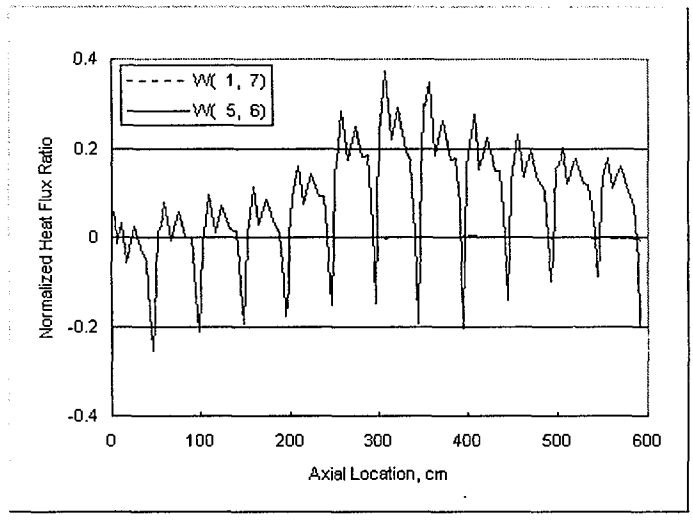

Figure 19. Axial Crossflow Distribution in Subchannel Number 1 and 5

APPENDIX I : Sample Input Data for ASSERT code

```
/=============================================================================
/
/   FILE:  IM_pv_v2r8_0101.inp       J.H. Park  2001-01-18
/
/              ***********************************************
/              **          ASSERT INPUT MODELLING           **
/              **           FOR ASSERT-PV V2R8              **
/              **                -----                      **
/              **          INPUT MODELLING CASE 0101:       **
/              **        RUFIC (43-ELEMENT) BASE CASE       **
/              ***********************************************
/
/   DISCLAIMER
/      This input file is for input modelling of RUFIC (CANFLEX-RU) bundle
/   for ASSERT-PV V2R8 application.  It represents a CANDU fuel channel
/   containing twelve RUFIC. The geometry input data were generated by CANGEO
/   code which was developed by J.H. Park at KAERI.
/
/   DESCRIPTION
/   - twelve fully-aligned RUFIC, CANFLEX-RU fuel bundles
/   - horizontal and uniform 3.1 % crept pressure tube
/   - heavy water-steam properties determined by HLWP at local (axial) pressure
/   - exit-skewed cosine axial heat flux profile
/   - fresh fuel radial heat flux distribution
/   - loss factors for bundle junctions, mid-plane spacer, bearing pads
/     and button planes.
/   - CHF determined by the LW-T-1995 lookup table
/
/=============================================================================
/
 9999
/
/=============================================================================
80101SISI1 ASSERT-PV V2R8 Input Modelling :  RUFIC(CANFLEX-RU) CANDU Base Case
/=============================================================================
/
/-----------------------------------------------------------------------------
/   Group 1:  Fluid Properties
/-----------------------------------------------------------------------------
/   N4 = 1: properties determined from HLWP property package
/   N5 = 0: properties evaluated using local (axial) pressure
/   N6 = 2: heavy-water coolant
/-----------------------------------------------------------------------------
    1    0    0    0    1    0    2
/-----------------------------------------------------------------------------
/   Group 2:  Friction Factor and Two-Phase Flow Options
/-----------------------------------------------------------------------------
/   N1 = 1: liquid non-equilibrium and vapour thermal equilibrium
/   N2 = 2: Colebrook-White turbulent friction factor, 0.8 um roughness height
/   N3 = 6: Friedel correlation for two-phase friction multiplier
/   N4 = 0: wall viscosity correction to friction factor
/   N5 = 1: laminar friction factor f = 64/Re
/   N6 = 0: Dittus-Boelter single-phase heat transfer correlation
/   N7 = 1: include gravity terms in transverse momentum equation
/   N8 = 1: include axial relative velocity option
/   N9 = 1: include lateral relative velocity option
/  N10 = 0: homogeneous two-phase multiplier for form losses
/-----------------------------------------------------------------------------
    2    1    2    6    0    1    0    1    1    1    0
 0.00008          * sheath roughness of 0.8 um.
 64.0 -1.0        * laminar friction factor f = 64/Re
  0.0             * axial relative velocity coefficients (not used)
 1.50 2.00        * lateral relative velocity coefficients
/-----------------------------------------------------------------------------
/   Group 3:  Axial Heat Flux Distribution
/-----------------------------------------------------------------------------
/   Exit-skewed cosine axial heat flux profile from the RUFIC bundles ????????
/   This profile reflects the unheated bundle end-plates at the beginning
/   and the end of the channel, each assumed to be 0.75 cm long.
/   The heat fluxes are normalized by the average heat flux over the HEATED
/   length.
/-----------------------------------------------------------------------------
    3   64
```

```
  0.0   0.0.0159.1790.0317.3347.0476.4635.0635.5794.0794.6864
.0952.7844.1111.8729.1270.9519.14291.024.15871.091.17461.152
.19051.208.20631.258.22221.304.23811.347.25401.382.26981.404
.28571.410.30161.396.31751.374.33331.349.34921.322.36511.299
.38101.282.39681.266.41271.250.42861.234.44441.220.46031.208
.47621.197.49211.187.50791.178.52381.170.53971.164.55561.159
.57141.156.58731.154.60321.153.61901.152.63491.152.65081.158
.66671.166.68251.173.69841.177.71431.173.73021.156.74601.127
.76191.090.77781.048.79371.004.8095.9589.8254.9084.84130.856
.8571.7998.8730.7408.8889.6774.9048.6070.9206.5301.93650.447
.9524.3574.9683.2584.9841.1380   1.0   0.0
/-------------------------------------------------------------------------------
/   Group 4:  Subchannel Layout and Dimension Data
/-------------------------------------------------------------------------------
/   RUFIC 43-Rod Full Bundle
/   Fresh fuel radial flux distribution (RFD).
/   Produced by CANGEO code
/   Fuel Channel Dimensions:
/      Pressure tube inside diameter        = 10.338 cm(10.338 design value)
/      Bundle diameter (incl bearing pads) = 10.250 cm(10.268 37-element)
/      Rod diameters (8 inner)               =  1.350 cm
/      Rod diameters (35 outer)              =  1.150 cm
/         Ring          # Rods  Diameter   Offset     RFD
/       - centre          1      0.0         0       0.910
/       - inner           7      3.468       0       0.947
/       - intermediate   14      6.150   12.857143   0.898
/       - outer          21      8.768       0       1.090
/   Computed Total Dimensions:
/       - flow area            =  36.13361 cm2
/       - wetted perimeter     = 192.85609 cm
/       - heated perimeter     = 160.37830 cm
/       - hydraulic diameter =   7.49442 cm
/-------------------------------------------------------------------------------
    4   70   70
    1.45972.1212.121    7.3840.8545270.0    8.15471.329 25.7    2.3840.8545141.4
    2.45972.1212.121   10.15471.329 77.1    3.3840.8545192.9
    3.45972.1212.121   12.15471.329128.6    4.3840.8545244.3
    4.45972.1212.121   14.15471.329180.0    5.3840.8545295.7
    5.45972.1212.121   16.15471.329231.4    6.3840.8545347.1
    6.45972.1212.121   18.15471.329282.9    7.3840.8545 38.6
    7.45972.1212.121   20.15471.329334.3
    8.83333.9183.918   21.18721.133297.6   23.21851.334 25.7    9.18721.133113.8
    9.28351.9061.906   25.2185.8851 51.4   10.18721.133169.1
   10.83333.9183.918   27.21851.334 77.1   11.18721.133165.2
   11.28351.9061.906   29.2185.8851102.9   12.18721.133220.5
   12.83333.9183.918   31.21851.334128.6   13.18721.133216.7
   13.28351.9061.906   33.2185.8851154.3   14.18721.133271.9
   14.83333.9183.918   35.21851.334180.0   15.18721.133268.1
   15.28351.9061.906   37.2185.8851205.7   16.18721.133323.3
   16.83333.9183.918   39.21851.334231.4   17.18721.133319.5
   17.28351.9061.906   41.2185.8851257.1   18.18721.133 14.8
   18.83333.9183.918   43.21851.334282.9   19.18721.133 10.9
   19.28351.9061.906   45.2185.8851308.6   20.18721.133 66.2
   20.83333.9183.918   47.21851.334334.3   21.18721.133 62.4
   21.28351.9061.906   49.2185.8851  0.0
   22.30961.8061.806   49.3958.7050241.8   50.15681.310  6.9   23.18751.104119.4
   23.74993.6133.613   51.15681.522 26.3   24.18751.104112.0
   24.30961.8061.806   52.15681.263 45.9   25.3958.7050169.7
   25.42911.8061.806   26.3958.7050113.2
   26.30961.8061.806   53.15681.214 59.1   27.18751.104170.8
   27.74993.6133.613   54.15681.392 77.9   28.18751.104163.5
   28.30961.8061.806   55.15681.107 97.1   29.3958.7050221.1
   29.42911.8061.806   30.3958.7050164.6
   30.30961.8061.806   56.15681.052109.0   31.18751.104222.3
   31.74993.6133.613   57.15681.230128.1   32.18751.104214.9
   32.30961.8061.806   58.1568.9567147.4   33.3958.7050272.5
   33.42911.8061.806   34.3958.7050216.1
   34.30961.8061.806   59.1568.9276159.5   35.18751.104273.7
   35.74993.6133.613   60.15681.145180.0   36.18751.104266.3
   36.30961.8061.806   61.1568.9276200.5   37.3958.7050323.9
   37.42911.8061.806   38.3958.7050267.5
   38.30961.8061.806   62.1568.9567212.6   39.18751.104325.1
   39.74993.6133.613   63.15681.230231.9   40.18751.104317.7
   40.30961.8061.806   64.15681.052251.0   41.3958.7050 15.4
   41.42911.8061.806   42.3958.7050318.9
   42.30961.8061.806   65.15681.107262.9   43.18751.104 16.5
   43.74993.6133.613   66.15681.392282.1   44.18751.104  9.2
   44.30961.8061.806   67.15681.214300.9   45.3958.7050 66.8
```

```
   45.42911.8061.806   46.3958.7050 10.3
   46.30961.8061.806   68.15681.261314.1   47.18751.104 68.0
   47.74993.6133.613   69.15681.522333.7   48.18751.104 60.6
   48.30961.8061.806   70.15681.310353.1   49.3958.7050118.2
   49.42911.8061.806
   501.3993.7151.992   70.70201.558270.0   51.68621.554107.9
   511.3443.6991.991   52.64061.543125.7
   521.2403.6711.988   53.57001.526143.3
   531.1033.6341.984   54.48191.507160.8
   54.94693.5941.980   55.38481.487178.0
   55.78883.5541.977   56.28761.468195.0
   56.64183.5191.973   57.19881.453211.9
   57.51683.4901.970   58.12551.444228.7
   58.42203.4681.968   59.07341.441245.3
   59.36293.4551.967   60.04641.441261.8
   60.34283.4501.966   61.04641.441278.2
   61.36293.4551.967   62.07341.441294.7
   62.42203.4681.968   63.12551.444311.3
   63.51683.4901.970   64.19881.453328.1
   64.64183.5191.973   65.28761.468345.0
   65.78883.5541.977   66.38481.487  2.0
   66.94693.5941.980   67.48191.507 19.2
   671.1033.6341.984   68.57001.526 36.7
   681.2403.6711.988   69.64061.543 54.3
   691.3443.6991.991   70.68621.554 72.1
   701.3993.7151.992
/------------------------------------------------------------------------------
/   Group 7:  Appendage Loss Factors (Uniform)
/------------------------------------------------------------------------------
/   Appendage Types:
/   1) Bundle Inlet
/   2) Oblong Buttons (used)
/   3) Cylindrial Buttons (not used)
/   4) Midplane Spacer and Bearing Pads
/   5) Bundle Junction
/
/   Description:
/   Appendage loss factors are obtained from AECL Memo (FCT-00-90, Sept. 2000).
/   Bearing pad height was assumed 1.4 mm.
/   Each subchannel K-factor was assumed uniform
/
/------------------------------------------------------------------------------
    7    2    0   73    5
* ---   Axial Location and Appendage Type  ---
.0002    1.0091    2.0209    3.0417    4.0624    3.0743    2
.0833    5.0924    2.1043    3.1250    4.1457    3.1576    2
.1667    5.1757    2.1876    3.2083    4.2291    3.2409    2
.2500    5.2591    2.2709    3.2917    4.3124    3.3243    2
.3333    5.3424    2.3543    3.3750    4.3957    3.4076    2
.4167    5.4257    2.4376    3.4583    4.4791    3.4909    2
.5000    5.5091    2.5209    3.5417    4.5624    3.5743    2
.5833    5.5924    2.6043    3.6250    4.6457    3.6576    2
.6667    5.6757    2.6876    3.7083    4.7291    3.7409    2
.7500    5.7591    2.7709    3.7917    4.8124    3.8243    2
.8333    5.8424    2.8543    3.8750    4.8957    3.9076    2
.9167    5.9257    2.9376    3.9583    4.9791    3.9909    2
.9998    5
* ---   Type 1 :  Bundle Entrance & Exit ---
    1.3586
    2.3586
    3.3586
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    8.3586
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   11.3586
   12.3586
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   16.3586
   17.3586
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   20.3586
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62.3586
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70.3586
* --- Type 2: Bearing Pads ---
1.0001
2.0001
3.0001
4.0001
5.0001
6.0001
7.0001
8.0001
9.0001
10.0001
11.0001
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* --- Type 3: Cylindrical Buttons ---
1.0707
2.0707
3.0707
4.0707
5.0707
6.0707
7.0707
8.0707
9.0707
10.0707
11.0707
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18.0707
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25.0707
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28.0707
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31.0707
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70.0707
* --- Type 4: Midplane Spacer and Bearing Pads ---
1.1325
2.1325
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9.1325
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68.1325
69.1325
70.1325
* ---  Type 5:  Bundle Junction ---
1.3586
2.3586
3.3586
4.3586
5.3586
6.3586
7.3586
8.3586
9.3586
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43.3586
44.3586
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46.3586
47.3586
48.3586
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   49.3586
   50.3586
   51.3586
   52.3586
   53.3586
   54.3586
   55.3586
   56.3586
   57.3586
   58.3586
   59.3586
   60.3586
   61.3586
   62.3586
   63.3586
   64.3586
   65.3586
   66.3586
   67.3586
   68.3586
   69.3586
   70.3586
/-------------------------------------------------------------------------------
/  Group 8:  Rod Layout and Radial Power Data
/-------------------------------------------------------------------------------
/  RUFIC 43-Rod Full Bundle
/  Fresh fuel radial flux distribution (RFD).
/  Produced by CANGEO.
/-------------------------------------------------------------------------------
   8   43   43    0    0    5    0    1    0    0    0    1
   11.3500.859    1.1429    2.1429    3.1429    4.1429    5.1429    6.1429    7.1429
   21.3500.908    1.1786    7.1786   20.2425   21.1579    8.2425
   31.3500.908    1.1786    8.2425    9.1579   10.2425    2.1786
   41.3500.908    2.1786   10.2425   11.1579   12.2425    3.1786
   51.3500.908    3.1786   12.2425   13.1579   14.2425    4.1786
   61.3500.908    4.1786   14.2425   15.1579   16.2425    5.1786
   71.3500.908    5.1786   16.2425   17.1579   18.2425    6.1786
   81.3500.908    6.1786   18.2425   19.1579   20.2425    7.1786
   91.1500.889    8.2575   21.1710   49.1770   22.1481   23.2463
  101.1500.889    8.2575   23.2463   24.1481   25.1770    9.1710
  111.1500.889    9.1710   25.1770   26.1481   27.2463   10.2575
  121.1500.889   10.2575   27.2463   28.1481   29.1770   11.1710
  131.1500.889   11.1710   29.1770   30.1481   31.2463   12.2575
  141.1500.889   12.2575   31.2463   32.1481   33.1770   13.1710
  151.1500.889   13.1710   33.1770   34.1481   35.2463   14.2575
  161.1500.889   14.2575   35.2463   36.1481   37.1770   15.1710
  171.1500.889   15.1710   37.1770   38.1481   39.2463   16.2575
  181.1500.889   16.2575   39.2463   40.1481   41.1770   17.1710
  191.1500.889   17.1710   41.1770   42.1481   43.2463   18.2575
  201.1500.889   18.2575   43.2463   44.1481   45.1770   19.1710
  211.1500.889   19.1710   45.1770   46.1481   47.2463   20.2575
  221.1500.889   20.2575   47.2463   48.1481   49.1770   21.1710
  231.1501.118   48.1532   70.2738   50.2738   22.1532   49.1460
  241.1501.118   22.1987   50.2776   51.2700   23.2537
  251.1501.118   23.2537   51.2810   52.2666   24.1987
  261.1501.118   24.1532   52.2836   53.2640   26.1532   52.2836
  271.1501.118   26.1987   53.2852   54.2624   27.2537
  281.1501.118   27.2537   54.2858   55.2618   28.1987
  291.1501.118   28.1532   55.2853   56.2624   30.1532   29.1460
  301.1501.118   30.1987   56.2838   57.2638   31.2537
  311.1501.118   31.2537   57.2815   58.2661   32.1987
  321.1501.118   32.1532   58.2787   59.2690   34.1532   33.1460
  331.1501.118   34.1987   59.2755   60.2722   35.2537
  341.1501.118   35.2537   60.2722   61.2755   36.1987
  351.1501.118   36.1532   61.2690   62.2787   38.1532   37.1460
  361.1501.118   38.1987   62.2661   63.2815   39.2537
  371.1501.118   39.2537   63.2638   64.2838   40.1987
  381.1501.118   40.1532   64.2624   65.2853   42.1532   41.1460
  391.1501.118   42.1987   65.2618   66.2858   43.2537
  401.1501.118   43.2537   66.2624   67.2852   44.1987
  411.1501.118   44.1532   67.2640   68.2836   46.1532   45.1460
  421.1501.118   46.1987   68.2666   69.2810   47.2537
  431.1501.118   47.2537   69.2700   70.2776   48.1987
   0    0    1    0    * apply CHF correction factor for orientation
/-------------------------------------------------------------------------------
/  Group 9:  Calculation Control Data
/-------------------------------------------------------------------------------
   9    0    0    0    0    0    3    0
```

```
   18    18   200      1       1.E-6       1.E-4       1.E-6       1.E-5       1.E-5
     1.E15      1          0.5      0
594.4   146 90.0 1.0 0.6670.667   1.00.667
   1249.5348.03    10
/-------------------------------------------------------------------------------
/   Group 10:  Mixing Parameters
/-------------------------------------------------------------------------------
   10     1     0
 0.05 0.0  * Constant turbulent void diffusion mixing coefficient
/-------------------------------------------------------------------------------
/   Group 11:  Operating Conditions and Forcing Function Data
/-------------------------------------------------------------------------------
   11     1     1
*    Pout          Tin           G           Q''
  10.00         256.00      5.5350    1.028384       * 20 kg/s, 9.5 MW
/-------------------------------------------------------------------------------
/   Group 12:  Output Printout Options
/-------------------------------------------------------------------------------
   12     0     1     0     0     9     0     0     0     6
  60
   4   5   6   7   8   9 10 11 12
    0
    0
```

APPENDIX II : Sample Output for ASSERT code

```
+-----------------------------------------+
|                                         |
|  ASSERT - PV V2R8 (VERSION 2 RELEASE 8)  |
|                                         |
|  ADVANCED SOLUTION OF SUBCHANNEL EQUATIONS |
|       IN REACTOR THERMALHYDRAULICS      |
|                                         |
+-----------------------------------------+

ASSERT IS A STATE OF THE ART SUBCHANNEL THERMALHYDRAULIC ANALYSIS CODE BEING DEVELOPED TO
COMPUTE FLOW AND ENTHALPY DISTRIBUTIONS FOR COOLANT BOILING IN ROD ARRAYS.  ASSERT USES
ADVANCED DRIFT-FLUX CONCEPTS AND THERMAL NON-EQUILIBRIUM TO PERMIT THE PHASES IN BOILING
WATER FLOWS TO EXHIBIT UNEQUAL VELOCITIES AND UNEQUAL TEMPERATURES (UVUT).

THE CURRENT VERSION WAS DEVELOPED JOINTLY BY D.S. ROWE AND ASSOCIATES AND THE COMPUTATIONAL
ANALYSIS SECTION, FUEL CHANNEL THERMALHYDRAULICS BRANCH, FUEL AND FUEL CYCLE DIVISION,
CHALK RIVER LABORATORIES.

                    USER INFORMATION IS REPORTED IN:

                ASSERT-PV V2R8 USERS MANUAL, COG-97-460

        E.K. ZARIFFEH, G.M. WADDINGTON, N. HAMMOUDA, L.N. CARLUCCI, V.C. FRISINA,
                J.C. KITELEY, D.S. ROWE AND P. PFEIFFER


                    ASSERT IS THE PROPERTY OF:

                        ATOMIC ENERGY OF CANADA LIMITED
            CHALK RIVER LABORATORIES - FUEL CHANNEL THERMALHYDRAULICS BRANCH

ASSERT HAS BEEN PARTIALLY FUNDED UNDER THE CANDU OWNERS GROUP (COG).  ONTARIO HYDRO,
NEW BRUNSWICK POWER AND HYDRO QUEBEC HAVE RIGHTS TO USE ASSERT UNDER THE COG AGREEMENT.
USE BY THIRD PARTIES IS RESTRICTED BY THIS AGREEMENT.


                            1998 JULY
```

```
+-------------------------------------+
| ASSERT-PV V2R8 (VERSION 2 RELEASE 8) |
|              1998 JULY              |
+-------------------------------------+

                    COPY OF USER INPUT

 LINE
NUMBER                                  LINE IMAGE
      1        10        20        30        40        50        60        70        80        90       100       110
.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....V.....
*****  /=============================================================================
*****  /
*****  /   FILE:  IM_pv_v2r8_0101.inp       J.H. Park  2000-12-1
*****  /
*****  /                 ********************************************
*****  /                 **          ASSERT INPUT MODELLING          **
*****  /                 **            FOR ASSERT-PV V2R8            **
*****  /                 **                 -----                    **
*****  /                 **          INPUT MODELLING CASE 0101:      **
*****  /                 **        RUFIC (43-ELEMENT) BASE CASE      **
*****  /                 ********************************************
*****  /
*****  /   DISCLAIMER
*****  /      This input file is for input modelling of RUFIC (CANFLEX-RU) bundle
*****  /   for ASSERT-PV V2R8 application.  It represents a CANDU fuel channel
*****  /   containing twelve RUFIC. The geometry input data were generated by CANGEO
*****  /   code which was developed by J.H. Park at KAERI.
*****  /
*****  /   DESCRIPTION
*****  /    - twelve fully-aligned RUFIC, CANFLEX-RU fuel bundles
*****  /    - horizontal and uniform 3.1 % crept pressure tube
*****  /    - heavy water-steam properties determined by HLWP at local (axial) pressure
*****  /    - exit-skewed cosine axial heat flux profile
*****  /    - fresh fuel radial heat flux distribution
*****  /    - loss factors for bundle junctions, mid-plane spacer, bearing pads
*****  /      and button planes.
*****  /    - CHF determined by the LW-T-1995 lookup table
*****  /
*****  /============================================================================
*****  /
00001  9999
*****  /
*****  /============================================================================
00002  80101SIS11 ASSERT-PV V2R8 Input Modelling :  RUFIC(CANFLEX-RU) CANDU Base Case
*****  /============================================================================
*****  /
*****  /  ---------------------------------------------------------------------------
*****  /     Group 1:  Fluid Properties
*****  /  ---------------------------------------------------------------------------
*****  /     N4 = 1: properties determined from HLWP property package
*****  /     N5 = 0: properties evaluated using local (axial) pressure
*****  /     N6 = 2: heavy-water coolant
*****  /  ---------------------------------------------------------------------------
00003  /     1    0    0    0    1    0    2
*****  /  ---------------------------------------------------------------------------
*****  /     Group 2:  Friction Factor and Two-Phase Flow Options
*****  /  ---------------------------------------------------------------------------
*****  /     N1 = 1: liquid non-equilibrium and vapour thermal equilibrium
*****  /     N2 = 2: Colebrook-White turbulent friction factor, 0.8 um roughness height
*****  /     N3 = 6: Friedel correlation for two-phase friction multiplier
*****  /     N4 = 0: wall viscosity correction to friction factor
*****  /     N5 = 1: laminar friction factor f = 64 Re
*****  /     N6 = 0: Dittus-Boelter single-phase heat transfer correlation
*****  /     N7 = 1: include gravity terms in transverse momentum equation
*****  /     N8 = 1: include axial relative velocity option
*****  /     N9 = 1: include lateral relative velocity option
*****  /    N10 = 0: homogeneous two-phase multiplier for form losses
*****  /  ---------------------------------------------------------------------------
00004  /     2    1    2    6    0    1    0    1    1    1    0
```

```
00005   0.00008          * sheath roughness of 0.8 um.
00006   64.0 -1.0        * laminar friction factor f = 64/Re
00007   0.0              * axial relative velocity coefficients (not used)
00008   1.50 2.00        * lateral relative velocity coefficients
*****   /---------------------------------------------------------------------------
*****   /   Group 3:  Axial Heat Flux Distribution
*****   /---------------------------------------------------------------------------
*****   /   Exit-skewed cosine axial heat flux profile from the RUFIC bundles ????????
*****   /   This profile reflects the unheated bundle end-plates at the beginning
*****   /   and the end of the channel, each assumed to be 0.75 cm long.
*****   /   The heat fluxes are normalized by the average heat flux over the HEATED
*****   /   length.
*****   /---------------------------------------------------------------------------
00009      3   64
00010    0.0   0.0.0159.1790.0317.3347.0476.4635.0635.5794.0794.6864
00011  .0952.7844.1111.8729.1270.9519.14291.024.15871.091.17461.152
00012  .19051.208.20631.238.22221.304.23811.347.25401.382.26981.404
00013  .28571.410.30161.396.31751.374.33331.349.34921.322.36511.299
00014  .38101.282.39681.266.41271.250.42861.234.44441.220.46031.208
00015  .47621.197.49211.187.50791.178.52381.170.53971.164.55561.159
00016  .57141.156.58731.154.60321.153.61901.152.63491.152.65081.158
00017  .66671.166.68251.173.69841.177.71431.173.73021.156.74601.127
00018  .76191.090.77781.048.79371.004.80951.9589.8254.9084.84130.856
00019  .8571.7998.8730.7408.8889.6774.9048.6070.9206.5301.93650.447
00020  .9524.3574.9683.2384.9841.1580   1.0   0.0
*****   /---------------------------------------------------------------------------
*****   /   Group 4:  Subchannel Layout and Dimension Data
*****   /---------------------------------------------------------------------------
*****   /   RUFIC 43-Rod Full Bundle
*****   /   Fresh fuel radial flux distribution (RFD).
*****   /   Produced by CANGEO code
*****   /   Fuel Channel Dimensions:
*****   /       Pressure tube inside diameter        = 10.663 cm(10.338 design value)
*****   /       Bundle diameter (incl bearing pads) = 10.230 cm(10.268 37-element)
*****   /       Rod diameters (8 inner)              =  1.350 cm
*****   /       Rod diameters (35 outer)             =  1.150 cm
*****   /          Ring          = Rods  Diameter   Offset    RFD
*****   /       - centre           1      0.0         0      0.910
*****   /       - inner            7      3.468       0      0.947
*****   /       - intermediate    14      6.150   12.857143  0.808
*****   /       - outer           21      8.768       0      1.090
*****   /   Computed Total Dimensions:
*****   /       - flow area          =  36.13361 cm2
*****   /       - wetted perimeter   = 122.85269 cm
*****   /       - heated perimeter   = 160.37880 cm
*****   /       - hydraulic diameter =   7.49442 cm
*****   /---------------------------------------------------------------------------
00021      4   70   70
00022      1.45972.1212.121     7.3840.8545270.0     8.15471.329  25.7     2.3840.8545141.4
00023      2.45972.1212.121    10.15471.329  77.1     3.3840.8545192.9
00024      3.45972.1212.121    12.15471.329128.6     4.3840.8545244.3
00025      4.45972.1212.121    14.15471.329180.0     5.3840.8545295.7
00026      5.45972.1212.121    16.15471.329231.4     6.3840.8545347.1
00027      6.45972.1212.121    18.15471.329282.9     7.3840.8545  38.6
00028      7.45972.1212.121    20.15471.329334.3
00029      8.83333.9183.918    21.18721.1332297.6    23.21851.334  25.7     9.18721.1331113.8
00030      9.28951.9061.906    23.21853.8851  51.4    10.18721.133169.1
00031     10.83333.9183.918    27.21851.334  77.1    11.18721.1331165.2
00032     11.28951.9061.906    29.21853.88511102.9    12.18721.1332220.5
00033     12.83333.9183.918    31.21851.3341226.6    13.18721.1332216.7
00034     13.28951.9061.906    33.21853.88511154.3    14.18721.133271.9
00035     14.83333.9183.918    35.21851.3341180.0    15.18721.1332268.1
00036     15.28951.9061.906    37.21853.88512057     16.18721.1333223.3
00037     16.83333.9183.918    39.21851.3342314      17.18721.1333119.5
00038     17.28951.9061.906    41.21853.8851257.1    18.18721.133  14.8
00039     18.83333.9183.918    43.21851.3342282.9    19.18721.133  10.9
00040     19.28951.9061.906    45.21853.88513086     20.18721.133  66.2
00041     20.83333.9183.918    47.21851.3343343      21.18721.133  62.4
00042     21.28951.9061.906    49.21853.8861   0.0
00043     22.30061.8061.806    49.3958.7050241.8     50.15681.310  6.9     23.18751.1041119.4
00044     23.74893.6133.613    51.15681.322  26.3    24.18751.1041112.0
00045     24.30061.8061.806    52.15681.263  45.9    25.3958.7050169.7
00046     25.42911.8061.806    26.3958.7050113.2
00047     26.30061.8061.806    53.15681.214  50.1    27.18751.1041170.8
00048     27.74893.6133.613    54.15681.392  77.9    28.18751.1041163.5
00049     28.30061.8061.806    55.15681.107  97.1    29.3958.7050221.1
00050     29.42911.8061.806    30.3958.7050164.6
00051     30.30061.8061.806    56.15681.0521100.0    31.18751.1042222.3
00052     31.74893.6133.613    57.15681.240128.1     32.18751.1042214.9
00053     32.30061.8061.806    58.1568.9567147.4     33.3958.7050272.5
00054     33.42911.8061.806    34.3958.7050216.1
00055     34.30061.8061.806    59.1568.9276159.5     35.18751.1042273.7
00056     35.74893.6133.613    60.15681.145180.0     36.18751.1042266.3
00057     36.30061.8061.806    61.1568.9276200.5     37.3958.7050323.9
00058     37.42911.8061.806    38.3958.7050267.5
00059     38.30061.8061.806    62.1568.8567212.6     39.18751.1043225.1
00060     39.74893.6133.613    63.15681.250231.9     40.18751.1043217.7
00061     40.30061.8061.806    64.15681.052251.0     41.3958.7050  15.4
00062     41.42911.8061.806    42.3958.7050318.9
00063     42.30061.8061.806    65.15681.1072262.9     43.18751.104  16.5
00064     43.74893.6133.613    66.15681.3922282.1     44.18751.104   9.2
00065     44.30061.8061.806    67.15681.214800.9      45.3958.7050  66.8
00066     45.42911.8061.806    46.3958.7050  10.3
00067     46.30061.8061.806    68.15681.261314.1      47.18751.104  68.0
00068     47.74893.6133.613    69.15681.522333.7      48.18751.104  60.6
00069     48.30061.8061.806    70.15681.310358.1      49.3958.7050118.2
00070     49.42911.8061.806
00071     501.3893.7151.992    70.70201.538270.0     51.68621.1554107.9
00072     511.3443.6891.991    32.64061.543125.7
00073     521.2403.6711.988    33.57001.526143.3
00074     531.1093.6341.984    34.48191.507160.8
00075     54.94693.5941.980    35.38481.487178.0
00076     55.78893.5541.977    36.28761.468195.0
00077     56.64183.5191.973    37.19881.453211.9
00078     57.51683.4901.970    38.12551.444228.7
00079     58.42203.4681.968    39.07341.441245.3
00080     59.36293.4551.967    40.04641.441261.8
00081     60.34293.4501.966    61.04641.441278.2
00082     61.36293.4551.967    62.07341.441294.7
00083     62.42203.4681.968    63.12551.444311.3
00084     63.51683.4901.970    64.19881.453328.1
00085     64.64183.5191.973    65.28761.468345.0
00086     65.78893.5541.977    66.38481.487   2.0
00087     66.94693.5941.980    67.48191.507  19.2
00088     671.1093.6341.984    68.57001.526  36.7
00089     681.2403.6711.988    69.64061.543  54.3
00090     691.3443.6891.991    70.69621.554  72.1
00091     701.3893.7151.992
*****   ---------------------------------------------------------------------------
*****   Group 7:  Appendage Loss Factors (Uniform)
*****   ---------------------------------------------------------------------------
*****   Appendage Types:
*****   1) Bundle Inlet
*****   2) Oblong Buttons (used)
*****   3) Cylindrial Buttons (not used)
```

```
*****  /   4) Midplane Spacer and Bearing Pads
*****  /   5) Bundle Junction
*****  /
*****  /   Description:
*****  /   Appendage loss factors are obtained from AECL Memo (FCT-00-90, Sept. 2000).
*****  /   Bearing pad height was assumed 1.4 mm.
*****  /   Each subchannel K-factor was assumed uniform
*****  /
*****  /-------------------------------------------------------------------------------
00092      7     2     0    73     5
*****  * ---  Axial Location and Appendage Type  ---
00093   .0002   1.0091   2.0209   3.0417   4.0624   3.0743   2
00094   .0833   5.0924   2.1043   3.1250   4.1457   3.1576   2
00095   .1667   5.1757   2.1876   3.2083   4.2291   3.2409   2
00096   .2500   5.2591   2.2709   3.2917   4.3124   3.3243   2
00097   .3333   5.3424   2.3543   3.3750   4.3957   3.4076   2
00098   .4167   5.4257   2.4376   3.4583   4.4791   3.4909   2
00099   .5000   5.5091   2.5209   3.5417   4.5624   3.5743   2
00100   .5833   5.5924   2.6043   3.6250   4.6457   3.6576   2
00101   .6667   5.6757   2.6876   3.7083   4.7291   3.7409   2
00102   .7500   5.7591   2.7709   3.7917   4.8124   3.8243   2
00103   .8333   5.8424   2.8543   3.8750   4.8957   3.9076   2
00104   .9167   5.9257   2.9376   3.9583   4.9791   3.9909   2
00105   .9998   5
*****  * ---  Type 1 :  Bundle Entrance & Exit  ---
00106      1.3586
00107      2.3586
00108      3.3586
00109      4.3586
00110      5.3586
00111      6.3586
00112      7.3586
00113      8.3586
00114      9.3586
00115     10.3586
00116     11.3586
00117     12.3586
00118     13.3586
00119     14.3586
00120     15.3586
00121     16.3586
00122     17.3586
00123     18.3586
00124     19.3586
00125     20.3586
00126     21.3586
00127     22.3586
00128     23.3586
00129     24.3586
00130     25.3586
00131     26.3586
00132     27.3586
00133     28.3586
00134     29.3586
00135     30.3586
00136     31.3586
00137     32.3586
00138     33.3586
00139     34.3586
00140     35.3586
00141     36.3586
00142     37.3586
00143     38.3586
00144     39.3586
00145     40.3586
00146     41.3586
00147     42.3586
00148     43.3586
00149     44.3586
00150     45.3586
00151     46.3586
00152     47.3586
00153     48.3586
00154     49.3586
00155     50.3586
00156     51.3586
00157     52.3586
00158     53.3586
00159     54.3586
00160     55.3586
00161     56.3586
00162     57.3586
00163     58.3586
00164     59.3586
00165     60.3586
00166     61.3586
00167     62.3586
00168     63.3586
00169     64.3586
00170     65.3586
00171     66.3586
00172     67.3586
00173     68.3586
00174     69.3586
00175     70.3586
*****  * ---  Type 2 :  Bearing Pads  ---
00176      1.0001
00177      2.0001
00178      3.0001
00179      4.0001
00180      5.0001
00181      6.0001
00182      7.0001
00183      8.0001
00184      9.0001
00185     10.0001
00186     11.0001
00187     12.0001
00188     13.0001
00189     14.0001
00190     15.0001
00191     16.0001
00192     17.0001
00193     18.0001
00194     19.0001
00195     20.0001
00196     21.0001
00197     22.0001
00198     23.0001
00199     24.0001
00200     25.0001
00201     26.0001
00202     27.0001
00203     28.0001
00204     29.0001
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00205     30.0001
00206     31.0001
00207     32.0001
00208     33.0001
00209     34.0001
00210     35.0001
00211     36.0001
00212     37.0001
00213     38.0001
00214     39.0001
00215     40.0001
00216     41.0001
00217     42.0001
00218     43.0001
00219     44.0001
00220     45.0001
00221     46.0001
00222     47.0001
00223     48.0001
00224     49.0001
00225     50.0001
00226     51.0001
00227     52.0001
00228     53.0001
00229     54.0001
00230     55.0001
00231     56.0001
00232     57.0001
00233     58.0001
00234     59.0001
00235     60.0001
00236     61.0001
00237     62.0001
00238     63.0001
00239     64.0001
00240     65.0001
00241     66.0001
00242     67.0001
00243     68.0001
00244     69.0001
00245     70.0001
***** * --- Type 3: Cylindrical Buttons ---
00246      1.0707
00247      2.0707
00248      3.0707
00249      4.0707
00250      5.0707
00251      6.0707
00252      7.0707
00253      8.0707
00254      9.0707
00255     10.0707
00256     11.0707
00257     12.0707
00258     13.0707
00259     14.0707
00260     15.0707
00261     16.0707
00262     17.0707
00263     18.0707
00264     19.0707
00265     20.0707
00266     21.0707
00267     22.0707
00268     23.0707
00269     24.0707
00270     25.0707
00271     26.0707
00272     27.0707
00273     28.0707
00274     29.0707
00275     30.0707
00276     31.0707
00277     32.0707
00278     33.0707
00279     34.0707
00280     35.0707
00281     36.0707
00282     37.0707
00283     38.0707
00284     39.0707
00285     40.0707
00286     41.0707
00287     42.0707
00288     43.0707
00289     44.0707
00290     45.0707
00291     46.0707
00292     47.0707
00293     48.0707
00294     49.0707
00295     50.0707
00296     51.0707
00297     52.0707
00298     53.0707
00299     54.0707
00300     55.0707
00301     56.0707
00302     57.0707
00303     58.0707
00304     59.0707
00305     60.0707
00306     61.0707
00307     62.0707
00308     63.0707
00309     64.0707
00310     65.0707
00311     66.0707
00312     67.0707
00313     68.0707
00314     69.0707
00315     70.0707
***** * --- Type 4: Midplane Spacer and Bearing Pads ---
00316      1.1325
00317      2.1325
00318      3.1325
00319      4.1325
00320      5.1325
00321      6.1325
00322      7.1325
00323      8.1325
00324      9.1325
00325     10.1325
00326     11.1325
00327     12.1325
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00328      13.1325
00329      14.1325
00330      15.1325
00331      16.1325
00332      17.1325
00333      18.1325
00334      19.1325
00335      20.1325
00336      21.1325
00337      22.1325
00338      23.1325
00339      24.1325
00340      25.1325
00341      26.1325
00342      27.1325
00343      28.1325
00344      29.1325
00345      30.1325
00346      31.1325
00347      32.1325
00348      33.1325
00349      34.1325
00350      35.1325
00351      36.1325
00352      37.1325
00353      38.1325
00354      39.1325
00355      40.1325
00356      41.1325
00357      42.1325
00358      43.1325
00359      44.1325
00360      45.1325
00361      46.1325
00362      47.1325
00363      48.1325
00364      49.1325
00365      50.1325
00366      51.1325
00367      52.1325
00368      53.1325
00369      54.1325
00370      55.1325
00371      56.1325
00372      57.1325
00373      58.1325
00374      59.1325
00375      60.1325
00376      61.1325
00377      62.1325
00378      63.1325
00379      64.1325
00380      65.1325
00381      66.1325
00382      67.1325
00383      68.1325
00384      69.1325
00385      70.1325
***** * --- Type 5: Bundle Junction ---
00386      1.35386
00387      2.35386
00388      3.35386
00389      4.35386
00390      5.35386
00391      6.35386
00392      7.35386
00393      8.35386
00394      9.35386
00395      10.35386
00396      11.35386
00397      12.35386
00398      13.35386
00399      14.35386
00400      15.35386
00401      16.35386
00402      17.35386
00403      18.35386
00404      19.35386
00405      20.35386
00406      21.35386
00407      22.35386
00408      23.35386
00409      24.35386
00410      25.35386
00411      26.35386
00412      27.35386
00413      28.35386
00414      29.35386
00415      30.35386
00416      31.35386
00417      32.35386
00418      33.35386
00419      34.35386
00420      35.35386
00421      36.35386
00422      37.35386
00423      38.35386
00424      39.35386
00425      40.35386
00426      41.35386
00427      42.35386
00428      43.35386
00429      44.35386
00430      45.35386
00431      46.35386
00432      47.35386
00433      48.35386
00434      49.35386
00435      50.35386
00436      51.35386
00437      52.35386
00438      53.35386
00439      54.35386
00440      55.35386
00441      56.35386
00442      57.35386
00443      58.35386
00444      59.35386
00445      60.35386
00446      61.35386
00447      62.35386
00448      63.35386
00449      64.35386
00450      65.35386
00451      66.35386
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00452     67.3586
00453     68.3586
00454     69.3586
00455     70.3586
*****  /---------------------------------------------------------------------------
*****  /   Group 8:  Rod Layout and Radial Power Data
*****  /---------------------------------------------------------------------------
*****  /   RUFIC 43-Rod Full Bundle
*****  /   Fresh fuel radial flux distribution (RFD).
*****  /   Produced by CANGEO.
*****  /---------------------------------------------------------------------------
00456     8   43   43    0    0    5    0    1    0    0    0    1
00457     11.3500.839    1.1429    2.1429    3.1429    4.1429    5.1429    6.1429    7.1429
00458     21.3500.908    1.1786    7.1786   20.2425   21.1579    8.2425
00459     31.3500.908    1.1786    8.2425    9.1579   10.2425    2.1786
00460     41.3500.908    2.1786   10.2425   11.1579   12.2425    3.1786
00461     51.3500.908    3.1786   12.2425   13.1579   14.2425    4.1786
00462     61.3500.908    4.1786   14.2425   15.1579   16.2425    5.1786
00463     71.3500.908    5.1786   16.2425   17.1579   18.2425    6.1786
00464     81.3500.908    6.1786   18.2425   19.1579   20.2425    7.1786
00465     91.1500.889    8.2575   21.1710   49.1770   22.1481   23.2463
00466    101.1500.889    8.2575   23.2463   24.1481   25.1770    9.1710
00467    111.1500.889    9.1710   25.1770   26.1481   27.2463   10.2575
00468    121.1500.889   10.2575   27.2463   28.1481   29.1770   11.1710
00469    131.1500.889   11.1710   29.1770   30.1481   31.2463   12.2575
00470    141.1500.889   12.2575   31.2463   32.1481   33.1770   13.1710
00471    151.1500.889   13.1710   33.1770   34.1481   35.2463   14.2575
00472    161.1500.889   14.2575   35.2463   36.1481   37.1770   15.1710
00473    171.1500.889   15.1710   37.1770   38.1481   39.2463   16.2575
00474    181.1500.889   16.2575   39.2463   40.1481   41.1770   17.1710
00475    191.1500.889   17.1710   41.1770   42.1481   43.2463   18.2575
00476    201.1500.889   18.2575   43.2463   44.1481   45.1770   19.1710
00477    211.1500.889   19.1710   45.1770   46.1481   47.2463   20.2575
00478    221.1500.889   20.2575   47.2463   48.1481   49.1770   21.1710
00479    231.1501.118   48.1532   70.2738   50.2738   22.1532   49.1460
00480    241.1501.118   22.1987   50.2776   51.2700   23.2537
00481    251.1501.118   23.2537   51.2810   52.2666   24.1987
00482    261.1501.118   24.1532   52.2836   53.2640   26.1532   52.2836
00483    271.1501.118   26.1987   53.2852   54.2624   27.2537
00484    281.1501.118   27.2537   54.2858   55.2618   28.1987
00485    291.1501.118   28.1532   55.2853   56.2624   30.1532   29.1460
00486    301.1501.118   30.1987   56.2838   57.2638   31.2537
00487    311.1501.118   31.2537   57.2815   58.2661   32.1987
00488    321.1501.118   32.1532   58.2787   59.2690   34.1532   33.1460
00489    331.1501.118   34.1987   59.2755   60.2722   35.2537
00490    341.1501.118   35.2537   60.2722   61.2755   36.1987
00491    351.1501.118   36.1532   61.2690   62.2787   38.1532   37.1460
00492    361.1501.118   38.1987   62.2661   63.2815   39.2537
00493    371.1501.118   39.2537   63.2638   64.2838   40.1987
00494    381.1501.118   40.1532   64.2624   65.2853   42.1532   41.1460
00495    391.1501.118   42.1987   65.2618   66.2858   43.2537
00496    401.1501.118   43.2537   66.2624   67.2852   44.1987
00497    411.1501.118   44.1532   67.2640   68.2836   46.1532   45.1460
00498    421.1501.118   46.1987   68.2666   69.2810   47.2537
00499    431.1501.118   47.2537   69.2700   70.2776   48.1987
00500     0    0    1    0    * apply CHF correction factor for orientation
*****  /---------------------------------------------------------------------------
*****  /   Group 9:  Calculation Control Data
*****  /---------------------------------------------------------------------------
00501     9    0    0    0    0    0    3    0
00502    18   18  200    1    1.E-6     1.E-4     1.E-6     1.E-5     1.E-5
00503     1.E15    1      0.5    0
00504  594.4   146 90.0 1.0 0.6670.667   1.00.667
00505     1249.5348.03    10
*****  /---------------------------------------------------------------------------
*****  /   Group 10:  Mixing Parameters
*****  /---------------------------------------------------------------------------
00506     10    1    0
00507   0.05 0.0   * Constant turbulent void diffusion mixing coefficient
*****  /---------------------------------------------------------------------------
*****  /   Group 11:  Operating Conditions and Forcing Function Data
*****  /---------------------------------------------------------------------------
00508     11    1    1
*****  *   Pout        Tin         G          Q"
00509    10.00        256.00     5.5350    1.028384     * 20 kg/s, 9.5 MW
*****  /---------------------------------------------------------------------------
*****  /   Group 12:  Output Printout Options
*****  /---------------------------------------------------------------------------
00510     12    0    1    0    0    9    0    0    0    6
00511     60
00512      4  5  6  7  8  9 10 11 12
00513      0
00514      0
```

ASSERT-PV DIMENSION PARAMETERS

MC - Number of subchannels. Add 1 for the pressure tube and 2 for the feeders.
MR - Number of fuel rods.
MG - Number of subchannel gap connections. Add 1 for the pressure tube.
MX - Number of axial locations for control volumes. Add 4 for the inlet and exit plenum and their boundaries to satisfy max(NDX+4, NDXIN+4, NDXEX+4).
MN - Number of radial nodes in TEMP2 fuel rod model (pellet, gap, cladding). Number of fuel pellet collocation points plus 3 (gap, cladding) for the TEMP fuel model. TEMP2 requirements normally determine this PARAMETER.
MP - Number of entries in property table.
MO - Number of gaps associated with a subchannel pair. LLI=MO+1 in dimension of LOCAL(LLI,MG). Use MO=5 for hexagonal array. Use MO=7 for square array including CANDU.
MSC - Number of azimuthal segments for fuel rod. Use 6 for up to six subchannels surrounding a rod.
ML - Number of axial locations for gap and area variations.
MA - Number of subchannels that can have area variations.
MS - Number of gaps that can have gap spacing variations.
MZ - Number of axial locations for grid spacers (appendages).
MK - Number of grid spacer types.
MT - Number of fuel types. Use 1 since only one fuel type is presently used in ASSERT-PV.
MY - Number of axial fuel type subdivisions. Use 1 since axially varying zones are not presently supported in ASSERT-PV.
MD - Number of elements in coefficient matrix COEFF(MD,MD), right side vector ERROR(MD) and solution vector ANSWER(MD). COEFF is used for both square and banded matrices. Set MD to the maximum of MC (MOMAX), MN (TEMP2) or 2*MX (REBAL2).
MAXNS - Maximum number of neighbouring subchannels

```
   MC=  100      MG=  201      MR=  100      MN=   10
   MW=    1      MP=  100      MX=  250      ME=    1
   MY=    1      MK=   25      MZ=  150      MS=   25
   MA=   35      ML=   50      MT=    1      MI=    1
   MO=    7      NI=    8      N1=    3      MD=  500
INPUT FOR CASE 80101      ASSERT-PV V2R8 Input Modelling :  RUFIC(CANFLEX-RU) CANDU Base    DATE  101- 1-18 TIME 16:18:31


SUMMARY OF INPUT OPTIONS
GROUP    N1   N2   N3   N4   N5   N6   N7   N8   N9  N10  N11
    1     0    0    0    1    0    2    0    0    0    0    0
    2     1    2    6    0    1    0    1    1    1    0    0
    3    64    0    0    0    0    0    0    0    0    0    0
    4    70   70    0    0    0    0    0    0    0    0    0
    7     2    0   73    5    0    0    0    0    0    0    0
    8    43   43    0    0    5    0    1    0    0    0    1
    9     0    0    0    0    0    3    0    0    0    0    0
   10     1    0    0    0    0    0    0    0    0    0    0
   11     1    1    0    0    0    0    0    0    0    0    0
   12     0    1    0    0    9    0    0    0    6    0    0

--------------------GROUP  1: WATER-STEAM PROPERTY TABLE--------------------

PROPERTY TABLE   HEAVY-WATER PROPERTIES FROM HLWP

     P          T          VF          VG          HF          HG          VISC.       KF        SIGMA
   [MPA]    [DEG. C]    [M3/KG]     [M3/KG]     [KJ/KG]     [KJ/KG]     [KG/S-M]    [W/M-C]     [N/M]

  0.0010       9.63   0.0009904   117.28788       24.62     2533.59   0.001759   0.582753   0.073350
  0.0020      20.03   0.0009905    60.52671       68.74     2550.86   0.001294   0.598051   0.071850
  0.0040      31.34   0.0009907    31.41717      116.70     2569.75   0.000961   0.612420   0.070117
  0.0050      35.27   0.0009908    25.48753      133.04     2576.14   0.000873   0.616880   0.069492
  0.0060      38.52   0.0009909    21.48881      146.66     2581.51   0.000810   0.620360   0.068968
  0.0080      43.70   0.0009910    16.38434      169.04     2590.25   0.000734   0.625522   0.068121
  0.0100      47.94   0.0009912    13.27883      186.93     2597.27   0.000680   0.629414   0.067415
  0.0200      62.15   0.0009918     6.91164      246.61     2620.13   0.000538   0.640297   0.064974
  0.0400      77.62   0.0009926     3.60067      311.91     2645.07   0.000432   0.648509   0.062208
  0.0500      83.15   0.0009929     2.92806      335.07     2653.45   0.000402   0.650563   0.061195
  0.0600      87.78   0.0009932     2.46821      354.21     2660.48   0.000380   0.651988   0.060338
  0.0800      95.10   0.0009937     1.88425      384.44     2671.85   0.000349   0.653486   0.058965
  0.1000     101.05   0.0009941     1.52692      409.49     2680.87   0.000327   0.654189   0.057835
  0.2000     121.57   0.0009957     0.79486      495.54     2709.98   0.000267   0.653956   0.053844
  0.3000     134.56   0.0009968     0.54384      549.02     2727.08   0.000239   0.649388   0.051247
  0.4000     144.53   0.0009978     0.41593      590.40     2739.36   0.000220   0.645258   0.049215
  0.5000     152.67   0.0009986     0.33749      624.55     2748.85   0.000207   0.641024   0.047532
  0.6000     159.73   0.0009993     0.28397      654.25     2756.25   0.000197   0.636742   0.046056
  0.7000     165.93   0.0010000     0.24515      680.22     2762.19   0.000189   0.632530   0.044746
  0.8000     171.39   0.0010006     0.21571      703.08     2767.26   0.000182   0.628477   0.043583
  0.9000     176.23   0.0010012     0.19260      723.42     2771.61   0.000177   0.624614   0.042542
  1.0000     180.59   0.0010017     0.17398      741.83     2775.35   0.000172   0.620930   0.041598
  1.5000     198.58   0.0010042     0.11737      819.16     2788.02   0.000155   0.603700   0.037643
  2.0000     212.62   0.0010062     0.08857      880.36     2794.65   0.000144   0.588072   0.034491
  2.5000     224.32   0.0010081     0.07108      931.86     2797.88   0.000136   0.573692   0.031820
  3.0000     234.19   0.0010099     0.05930      975.76     2798.93   0.000129   0.560511   0.029544
  3.5000     242.65   0.0010116     0.05080     1014.08     2798.42   0.000125   0.548600   0.027576
  4.0000     250.14   0.0010132     0.04436     1048.83     2796.73   0.000121   0.537503   0.025835
  4.5000     257.04   0.0010147     0.03939     1081.53     2794.12   0.000117   0.526924   0.024280
  5.0000     263.52   0.0010163     0.03520     1112.03     2790.74   0.000114   0.516690   0.022880
  5.5000     269.47   0.0010178     0.03180     1140.65     2786.69   0.000112   0.506928   0.021591
  6.0000     275.03   0.0010193     0.02895     1167.76     2782.08   0.000109   0.497577   0.019389
  6.5000     280.28   0.0010208     0.02650     1193.75     2776.94   0.000107   0.488514   0.018761
  7.0000     285.27   0.0010223     0.02439     1218.74     2771.33   0.000105   0.479678   0.017597
  7.5000     290.03   0.0010238     0.02255     1242.81     2765.27   0.000104   0.471080   0.016494
  8.0000     294.56   0.0010253     0.02093     1266.03     2758.81   0.000102   0.462728   0.015450
  8.5000     298.88   0.0010268     0.01950     1288.45     2751.96   0.000100   0.454628   0.014462
  9.0000     302.99   0.0010284     0.01821     1310.16     2744.72   0.000099   0.446781   0.013528
  9.5000     306.91   0.0010300     0.01705     1331.23     2737.08   0.000098   0.439186   0.012644
 10.0000     310.66   0.0010316     0.01601     1351.71     2729.05   0.000097   0.431840   0.011809
 10.5000     314.23   0.0010332     0.01505     1371.69     2720.60   0.000095   0.424736   0.011019
 11.0000     317.66   0.0010349     0.01418     1391.23     2711.76   0.000094   0.417865   0.010271
 11.5000     320.93   0.0010366     0.01337     1410.40     2702.49   0.000093   0.411216   0.009563
 12.0000     324.08   0.0010384     0.01263     1429.27     2692.82   0.000093   0.404775   0.008891
 12.5000     327.11   0.0010403     0.01194     1447.92     2682.72   0.000092   0.398525   0.008252
 13.0000     330.03   0.0010422     0.01130     1466.40     2672.20   0.000091   0.392448   0.007644
 13.5000     332.86   0.0010442     0.01071     1484.80     2661.26   0.000090   0.386522   0.007064
 14.0000     335.61   0.0010463     0.01015     1503.17     2649.82   0.000089   0.380724   0.006508
 14.5000     338.28   0.0010485     0.00962     1521.60     2637.82   0.000089   0.375027   0.005975
 15.0000     340.90   0.0010508     0.00912     1540.08     2625.19   0.000088   0.369405   0.005462
 15.5000     343.47   0.0010532     0.00865     1558.62     2611.86   0.000087   0.363826   0.004967
 16.0000     346.00   0.0010558     0.00820     1577.31     2597.76   0.000087   0.358267   0.004487
 16.5000     348.47   0.0010585     0.00777     1596.20     2582.81   0.000086   0.352803   0.004027
 17.0000     350.87   0.0010615     0.00736     1615.31     2566.96   0.000086   0.347450   0.003589
 17.5000     353.21   0.0010647     0.00696     1634.68     2550.07   0.000085   0.342205   0.003170
 18.0000     355.49   0.0010683     0.00657     1654.66     2531.84   0.000085   0.337062   0.002770
 18.5000     357.72   0.0010723     0.00619     1675.58     2511.95   0.000084   0.332016   0.002388
 19.0000     359.90   0.0010768     0.00582     1697.78     2490.08   0.000084   0.327059   0.002024
 19.5000     362.02   0.0010821     0.00544     1721.60     2465.38   0.000083   0.322185   0.001676
 20.0000     364.11   0.0010885     0.00505     1747.49     2436.60   0.000083   0.317386   0.001345

SATURATION PROPERTIES CALCULATED AT CHANNEL 1 PRESSURE

SUBMODELS (CHF) BASED ON HEAVY-WATER COOLANT


--------------------GROUP  2: FRICTION FACTORS AND TWO PHASE FLOW OPTIONS--------------------

FRICTION FACTOR CORRELATION
   Subchannel type  1:  f = max ( Colebrook type 2 (roughness height = .800E-04 cm), 64.000*Re**(-1.000) + 0.0000 )
   WALL VISCOCITY CORRECTION TO FRICTION FACTOR IS NOT INCLUDED

TWO-PHASE FLOW CORRELATIONS
   LIQUID THERMAL NON-EQUILIBRIUM
   VAPOUR THERMAL EQUILIBRIUM
   Friedel Two-Phase Friction Multiplier
   Two-phase multiplier for form losses:  Homogeneous model


RELATIVE VELOCITY PARAMETERS
   AXIAL DIRECTION      1     0.0000     0.0000     0.0000     0.0000
   LATERAL DIRECTION    1     1.5000     2.0000     0.0000     0.0000
BILATERAL MOMENTUM GRAVITY HEAD TERMS INCLUDED


--------------------GROUP  3: AXIAL HEAT FLUX PROFILE TABLE--------------------

AXIAL HEAT FLUX DISTRIBUTION

 AXIAL   LOCATION      RELATIVE
 (X/L)     [CM]     HEAT  FLUX
```

0.000	0.00	0.000
0.016	9.45	0.179
0.032	18.84	0.335
0.048	28.29	0.464
0.064	37.74	0.579
0.079	47.19	0.686
0.095	56.58	0.784
0.111	66.03	0.873
0.127	75.48	0.952
0.143	84.93	1.024
0.159	94.32	1.091
0.175	103.78	1.152
0.191	113.23	1.208
0.206	122.62	1.258
0.222	132.07	1.304
0.238	141.52	1.347
0.254	150.97	1.382
0.270	160.36	1.404
0.286	169.81	1.410
0.302	179.26	1.396
0.318	188.71	1.374
0.333	198.10	1.349
0.349	207.55	1.322
0.365	217.00	1.293
0.381	226.45	1.262
0.397	235.84	1.266
0.413	245.29	1.250
0.429	254.74	1.234
0.444	264.13	1.220
0.460	273.58	1.208
0.476	283.03	1.197
0.492	292.48	1.187
0.508	301.88	1.178
0.524	311.33	1.170
0.540	320.78	1.164
0.556	330.23	1.159
0.571	339.62	1.156
0.587	349.07	1.154
0.603	358.52	1.153
0.619	367.91	1.152
0.635	377.36	1.152
0.651	386.81	1.153
0.667	396.26	1.166
0.683	405.65	1.173
0.698	415.10	1.177
0.714	424.55	1.173
0.730	434.00	1.156
0.746	443.39	1.127
0.762	452.84	1.090
0.778	462.29	1.048
0.794	471.74	1.004
0.810	481.13	0.959
0.825	490.58	0.908
0.841	500.04	0.856
0.857	509.43	0.800
0.873	518.88	0.741
0.889	528.33	0.677
0.905	537.78	0.607
0.921	547.17	0.530
0.937	556.62	0.447
0.952	566.07	0.357
0.968	575.52	0.258
0.984	584.91	0.138
1.000	594.36	0.000

WEIGHTED AVERAGE AXIAL HEAT FLUX (assuming AFD normalized over channel length) = 1.00009

----------GROUP 4: SUBCHANNEL LAYOUT AND DIMENSION DATA----------

SUBCHANNEL INPUT DATA

CHANNEL NO.	TYPE	FLOW AREA [CM2]	WETTED PERIM. [CM]	HEATED PERIM. [CM]	HYDRAULIC DIAMETER [CM]	(ADJACENT CHANNEL NO., SPACING, CENTROID DIST., GAP ANGLE) [CM] [CM] [DEG.]
1	1	0.4597	2.1210	2.1210	0.86935	(7,0.384,0.855, 270.)(8,0.155,1.329, 26.)(2,0.384,0.855, 141.)(0,0.000,0.000, 0.)
2	1	0.4597	2.1210	2.1210	0.86935	(10,0.155,1.329, 77.)(3,0.384,0.855, 193.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
3	1	0.4597	2.1210	2.1210	0.86935	(12,0.155,1.329, 129.)(4,0.384,0.855, 244.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
4	1	0.4597	2.1210	2.1210	0.86935	(14,0.155,1.329, 180.)(5,0.384,0.855, 296.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
5	1	0.4597	2.1210	2.1210	0.86935	(16,0.155,1.329, 231.)(6,0.384,0.855, 347.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
6	1	0.4597	2.1210	2.1210	0.86935	(18,0.155,1.329, 283.)(7,0.384,0.855, 39.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
7	1	0.4597	2.1210	2.1210	0.86935	(20,0.155,1.329, 334.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
8	1	0.8333	3.9180	3.9180	0.85074	(21,0.187,1.133, 298.)(23,0.219,1.334, 26.)(9,0.187,1.133, 114.)(0,0.000,0.000, 0.)
9	1	0.2835	1.9060	1.9060	0.59496	(25,0.219,0.885, 51.)(10,0.187,1.133, 169.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
10	1	0.8333	3.9180	3.9180	0.85074	(27,0.219,1.334, 77.)(11,0.187,1.133, 165.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
11	1	0.2835	1.9060	1.9060	0.59496	(29,0.219,0.885, 103.)(12,0.187,1.133, 221.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
12	1	0.8333	3.9180	3.9180	0.85074	(31,0.219,1.334, 129.)(13,0.187,1.133, 217.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
13	1	0.2835	1.9060	1.9060	0.59496	(33,0.219,0.885, 154.)(14,0.187,1.133, 272.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
14	1	0.8333	3.9180	3.9180	0.85074	(35,0.219,1.334, 180.)(15,0.187,1.133, 268.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
15	1	0.2835	1.9060	1.9060	0.59496	(37,0.219,0.885, 206.)(16,0.187,1.133, 323.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
16	1	0.8333	3.9180	3.9180	0.85074	(39,0.219,1.334, 231.)(17,0.187,1.133, 320.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
17	1	0.2835	1.9060	1.9060	0.59496	(41,0.219,0.885, 257.)(18,0.187,1.133, 15.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
18	1	0.8333	3.9180	3.9180	0.85074	(43,0.219,1.334, 283.)(19,0.187,1.133, 11.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
19	1	0.2835	1.9060	1.9060	0.59496	(45,0.219,0.885, 309.)(20,0.187,1.133, 66.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
20	1	0.8333	3.9180	3.9180	0.85074	(47,0.219,1.334, 334.)(21,0.187,1.133, 62.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
21	1	0.2835	1.9060	1.9060	0.59496	(49,0.219,0.885, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
22	1	0.3096	1.8060	1.8060	0.68571	(49,0.396,0.705, 242.)(50,0.157,1.310, 7.)(23,0.188,1.104, 119.)(0,0.000,0.000, 0.)
23	1	0.7499	3.6130	3.6130	0.83022	(51,0.157,1.522, 26.)(24,0.188,1.104, 112.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
24	1	0.3096	1.8060	1.8060	0.68571	(52,0.157,1.263, 46.)(25,0.396,0.705, 170.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
25	1	0.4291	1.8060	1.8060	0.95089	(26,0.396,0.705, 113.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
26	1	0.3096	1.8060	1.8060	0.68571	(53,0.157,1.214, 59.)(27,0.188,1.104, 171.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
27	1	0.7499	3.6130	3.6130	0.83022	(54,0.157,1.382, 78.)(28,0.188,1.104, 164.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
28	1	0.3096	1.8060	1.8060	0.68571	(55,0.157,1.107, 97.)(29,0.396,0.705, 221.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
29	1	0.4291	1.8060	1.8060	0.95089	(30,0.396,0.705, 163.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
30	1	0.3096	1.8060	1.8060	0.68571	(56,0.157,1.032, 109.)(31,0.188,1.104, 222.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
31	1	0.7499	3.6130	3.6130	0.83022	(57,0.157,1.220, 128.)(32,0.188,1.104, 215.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
32	1	0.3096	1.8060	1.8060	0.68571	(58,0.157,0.957, 147.)(33,0.396,0.705, 273.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
33	1	0.4291	1.8060	1.8060	0.95089	(34,0.396,0.705, 216.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
34	1	0.3096	1.8060	1.8060	0.68571	(59,0.157,0.928, 160.)(35,0.188,1.104, 274.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
35	1	0.7499	3.6130	3.6130	0.83022	(60,0.157,1.145, 180.)(36,0.188,1.104, 266.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
36	1	0.3096	1.8060	1.8060	0.68571	(61,0.157,0.928, 201.)(37,0.396,0.705, 324.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
37	1	0.4291	1.8060	1.8060	0.95089	(38,0.396,0.705, 268.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
38	1	0.3096	1.8060	1.8060	0.68571	(62,0.157,0.957, 213.)(39,0.188,1.104, 325.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
39	1	0.7499	3.6130	3.6130	0.83022	(64,0.157,1.220, 232.)(40,0.188,1.104, 318.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
40	1	0.3096	1.8060	1.8060	0.68571	(64,0.157,1.032, 251.)(41,0.396,0.705, 15.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
41	1	0.4291	1.8060	1.8060	0.95089	(42,0.396,0.705, 319.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
42	1	0.3096	1.8060	1.8060	0.68571	(65,0.157,1.107, 263.)(43,0.188,1.104, 17.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
43	1	0.7499	3.6130	3.6130	0.83022	(66,0.157,1.382, 282.)(44,0.188,1.104, 9.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
44	1	0.3096	1.8060	1.8060	0.68571	(67,0.157,1.214, 301.)(45,0.396,0.705, 67.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
45	1	0.4291	1.8060	1.8060	0.95089	(46,0.396,0.705, 10.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)
46	1	0.3096	1.8060	1.8060	0.68571	(68,0.157,1.261, 314.)(47,0.188,1.104, 68.)(0,0.000,0.000, 0.)(0,0.000,0.000, 0.)

47	1	0.7499	3.6130	3.6130	0.83022	(	69,0.157,1.522,	334.)(	48,0.188,1.104,	61.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
48	1	0.3096	1.8060	1.8060	0.68371	(	70,0.157,1.310,	353.)(	49,0.396,0.705,	118.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
49	1	0.4291	1.8060	1.8060	0.95039	(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
50	1	1.3990	3.7150	1.9920	1.50633	(	70,0.702,1.558,	270.)(	51,0.686,1.554,	108.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
51	1	1.3440	3.6910	1.9910	1.45337	(	52,0.641,1.543,	126.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
52	1	1.2400	3.6710	1.9880	1.35113	(	53,0.570,1.526,	143.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
53	1	1.1030	3.6340	1.9840	1.21409	(	54,0.482,1.507,	161.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
54	1	0.9469	3.5940	1.9800	1.05387	(	55,0.385,1.487,	178.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
55	1	0.7888	3.5540	1.9770	0.88779	(	56,0.288,1.468,	195.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
56	1	0.6418	3.5190	1.9730	0.72853	(	57,0.199,1.453,	212.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
57	1	0.5168	3.4900	1.9700	0.59232	(	58,0.126,1.444,	229.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
58	1	0.4220	3.4680	1.9680	0.48674	(	59,0.073,1.441,	245.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
59	1	0.3629	3.4550	1.9670	0.42014	(	60,0.046,1.441,	262.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
60	1	0.3428	3.4500	1.9660	0.39745	(	61,0.046,1.441,	278.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
61	1	0.3629	3.4550	1.9670	0.42014	(	62,0.073,1.441,	295.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
62	1	0.4220	3.4680	1.9680	0.48674	(	63,0.126,1.444,	311.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
63	1	0.5168	3.4900	1.9700	0.59232	(	64,0.199,1.453,	328.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
64	1	0.6418	3.5190	1.9730	0.72853	(	65,0.288,1.468,	345.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
65	1	0.7888	3.5540	1.9770	0.88779	(	66,0.385,1.487,	2.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
66	1	0.9469	3.5940	1.9800	1.05387	(	67,0.482,1.507,	19.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
67	1	1.1030	3.6340	1.9840	1.21409	(	68,0.570,1.526,	37.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
68	1	1.2400	3.6710	1.9880	1.35113	(	69,0.641,1.543,	54.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
69	1	1.3440	3.6910	1.9910	1.45337	(	70,0.686,1.554,	72.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)
70	1	1.3990	3.7150	1.9920	1.50633	(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)(	0,0.000,0.000,	0.)

TOTAL FLOW AREA = 41.4961 [CM2] = 0.004150 [M2]
TOTAL HEATED PERIMETER = 160.3780 [CM] = 1.603780 [M]
TOTAL WETTED PERIMETER = 193.8800 [CM] = 1.938800 [M]

SUBCHANNEL INTERCONNECTIONS - GAP MAPPING TABLE

GAP NUMBER [K]	INTERCONNECTED SUBCHANNELS [II] - [JJJ]		GAP WIDTH [CM]	CENTROID DISTANCE [CM]	ORIENTATION ANGLE [DEGREES]
1	1	7	0.38400	0.85450	270.00000
2	1	8	0.15470	1.32900	25.70000
3	1	2	0.38400	0.85450	141.40000
4	2	10	0.15470	1.32900	77.10000
5	2	3	0.38400	0.85450	192.90000
6	3	12	0.15470	1.32900	128.60000
7	3	4	0.38400	0.85450	244.30000
8	4	14	0.15470	1.32900	180.00000
9	4	5	0.38400	0.85450	295.70000
10	5	16	0.15470	1.32900	231.40000
11	5	6	0.38400	0.85450	347.10000
12	6	18	0.15470	1.32900	282.90000
13	6	7	0.38400	0.85450	38.60000
14	7	20	0.15470	1.32900	334.30000
15	8	21	0.18720	1.13300	247.60000
16	8	23	0.21850	1.33400	25.70000
17	8	9	0.18720	1.13300	113.80000
18	9	25	0.21850	0.88510	51.40000
19	9	10	0.18720	1.13300	169.10000
20	10	27	0.21850	1.33400	77.10000
21	10	11	0.18720	1.13300	165.20000
22	11	29	0.21850	0.88510	102.90000
23	11	12	0.18720	1.13300	220.50000
24	12	31	0.21850	1.33400	128.60000
25	12	13	0.18720	1.13300	216.70000
26	13	33	0.21850	0.88510	154.30000
27	13	14	0.18720	1.13300	271.90000
28	14	35	0.21850	1.33400	180.00000
29	14	15	0.18720	1.13300	268.10000
30	15	37	0.21850	0.88510	205.70000
31	15	16	0.18720	1.13300	323.30000
32	16	39	0.21850	1.33400	231.40000
33	16	17	0.18720	1.13300	319.50000
34	17	41	0.21850	0.88510	257.10000
35	17	18	0.18720	1.13300	14.80000
36	18	43	0.21850	1.33400	282.90000
37	18	19	0.18720	1.13300	10.90000
38	19	45	0.21850	0.88510	308.60000
39	19	20	0.18720	1.13300	66.20000
40	20	47	0.21850	1.33400	334.30000
41	20	21	0.18720	1.13300	62.40000
42	21	49	0.21850	0.88510	0.00000
43	22	49	0.39580	0.70500	241.80000
44	22	50	0.15680	1.31000	6.90000
45	23	23	0.18750	1.10400	119.40000
46	23	51	0.15680	1.52200	26.30000
47	23	24	0.18750	1.10400	112.00000
48	24	52	0.15680	1.26300	45.90000
49	24	25	0.39580	0.70500	169.70000
50	25	26	0.39580	0.70500	113.20000
51	26	53	0.15680	1.21400	59.10000
52	26	27	0.18750	1.10400	170.80000
53	27	54	0.15680	1.39200	77.90000
54	27	28	0.18750	1.10400	163.50000
55	28	55	0.15680	1.10700	97.10000
56	28	29	0.39580	0.70500	221.10000
57	29	30	0.39580	0.70500	164.60000
58	30	56	0.15680	1.05200	109.00000
59	30	31	0.18750	1.10400	222.30000
60	31	57	0.15680	1.23000	128.10000
61	31	32	0.18750	1.10400	214.90000
62	32	58	0.15680	0.95670	147.40000
63	32	33	0.39580	0.70500	272.50000
64	33	34	0.39580	0.70500	216.10000
65	34	59	0.15680	0.92750	159.50000
66	34	35	0.18750	1.10400	273.70000
67	35	60	0.15680	1.14500	180.00000
68	35	36	0.18750	1.10400	266.30000
69	36	61	0.15680	0.92760	200.50000
70	36	37	0.39580	0.70500	323.90000
71	37	38	0.39580	0.70500	267.50000
72	38	62	0.15680	0.95670	212.60000
73	38	39	0.18750	1.10400	325.10000
74	39	63	0.15680	1.23000	231.90000
75	39	40	0.18750	1.10400	317.70000
76	40	64	0.15680	1.05200	251.00000
77	40	41	0.39580	0.70500	15.40000
78	41	42	0.39580	0.70500	318.90000
79	42	65	0.15680	1.10700	262.90000
80	42	43	0.18750	1.10400	16.50000
81	43	66	0.15680	1.39200	282.10000
82	43	44	0.18750	1.10400	9.20000
83	44	67	0.15680	1.21400	300.90000
84	44	45	0.39580	0.70500	66.80000
85	45	46	0.39580	0.70500	10.30000

86	46	68	0.15680	1.26100	314.10000
87	46	47	0.18750	1.10400	68.00000
88	47	69	0.15680	1.52200	333.70000
89	47	48	0.18750	1.10400	60.60000
90	48	70	0.15680	1.31000	353.10000
91	48	49	0.39580	0.70500	118.20000
92	50	70	0.70200	1.55800	270.00000
93	50	51	0.68620	1.55400	107.90000
94	51	52	0.64060	1.54300	125.70000
95	52	53	0.57000	1.52600	143.30000
96	53	54	0.48190	1.50700	160.80000
97	54	55	0.38480	1.48700	178.00000
98	55	56	0.28760	1.46800	195.00000
99	56	57	0.19880	1.45300	211.90000
100	57	58	0.12550	1.44400	228.70000
101	58	59	0.07340	1.44100	245.30000
102	59	60	0.04640	1.44100	261.80000
103	60	61	0.04640	1.44100	278.20000
104	61	62	0.07340	1.44100	294.70000
105	62	63	0.12550	1.44400	311.30000
106	63	64	0.19880	1.45300	328.10000
107	64	65	0.28760	1.46800	345.00000
108	65	66	0.38480	1.48700	2.00000
109	66	67	0.48190	1.50700	19.20000
110	67	68	0.57000	1.52600	36.70000
111	68	69	0.64060	1.54400	54.30000
112	69	70	0.68620	1.55400	72.10000

----------GROUP 5: SUBCHANNEL FLOW VARIATION TABLE----------

----------GROUP 6: GAP SIZE VARIATION TABLE----------

----------GROUP 7: GRID SPACER DATA----------

Form Losses at 73 Axial Locations

AXIAL LOCATION (X/L)	LOSS TYPE (No.)	AXIAL LOCATION (X/L)	LOSS TYPE (No.)	AXIAL LOCATION (X/L)	LOSS TYPE (No.)	AXIAL LOCATION (X/L)	LOSS TYPE (No.)	AXIAL LOCATION (X/L)	LOSS TYPE (No.)	AXIAL LOCATION (X/L)	LOSS TYPE (No.)	AXIAL LOCATION	LOSS TYPE
0.0002	1	0.0091	2	0.0209	3	0.0417	4	0.0624	3	0.0743	2		
0.0833	5	0.0924	2	0.1043	3	0.1250	4	0.1457	3	0.1576	2		
0.1667	5	0.1757	2	0.1876	3	0.2083	4	0.2291	3	0.2409	2		
0.2500	5	0.2591	2	0.2709	3	0.2917	4	0.3124	3	0.3243	2		
0.3333	5	0.3424	2	0.3543	3	0.3750	4	0.3957	3	0.4076	2		
0.4167	5	0.4257	2	0.4376	3	0.4583	4	0.4791	3	0.4909	2		
0.5000	5	0.5091	2	0.5209	3	0.5417	4	0.5624	3	0.5743	2		
0.5833	5	0.5924	2	0.6043	3	0.6250	4	0.6457	3	0.6576	2		
0.6667	5	0.6757	2	0.6876	3	0.7083	4	0.7291	3	0.7409	2		
0.7500	5	0.7591	2	0.7709	3	0.7917	4	0.8124	3	0.8243	2		
0.8333	5	0.8424	2	0.8543	3	0.8750	4	0.8957	3	0.9076	2		
0.9167	5	0.9257	2	0.9376	3	0.9583	4	0.9791	3	0.9909	2		
0.9998	5												

Form Loss Type: 1

CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.
1	0.3586	2	0.3586	3	0.3586	4	0.3586	5	0.3586	6	0.3586		
7	0.3586	8	0.3586	9	0.3586	10	0.3586	11	0.3586	12	0.3586		
13	0.3586	14	0.3586	15	0.3586	16	0.3586	17	0.3586	18	0.3586		
19	0.3586	20	0.3586	21	0.3586	22	0.3586	23	0.3586	24	0.3586		
25	0.3586	26	0.3586	27	0.3586	28	0.3586	29	0.3586	30	0.3586		
31	0.3586	32	0.3586	33	0.3586	34	0.3586	35	0.3586	36	0.3586		
37	0.3586	38	0.3586	39	0.3586	40	0.3586	41	0.3586	42	0.3586		
43	0.3586	44	0.3586	45	0.3586	46	0.3586	47	0.3586	48	0.3586		
49	0.3586	50	0.3586	51	0.3586	52	0.3586	53	0.3586	54	0.3586		
55	0.3586	56	0.3586	57	0.3586	58	0.3586	59	0.3586	60	0.3586		
61	0.3586	62	0.3586	63	0.3586	64	0.3586	65	0.3586	66	0.3586		
67	0.3586	68	0.3586	69	0.3586	70	0.3586						

Form Loss Type: 2

CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.
1	0.0001	2	0.0001	3	0.0001	4	0.0001	5	0.0001	6	0.0001		
7	0.0001	8	0.0001	9	0.0001	10	0.0001	11	0.0001	12	0.0001		
13	0.0001	14	0.0001	15	0.0001	16	0.0001	17	0.0001	18	0.0001		
19	0.0001	20	0.0001	21	0.0001	22	0.0001	23	0.0001	24	0.0001		
25	0.0001	26	0.0001	27	0.0001	28	0.0001	29	0.0001	30	0.0001		
31	0.0001	32	0.0001	33	0.0001	34	0.0001	35	0.0001	36	0.0001		
37	0.0001	38	0.0001	39	0.0001	40	0.0001	41	0.0001	42	0.0001		
43	0.0001	44	0.0001	45	0.0001	46	0.0001	47	0.0001	48	0.0001		
49	0.0001	50	0.0001	51	0.0001	52	0.0001	53	0.0001	54	0.0001		
55	0.0001	56	0.0001	57	0.0001	58	0.0001	59	0.0001	60	0.0001		
61	0.0001	62	0.0001	63	0.0001	64	0.0001	65	0.0001	66	0.0001		
67	0.0001	68	0.0001	69	0.0001	70	0.0001						

Form Loss Type: 3

CHANNEL NO	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.
1	0.0707	2	0.0707	3	0.0707	4	0.0707	5	0.0707	6	0.0707		
7	0.0707	8	0.0707	9	0.0707	10	0.0707	11	0.0707	12	0.0707		
13	0.0707	14	0.0707	15	0.0707	16	0.0707	17	0.0707	18	0.0707		
19	0.0707	20	0.0707	21	0.0707	22	0.0707	23	0.0707	24	0.0707		
25	0.0707	26	0.0707	27	0.0707	28	0.0707	29	0.0707	30	0.0707		
31	0.0707	32	0.0707	33	0.0707	34	0.0707	35	0.0707	36	0.0707		
37	0.0707	38	0.0707	39	0.0707	40	0.0707	41	0.0707	42	0.0707		
43	0.0707	44	0.0707	45	0.0707	46	0.0707	47	0.0707	48	0.0707		
49	0.0707	50	0.0707	51	0.0707	52	0.0707	53	0.0707	54	0.0707		
55	0.0707	56	0.0707	57	0.0707	58	0.0707	59	0.0707	60	0.0707		
61	0.0707	62	0.0707	63	0.0707	64	0.0707	65	0.0707	66	0.0707		
67	0.0707	68	0.0707	69	0.0707	70	0.0707						

Form Loss Type: 4

CHANNEL NO	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.
1	0.1325	2	0.1325	3	0.1325	4	0.1325	5	0.1325	6	0.1325		
7	0.1325	8	0.1325	9	0.1325	10	0.1325	11	0.1325	12	0.1325		
13	0.1325	14	0.1325	15	0.1325	16	0.1325	17	0.1325	18	0.1325		
19	0.1325	20	0.1325	21	0.1325	22	0.1325	23	0.1325	24	0.1325		

25	0.1325	26	0.1325	27	0.1325	28	0.1325	29	0.1325	30	0.1325
31	0.1325	32	0.1325	33	0.1325	34	0.1325	35	0.1325	36	0.1325
37	0.1325	38	0.1325	39	0.1325	40	0.1325	41	0.1325	42	0.1325
43	0.1325	44	0.1325	45	0.1325	46	0.1325	47	0.1325	48	0.1325
49	0.1325	50	0.1325	51	0.1325	52	0.1325	53	0.1325	54	0.1325
55	0.1325	56	0.1325	57	0.1325	58	0.1325	59	0.1325	60	0.1325
61	0.1325	62	0.1325	63	0.1325	64	0.1325	65	0.1325	66	0.1325
67	0.1325	68	0.1325	69	0.1325	70	0.1325				

Form Loss Type: 5

CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.	CHANNEL NO.	LOSS COEFF.
1	0.3586	2	0.3586	3	0.3586	4	0.3586	5	0.3586	6	0.3586
7	0.3586	8	0.3586	9	0.3586	10	0.3586	11	0.3586	12	0.3586
13	0.3586	14	0.3586	15	0.3586	16	0.3586	17	0.3586	18	0.3586
19	0.3586	20	0.3586	21	0.3586	22	0.3586	23	0.3586	24	0.3586
25	0.3586	26	0.3586	27	0.3586	28	0.3586	29	0.3586	30	0.3586
31	0.3586	32	0.3586	33	0.3586	34	0.3586	35	0.3586	36	0.3586
37	0.3586	38	0.3586	39	0.3586	40	0.3586	41	0.3586	42	0.3586
43	0.3586	44	0.3586	45	0.3586	46	0.3586	47	0.3586	48	0.3586
49	0.3586	50	0.3586	51	0.3586	52	0.3586	53	0.3586	54	0.3586
55	0.3586	56	0.3586	57	0.3586	58	0.3586	59	0.3586	60	0.3586
61	0.3586	62	0.3586	63	0.3586	64	0.3586	65	0.3586	66	0.3586
67	0.3586	68	0.3586	69	0.3586	70	0.3586				

----------GROUP 8: FUEL ROD LAYOUT AND PROPERTY DATA----------

ROD INPUT DATA

ROD NO.	TYPE NO.	DIAMETER [CM]	RADIAL POWER FACTOR	FRACTION OF POWER TO ADJACENT CHANNELS (ADJ. CHANNEL NO.)						
1	1	1.3500	0.8890	0.1429(1)	0.1429(2)	0.1429(3)	0.1429(4)	0.1429(5)	0.1429(6)	0.1429(7)
2	1	1.3500	0.9080	0.1786(1)	0.1786(7)	0.2425(20)	0.1579(21)	0.2425(8)	0.0000(0)	0.0000(0)
3	1	1.3500	0.9080	0.1786(1)	0.2425(8)	0.1579(9)	0.2425(10)	0.1786(2)	0.0000(0)	0.0000(0)
4	1	1.3500	0.9080	0.1786(2)	0.2425(10)	0.1579(11)	0.2425(12)	0.1786(3)	0.0000(0)	0.0000(0)
5	1	1.3500	0.9080	0.1786(3)	0.2425(12)	0.1579(13)	0.2425(14)	0.1786(4)	0.0000(0)	0.0000(0)
6	1	1.3500	0.9080	0.1786(4)	0.2425(14)	0.1579(15)	0.2425(16)	0.1786(5)	0.0000(0)	0.0000(0)
7	1	1.3500	0.9080	0.1786(5)	0.2425(16)	0.1579(17)	0.2425(18)	0.1786(6)	0.0000(0)	0.0000(0)
8	1	1.3500	0.9080	0.1786(6)	0.2425(18)	0.1579(19)	0.2425(20)	0.1786(7)	0.0000(0)	0.0000(0)
9	1	1.1500	0.8890	0.2575(8)	0.1710(21)	0.1770(49)	0.1481(22)	0.2463(23)	0.0000(0)	0.0000(0)
10	1	1.1500	0.8890	0.2575(8)	0.2463(23)	0.1481(24)	0.1770(25)	0.1710(9)	0.0000(0)	0.0000(0)
11	1	1.1500	0.8890	0.1710(9)	0.1770(25)	0.1481(26)	0.2463(27)	0.2575(10)	0.0000(0)	0.0000(0)
12	1	1.1500	0.8890	0.2575(10)	0.2463(27)	0.1481(28)	0.1770(29)	0.1710(11)	0.0000(0)	0.0000(0)
13	1	1.1500	0.8890	0.1710(11)	0.1770(29)	0.1481(30)	0.2463(31)	0.2575(12)	0.0000(0)	0.0000(0)
14	1	1.1500	0.8890	0.2575(12)	0.2463(31)	0.1481(32)	0.1770(33)	0.1710(13)	0.0000(0)	0.0000(0)
15	1	1.1500	0.8890	0.1710(13)	0.1770(33)	0.1481(34)	0.2463(35)	0.2575(14)	0.0000(0)	0.0000(0)
16	1	1.1500	0.8890	0.2575(14)	0.2463(35)	0.1481(36)	0.1770(37)	0.1710(15)	0.0000(0)	0.0000(0)
17	1	1.1500	0.8890	0.1710(15)	0.1770(37)	0.1481(38)	0.2463(39)	0.2575(16)	0.0000(0)	0.0000(0)
18	1	1.1500	0.8890	0.2575(16)	0.2463(39)	0.1481(40)	0.1770(41)	0.1710(17)	0.0000(0)	0.0000(0)
19	1	1.1500	0.8890	0.1710(17)	0.1770(41)	0.1481(42)	0.2463(43)	0.2575(18)	0.0000(0)	0.0000(0)
20	1	1.1500	0.8890	0.2575(18)	0.2463(43)	0.1481(44)	0.1770(45)	0.1710(19)	0.0000(0)	0.0000(0)
21	1	1.1500	0.8890	0.1710(19)	0.1770(45)	0.1481(46)	0.2463(47)	0.2575(20)	0.0000(0)	0.0000(0)
22	1	1.1500	0.8890	0.2575(20)	0.2463(47)	0.1481(48)	0.1770(49)	0.1710(21)	0.0000(0)	0.0000(0)
23	1	1.1500	1.1180	0.1532(48)	0.2738(70)	0.2738(50)	0.1532(22)	0.1460(49)	0.0000(0)	0.0000(0)
24	1	1.1500	1.1180	0.1987(22)	0.2776(50)	0.2700(51)	0.2537(23)	0.0000(0)	0.0000(0)	0.0000(0)
25	1	1.1500	1.1180	0.2537(23)	0.2810(51)	0.2666(52)	0.1987(24)	0.0000(0)	0.0000(0)	0.0000(0)
26	1	1.1500	1.1180	0.1532(24)	0.2836(52)	0.2640(53)	0.1532(26)	0.2836(52)	0.0000(0)	0.0000(0)
27	1	1.1500	1.1180	0.1987(26)	0.2852(53)	0.2624(54)	0.2537(27)	0.0000(0)	0.0000(0)	0.0000(0)
28	1	1.1500	1.1180	0.2537(27)	0.2858(54)	0.2618(55)	0.1987(28)	0.0000(0)	0.0000(0)	0.0000(0)
29	1	1.1500	1.1180	0.1532(28)	0.2853(55)	0.2624(56)	0.1532(30)	0.1460(29)	0.0000(0)	0.0000(0)
30	1	1.1500	1.1180	0.1987(30)	0.2838(56)	0.2638(57)	0.2537(31)	0.0000(0)	0.0000(0)	0.0000(0)
31	1	1.1500	1.1180	0.2537(31)	0.2815(57)	0.2661(58)	0.1987(32)	0.0000(0)	0.0000(0)	0.0000(0)
32	1	1.1500	1.1180	0.1532(32)	0.2787(58)	0.2690(59)	0.1532(34)	0.1460(33)	0.0000(0)	0.0000(0)
33	1	1.1500	1.1180	0.1987(34)	0.2755(59)	0.2722(60)	0.2537(35)	0.0000(0)	0.0000(0)	0.0000(0)
34	1	1.1500	1.1180	0.2537(35)	0.2722(60)	0.2755(61)	0.1987(36)	0.0000(0)	0.0000(0)	0.0000(0)
35	1	1.1500	1.1180	0.1532(36)	0.2690(61)	0.2787(62)	0.1532(38)	0.1460(37)	0.0000(0)	0.0000(0)
36	1	1.1500	1.1180	0.1987(38)	0.2661(62)	0.2815(63)	0.2537(39)	0.0000(0)	0.0000(0)	0.0000(0)
37	1	1.1500	1.1180	0.2537(39)	0.2638(63)	0.2838(64)	0.1987(40)	0.0000(0)	0.0000(0)	0.0000(0)
38	1	1.1500	1.1180	0.1532(40)	0.2624(64)	0.2853(65)	0.1532(42)	0.1460(41)	0.0000(0)	0.0000(0)
39	1	1.1500	1.1180	0.1987(42)	0.2618(65)	0.2858(66)	0.2537(43)	0.0000(0)	0.0000(0)	0.0000(0)
40	1	1.1500	1.1180	0.2537(43)	0.2624(66)	0.2852(67)	0.1987(44)	0.0000(0)	0.0000(0)	0.0000(0)
41	1	1.1500	1.1180	0.1532(44)	0.2640(67)	0.2836(68)	0.1532(46)	0.1460(45)	0.0000(0)	0.0000(0)
42	1	1.1500	1.1180	0.1987(46)	0.2666(68)	0.2810(69)	0.2537(47)	0.0000(0)	0.0000(0)	0.0000(0)
43	1	1.1500	1.1180	0.2537(47)	0.2700(69)	0.2776(70)	0.1987(48)	0.0000(0)	0.0000(0)	0.0000(0)

ROD INPUT DATA POWER BALANCE SUMMARY

THE TOTAL HEATED PERIMETER OF THE RODS = 160.87678147 [CM]
THE COMPUTED NUMBER OF RODS (SUM OF FRACTIONS) = 43.13780000
THE OVERALL AVERAGE ROD RADIAL POWER FACTOR = 1.00042255

FUEL MODEL OPTION [NC=0] = NO FUEL MODEL SELECTED

CRITICAL HEAT FLUX OPTION [NCHF=5] = LW-T-1995 CHF TABLE LOOK UP METHOD

CHF CALCULATION OPTION [NHTC=0] = POST MORTEM CHF CALCULATION, NEGLECTS PDO

Pre-CHF Wall Heat Transfer Division Option [NHFW = 0]: Chen correlation

CHF LOOK-UP TABLE CORRECTION FACTOR FOR FLOW ORIENTATION IS APPLIED

----------GROUP 9: CALCULATION CONTROL AND AXIAL NODING DATA----------

IMPLICIT SOLUTION

DATA FOR IMPLICIT SOLUTION

EXTERNAL ITERATION LIMIT (NTRIES) = 200
INTERNAL ITERATION LIMIT (MAXINR) = 18
(REBALANCING EVERY 1 INNER ITERATIONS)
ENERGY ITERATION LIMIT (IELIMT) = 18

CONVERGENCE CRITERIA :

DELTA ENTHALPY ERROR (HERROR) = 1.00E-06
DELTA FLOW ERROR (FERROR) = 1.00E-04
DELTA CONTINUITY ERROR (MERROR) = 1.00E-06
LATERAL MOMENTUM ERROR (TERROR) = 1.00E-02 [KG] (NOT USED)
AXIAL MOMENTUM ERROR (AXERROR) = 1.00E-02 [KG] (NOT USED)

STEADY STATE SOLUTION PARAMETERS :

STEP SIZE (SSDT) = 1.0E+15 [SECONDS]
NUMBER OF STEPS (NSSS) = 1

TRANSIENT SOLUTION PARAMETERS :

TOTAL TRANSIENT TIME (TTIME) = 0.0000 [SECONDS]
TIME STEP SIZE (TTDT) = 0.5000 [SECONDS]
NUMBER OF TIME STEPS (NDT) = 0

CALCULATION PARAMETERS

CHANNEL LENGTH (Z) = 594.3600 [CM]
NUMBER OF AXIAL NODES (NDX) = 133
BUNDLE ORIENTATION (THETA) = 90.0000 [DEGREES]

LATERAL K FACTOR (KIJ) = 1.0000
LATERAL RELAXATION (WRELAX) = 0.6670
AXIAL RELAXATION (FRELAX) = 0.6670
ENTHALPY RELAXATION (HRELAX) = 0.6670
DENSITY RELAXATION (RRELAX) = 1.0000

CANDU BUNDLES DATA

NUMBER OF CANDU BUNDLES = 12
LENGTH OF ONE CANDU BUNDLE = 49.5300 [CM]
HEATED LENGTH OF ONE CANDU BUNDLE = 48.0300 [CM]
NO. OF AXIAL NODES IN HEATED LENGTH OF ONE BUNDLE = 10

The heated zone in each bundle is discretized axially following a geometric progression where L(j) / L(j-1) = 1.41689154804915

AXIAL NODING AND POWER FACTORS FOR 133 NODES

NODE J	X(J) [CM]	DX(J) [CM]	FACTOR QAX(J)	NODE ID
1	0.00	0.00	0.0000	1
2	0.75	0.75	0.0000	2
3	2.88	2.13	0.0543	0
4	5.89	3.01	0.0830	0
5	10.15	4.27	0.1518	0
6	16.20	6.05	0.2408	0
7	24.77	8.57	0.3559	0
8	33.33	8.57	0.4718	0
9	39.38	6.05	0.5622	0
10	43.64	4.27	0.6221	0
11	46.65	3.01	0.6633	0
12	48.78	2.13	0.6918	0
13	50.28	1.50	0.0000	2
14	52.41	2.13	0.7297	0
15	55.42	3.01	0.7565	0
16	59.68	4.27	0.7933	0
17	65.73	6.05	0.8417	0
18	74.30	8.57	0.9062	0
19	82.86	8.57	0.9754	0
20	88.91	6.05	1.0306	0
21	93.17	4.27	1.0676	0
22	96.18	3.01	1.0931	0
23	98.31	2.13	1.1099	0
24	99.81	1.50	0.0000	2
25	101.94	2.13	1.1333	0
26	104.95	3.01	1.1497	0
27	109.21	4.27	1.1716	0
28	115.26	6.05	1.2019	0
29	123.83	8.57	1.2416	0
30	132.39	8.57	1.2847	0
31	138.44	6.05	1.3192	0
32	142.70	4.27	1.3426	0
33	145.71	3.01	1.3570	0
34	147.84	2.13	1.3665	0
35	149.34	1.50	0.0000	2
36	151.47	2.13	1.3788	0
37	154.48	3.01	1.3897	0
38	158.74	4.27	1.3952	0
39	164.79	6.05	1.4045	0
40	173.36	8.57	1.4080	0
41	181.92	8.57	1.3981	0
42	187.97	6.05	1.3828	0
43	192.23	4.27	1.3703	0
44	195.24	3.01	1.3606	0
45	197.37	2.13	1.3538	0
46	198.87	1.50	0.0000	2
47	201.00	2.13	1.3438	0
48	204.01	3.01	1.3364	0
49	208.27	4.27	1.3261	0
50	214.32	6.05	1.3129	0
51	222.89	8.57	1.2964	0
52	231.45	8.57	1.2808	0
53	237.50	6.05	1.2683	0
54	241.76	4.27	1.2596	0
55	244.77	3.01	1.2534	0
56	246.90	2.13	1.2491	0
57	248.40	1.50	0.0000	2
58	250.53	2.13	1.2429	0
59	253.54	3.01	1.2386	0
60	257.80	4.27	1.2327	0
61	263.85	6.05	1.2249	0
62	272.42	8.57	1.2149	0
63	280.98	8.57	1.2044	0
64	287.03	6.05	1.1960	0
65	291.29	4.27	1.1905	0
66	294.30	3.01	1.1867	0
67	296.43	2.13	1.1842	0
68	297.93	1.50	0.0000	2
69	300.06	2.13	1.1808	0
70	303.07	3.01	1.1783	0
71	307.33	4.27	1.1752	0
72	313.38	6.05	1.1709	0
73	321.95	8.57	1.1660	0
74	330.51	8.57	1.1611	0
75	336.56	6.05	1.1579	0
76	340.82	4.27	1.1563	0
77	343.83	3.01	1.1554	0
78	345.96	2.13	1.1549	0
79	347.46	1.50	0.0000	2
80	349.59	2.13	1.1541	0
81	352.60	3.01	1.1538	0
82	356.86	4.27	1.1534	0

83	362.91	6.05	1.1529	0
84	371.48	8.57	1.1522	0
85	380.04	8.57	1.1523	0
86	386.09	6.05	1.1536	0
87	390.35	4.27	1.1592	0
88	393.36	3.01	1.1623	0
89	395.49	2.13	1.1644	0
90	396.99	1.50	0.0000	2
91	399.12	2.13	1.1673	0
92	402.13	3.01	1.1693	0
93	406.39	4.27	1.1719	0
94	412.44	6.05	1.1746	0
95	421.01	8.57	1.1760	0
96	429.57	8.57	1.1707	0
97	435.62	6.05	1.1583	0
98	439.88	4.27	1.1444	0
99	442.89	3.01	1.1332	0
100	445.02	2.13	1.1247	0
101	446.52	1.50	0.0000	2
102	448.65	2.13	1.1106	0
103	451.66	3.01	1.1005	0
104	455.92	4.27	1.0857	0
105	461.97	6.05	1.0629	0
106	470.54	8.57	1.0296	0
107	479.10	8.57	0.9892	0
108	485.15	6.05	0.9534	0
109	489.41	4.27	0.9261	0
110	492.42	3.01	0.9065	0
111	494.55	2.13	0.8923	0
112	496.05	1.50	0.0000	2
113	498.18	2.13	0.8722	0
114	501.19	3.01	0.8579	0
115	505.45	4.27	0.8363	0
116	511.50	6.05	0.8054	0
117	520.07	8.57	0.7601	0
118	528.63	8.57	0.7041	0
119	534.68	6.05	0.6526	0
120	538.94	4.27	0.6141	0
121	541.95	3.01	0.5851	0
122	544.08	2.13	0.5641	0
123	545.58	1.50	0.0000	2
124	547.71	2.13	0.5344	0
125	550.72	3.01	0.5121	0
126	554.98	4.27	0.4801	0
127	561.03	6.05	0.4337	0
128	569.60	8.57	0.3688	0
129	578.16	8.57	0.2746	0
130	584.21	6.05	0.1858	0
131	588.47	4.27	0.1170	0
132	591.48	3.01	0.0640	0
133	593.61	2.13	0.0265	0
134	594.36	0.75	0.0000	2
135	594.36	0.00	0.0000	3

WEIGHTED AVERAGE AXIAL HEAT FLUX (assuming AFD normalized over channel length) = 0.97017
WEIGHTED AVERAGE AXIAL HEAT FLUX (assuming AFD normalized over heated length) = 1.00046

----------GROUP 10: MIXING OPTIONS AND DATA----------

THERMAL MIXING PARAMETERS 1 0.0000 0.0000

VOID DIFFUSION PARAMETERS 0 0.0500 0.0000

VOID DRIFT MODEL OPTION (NEQMIX=0): NO VOID DRIFT MODEL

----------GROUP 11: OPERATING CONDITIONS AND TRANSIENT FORCING FUNCTIONS----------

OPERATING CONDITIONS :

SYSTEM PRESSURE (PEXIT) = 10.0000 (MPA)
INLET TEMPERATURE (TIN) = 256.00 (DEGREES C)
INLET ENTHALPY (HIN) = 1076.45 (KJ/KG)
AVG. MASS VELOCITY (GIN) = 5.3350 (MG/M2-S)
AVG. HEAT FLUX (AFLUX) = 1.02838 (MW/M2)
EXIT ENTHALPY (HOUT) = 24.62 (KJ/KG)

THEORETICAL ENERGY ADDED (ASSUMING NORMALIZED AXIAL AND RADIAL HEAT FLUX PROFILES)
ENERGY ADDED = AFLUX * PHTOT * Z = 0.98333E+04 (KW)

THEORETICAL ENERGY ADDED (assuming axial heat flux profile normalized by heated length)
ENERGY ADDED = AFLUX * PHTOT * HEATL = 0.95353E+04 (KW)

BOUNDARY CONDITIONS:
INLET REFERENCE CHANNEL IS 1
EXIT REFERENCE CHANNEL IS 1
UNIFORM INLET OR EXIT TEMPERATURE
INLET FLOW BOUNDARY: NO PLENUM MODEL
FLOW SPLIT FOR EQUAL DP/DX APPLIED AT INLET (CHANNEL-FLOW)
(1 - 2.505E-01) (2 - 2.505E-01) (3 - 2.505E-01) (4 - 2.505E-01) (5 - 2.505E-01) (6 - 2.505E-01)
(7 - 2.505E-01) (8 - 4.504E-01) (9 - 1.292E-01) (10 - 4.504E-01) (11 - 1.292E-01) (12 - 4.504E-01)
(13 - 1.292E-01) (14 - 4.504E-01) (15 - 1.292E-01) (16 - 4.504E-01) (17 - 1.292E-01) (18 - 4.504E-01)
(19 - 1.292E-01) (20 - 4.504E-01) (21 - 1.292E-01) (22 - 1.514E-01) (23 - 4.009E-01) (24 - 1.514E-01)
(25 - 2.433E-01) (26 - 1.514E-01) (27 - 4.009E-01) (28 - 1.514E-01) (29 - 2.433E-01) (30 - 1.514E-01)
(31 - 4.009E-01) (32 - 1.514E-01) (33 - 2.433E-01) (34 - 1.514E-01) (35 - 4.009E-01) (36 - 1.514E-01)
(37 - 2.433E-01) (38 - 1.514E-01) (39 - 4.009E-01) (40 - 1.514E-01) (41 - 2.433E-01) (42 - 1.514E-01)
(43 - 4.009E-01) (44 - 1.514E-01) (45 - 2.433E-01) (46 - 1.514E-01) (47 - 4.009E-01) (48 - 1.514E-01)
(49 - 2.433E-01) (50 - 9.444E-01) (51 - 8.964E-01) (52 - 8.064E-01) (53 - 6.888E-01) (54 - 5.604E-01)
(55 - 4.344E-01) (56 - 3.233E-01) (57 - 2.351E-01) (58 - 1.752E-01) (59 - 1.375E-01) (60 - 1.250E-01)
(61 - 1.375E-01) (62 - 1.752E-01) (63 - 2.351E-01) (64 - 3.233E-01) (65 - 4.344E-01) (66 - 5.604E-01)
(67 - 6.888E-01) (68 - 8.064E-01) (69 - 8.964E-01) (70 - 9.444E-01)
EXIT PRESSURE BOUNDARY: NO PLENUM MODEL

No onset-of-dryout iterations requested.

----------GROUP 12: OUTPUT OPTION SELECT DATA----------
Print Subchannel Data at Channel Exit Only
Print Axial Data for the Specified Subchannels
Print No Axial Fuel Rod Data
Print Crossflow Data for the Specified Gaps

NO PLOTS WILL BE PRODUCED

----------GROUP 13: HEATED PERIMETER VARIATION TABLE----------

----------GROUP 14: WETTED PERIMETER VARIATION TABLE----------

----------GROUP 15: HEADER TO HEADER PRESSURE DROP, PRESSURE DROP BOUNDARY AND CCP CALCULATION OPTIONS----------

CALCULATION OF THE HEADER-TO-HEADER PRESSURE DROP OR FEEDER MODELING IS NOT INCLUDED

----------GROUP 16: THERMAL WALL MODEL DATA----------

CALCULATION OF HEAT LOSS THROUGH FUEL CHANNEL IS NOT INCLUDED

1

ITERATION SUMMARY

STEADY STATE ITERATION -- STEP 1 OF 1

ITERATION SUMMARY -- MAXIMUM VALUES AND LOCATION

OUTER ITER	FLOW (OUTER) DE/F	[I, J]	DC/F	[I, J]	MASS (INNER) IN	DH/H	[I, J]	ENERGY (INNER) IE	(N)	[I, J]	AX MOM (AXERR) (N)	[K, J]	LAT MOM (TRERR)
1	5.77E-02	[60,134]	-6.60E-07	[50, 3]	16	9.91E-07	[48,124]	7	-1.35E+00	[50, 78]	1.29E-01	[20, 8]	
2	+6.87E-02	[60, 73]	7.37E-07	[70,111]	14	9.99E-07	[44, 35]	7	-1.17E+00	[14,123]	9.67E-02	[28,128]	
3	-5.42E-02	[60, 74]	6.81E-07	[70,111]	13	9.66E-07	[62, 31]	7	-7.28E-01	[14,123]	-6.75E-02	[67,124]	
4	-4.70E-02	[60, 74]	7.89E-07	[70, 3]	12	9.69E-07	[46, 78]	6	-4.17E-01	[14,128]	-3.47E-02	[67,124]	
5	-3.93E-02	[60, 75]	7.75E-07	[70,100]	12	9.61E-07	[13,129]	7	3.58E-01	[70,108]	2.81E-02	[46,114]	
6	-3.44E-02	[61, 76]	6.70E-07	[70, 3]	12	9.73E-07	[37,134]	7	3.37E-01	[70,109]	3.22E-02	[109,102]	
7	-3.06E-02	[61, 76]	9.11E-07	[70, 3]	11	9.68E-07	[2,104]	7	3.10E-01	[70,110]	4.12E-02	[109,102]	
8	-2.76E-02	[59, 66]	-6.60E-07	[70,110]	12	9.91E-07	[15,129]	6	2.92E-01	[70,110]	4.39E-02	[109,102]	
9	-2.53E-02	[33, 89]	-8.67E-07	[70,110]	12	9.96E-07	[35,131]	6	2.69E-01	[70,122]	4.13E-02	[109,124]	
10	-2.32E-02	[33, 90]	-9.27E-07	[70,110]	12	9.24E-07	[6,133]	6	2.51E-01	[70,122]	3.18E-02	[109,125]	
11	-2.19E-02	[33, 91]	-8.11E-07	[70,110]	12	9.97E-07	[6,133]	6	2.30E-01	[70,123]	2.54E-02	[109,125]	
12	-2.04E-02	[33, 91]	-5.93E-07	[70,100]	12	9.92E-07	[60, 6]	6	2.11E-01	[70,123]	2.11E-02	[109,126]	
13	-1.97E-02	[33, 92]	-6.51E-07	[70,122]	11	9.76E-07	[21, 58]	6	1.91E-01	[70,114]	-1.86E-02	[109,101]	
14	-1.79E-02	[33, 92]	6.72E-07	[70, 3]	9	9.98E-07	[60, 8]	6	1.81E-01	[70,115]	-2.13E-02	[109,113]	
15	-1.68E-02	[33, 93]	9.06E-07	[70,100]	10	9.83E-07	[21, 75]	6	1.71E-01	[70,115]	-1.97E-02	[109,102]	
16	-1.54E-02	[33, 94]	7.32E-07	[70,100]	11	9.89E-07	[2,133]	7	1.58E-01	[70,116]	-1.90E-02	[109,103]	
17	-1.41E-02	[33, 94]	8.13E-07	[70,100]	11	9.92E-07	[2,121]	6	1.46E-01	[70,116]	-1.65E-02	[109,103]	
18	-1.24E-02	[33,105]	7.53E-07	[70,100]	11	9.95E-07	[60, 11]	6	-1.36E-01	[14,128]	-1.38E-02	[109,104]	
19	-1.12E-02	[33, 96]	6.37E-07	[70,100]	11	1.00E-06	[35,109]	6	-1.28E-01	[14,128]	-1.15E-02	[109, 93]	
20	-1.03E-02	[33,107]	5.14E-07	[70, 89]	11	9.94E-07	[38, 50]	5	-1.17E-01	[14,128]	-9.40E-03	[109, 93]	
21	-9.66E-03	[33, 98]	7.34E-07	[70, 89]	10	9.97E-07	[48, 12]	5	-1.05E-01	[14,128]	9.95E-03	[109,124]	
22	-9.13E-03	[33, 98]	9.07E-07	[70, 89]	9	9.89E-07	[33,113]	5	-9.34E-02	[14,130]	1.09E-02	[109,124]	
23	-8.74E-03	[33, 99]	4.98E-07	[70,132]	9	1.00E-06	[60, 41]	6	-8.86E-02	[14,134]	1.10E-02	[109,124]	
24	-8.28E-03	[33,100]	4.70E-07	[70,132]	9	9.91E-07	[64, 70]	5	-8.51E-02	[14,134]	1.04E-02	[109,124]	
25	-7.79E-03	[37,122]	-5.75E-07	[70,110]	9	9.93E-07	[33,132]	5	-8.15E-02	[14,134]	9.09E-03	[109,125]	
26	-7.14E-03	[33,122]	-6.36E-07	[70,110]	9	9.90E-07	[49, 75]	5	-7.75E-02	[14,134]	8.20E-03	[109,125]	
27	-6.53E-03	[37,124]	-5.97E-07	[70,110]	9	9.98E-07	[47, 85]	5	-7.29E-02	[14,134]	7.50E-03	[109,126]	
28	-6.17E-03	[37,125]	-9.62E-07	[70,110]	8	9.91E-07	[58, 17]	5	-6.79E-02	[14,134]	7.17E-03	[109,127]	
29	-5.81E-03	[33,125]	7.13E-07	[70,132]	8	9.76E-07	[49, 77]	5	-6.27E-02	[14,134]	6.77E-03	[109,127]	
30	-5.34E-03	[33,125]	6.32E-07	[70,132]	8	9.98E-07	[54, 85]	5	-5.77E-02	[14,134]	6.07E-03	[109,128]	
31	-4.90E-03	[33,126]	5.65E-07	[70,132]	8	9.54E-07	[70, 91]	5	-5.36E-02	[14,128]	5.65E-03	[109,128]	
32	-4.48E-03	[33,116]	5.13E-07	[70,132]	8	9.95E-07	[55, 43]	5	-5.12E-02	[14,128]	5.01E-03	[109,129]	
33	-4.00E-03	[33,127]	6.46E-07	[70,122]	8	9.56E-07	[48, 67]	5	-4.82E-02	[14,128]	4.53E-03	[109,129]	
34	-3.70E-03	[35,127]	7.36E-07	[70,100]	8	9.91E-07	[57, 20]	5	-4.48E-02	[14,128]	-4.07E-03	[109,103]	
35	-3.38E-03	[35,127]	8.20E-07	[70,100]	8	9.92E-07	[48,102]	5	-4.11E-02	[14,128]	4.00E-03	[95,103]	
36	-3.12E-03	[14,132]	8.23E-07	[70,100]	8	9.98E-07	[57, 21]	5	-3.73E-02	[14,128]	-3.65E-03	[110,103]	
37	-2.97E-03	[14,132]	7.55E-07	[50,100]	8	9.98E-07	[28, 46]	5	-3.52E-02	[14,134]	3.09E-03	[95,104]	
38	-2.81E-03	[14,132]	6.40E-07	[50,100]	8	9.97E-07	[46, 84]	5	-3.33E-02	[14,134]	2.83E-03	[108,124]	
39	-2.62E-03	[14,132]	9.46E-07	[50,100]	7	9.80E-07	[56, 23]	5	-3.14E-02	[14,134]	2.97E-03	[108,124]	
40	-2.43E-03	[14,133]	6.79E-07	[50,100]	7	9.89E-07	[13,117]	5	-2.95E-02	[14,134]	3.13E-03	[109,124]	
41	-2.26E-03	[14,133]	5.98E-07	[70,132]	7	9.98E-07	[64, 25]	5	-2.75E-02	[14,134]	3.21E-03	[109,113]	
42	-2.08E-03	[14,133]	5.64E-07	[70,132]	7	9.90E-07	[56, 26]	5	-2.55E-02	[14,134]	3.26E-03	[110,113]	
43	-1.89E-03	[14,133]	5.29E-07	[70,132]	7	9.88E-07	[5,132]	5	-2.35E-02	[14,134]	3.24E-03	[110,125]	
44	-1.74E-03	[14,125]	4.88E-07	[70,132]	7	9.98E-07	[42, 46]	5	-2.14E-02	[14,134]	3.02E-03	[110,125]	
45	-1.60E-03	[14,125]	4.41E-07	[70,132]	7	9.97E-07	[42,129]	5	-1.95E-02	[14,134]	2.83E-03	[110,126]	
46	-1.49E-03	[14,126]	-4.16E-07	[50,110]	7	9.90E-07	[65, 78]	5	-1.77E-02	[14,134]	2.58E-03	[110,127]	
47	-1.38E-03	[14,127]	8.51E-07	[70,132]	6	9.90E-07	[64, 69]	5	-1.60E-02	[14,134]	2.38E-03	[110,127]	
48	-1.27E-03	[14,127]	6.91E-07	[70,132]	6	9.95E-07	[42,110]	5	-1.46E-02	[14,134]	2.21E-03	[110,128]	
49	-1.16E-03	[14,127]	5.29E-07	[70,132]	6	9.78E-07	[42, 46]	5	-1.34E-02	[14,134]	1.97E-03	[110,128]	
50	-1.05E-03	[14,127]	3.80E-07	[70,132]	6	9.74E-07	[42, 46]	5	-1.23E-02	[14,134]	1.64E-03	[110,128]	
51	-9.72E-04	[14,132]	-7.23E-07	[50,109]	5	9.94E-07	[64, 31]	5	-1.14E-02	[14,134]	1.41E-03	[95,113]	
52	-9.16E-04	[14,132]	9.06E-07	[70,112]	5	9.44E-07	[56, 21]	5	-1.07E-02	[14,134]	-1.29E-03	[110,113]	
53	-8.50E-04	[14,132]	6.03E-07	[50,112]	6	9.88E-07	[48, 23]	5	-9.99E-03	[14,134]	1.24E-03	[95,114]	
54	-7.90E-04	[14,132]	6.08E-07	[50,112]	6	9.54E-07	[22, 24]	4	-9.35E-03	[14,134]	1.13E-03	[110,132]	
55	-7.42E-04	[14,133]	6.08E-07	[70,122]	6	9.94E-07	[13,127]	4	-8.73E-03	[14,134]	1.10E-03	[110,133]	
56	-6.87E-04	[14,133]	5.57E-07	[50,122]	6	9.92E-07	[22, 23]	4	-8.11E-03	[14,134]	1.07E-03	[110,133]	
57	-6.30E-04	[14,133]	8.93E-07	[50,122]	5	9.75E-07	[21, 40]	4	-7.49E-03	[14,134]	9.72E-04	[110,123]	
58	-5.73E-04	[14,133]	7.20E-07	[50,122]	5	9.67E-07	[48, 24]	4	-6.86E-03	[14,134]	1.08E-03	[109,124]	
59	-5.17E-04	[14,133]	5.46E-07	[50,121]	5	9.73E-07	[15,127]	4	-6.25E-03	[14,134]	1.16E-03	[110,124]	
60	-4.64E-04	[14,134]	5.28E-07	[70,132]	5	9.83E-07	[48, 24]	4	-5.65E-03	[14,134]	1.21E-03	[110,125]	
61	-4.16E-04	[14,134]	5.35E-07	[70,132]	5	9.98E-07	[64, 37]	4	-5.08E-03	[14,134]	1.23E-03	[110,125]	
62	3.90E-04	[65,127]	4.96E-07	[70,132]	5	9.89E-07	[22, 24]	4	-4.56E-03	[14,134]	1.14E-03	[110,125]	
63	3.73E-04	[65,127]	-4.56E-07	[70,112]	5	9.79E-07	[48, 24]	4	4.17E-03	[65,128]	1.03E-03	[110,126]	
64	3.46E-04	[65,127]	8.64E-07	[70,132]	4	9.97E-07	[56, 32]	4	4.09E-03	[65,128]	8.97E-04	[110,126]	
65	3.19E-04	[64,129]	-8.63E-07	[70,122]	4	9.94E-07	[48, 24]	4	3.89E-03	[65,128]	8.02E-04	[110,127]	
66	3.08E-04	[65,129]	-8.18E-07	[70,122]	4	9.99E-07	[56, 34]	4	3.57E-03	[66,128]	7.21E-04	[110,128]	
67	2.97E-04	[64,131]	-6.63E-07	[50,122]	4	9.82E-07	[64, 33]	4	3.25E-03	[65,130]	6.36E-04	[110,128]	
68	2.88E-04	[64,132]	-6.93E-07	[50,132]	4	9.98E-07	[22, 25]	5	3.09E-03	[65,130]	5.20E-04	[110,128]	
69	2.77E-04	[64,132]	-9.15E-07	[50,132]	4	9.92E-07	[36,129]	3	2.86E-03	[66,130]	4.13E-04	[110,129]	
70	2.64E-04	[64,132]	-3.23E-07	[50,132]	5	9.83E-07	[22, 24]	4	2.71E-03	[65,132]	3.89E-04	[110,132]	
71	2.44E-04	[64,132]	-9.64E-07	[50,132]	4	9.87E-07	[64, 36]	4	2.59E-03	[65,134]	4.01E-04	[110,132]	
72	2.31E-04	[64,132]	-8.89E-07	[50,132]	4	9.81E-07	[22, 24]	4	2.51E-03	[65,134]	3.88E-04	[110,132]	
73	2.15E-04	[64,133]	-7.07E-07	[50,132]	4	9.87E-07	[64, 36]	4	-2.47E-03	[50,134]	3.92E-04	[110,133]	
74	1.99E-04	[64,133]	5.26E-07	[70,122]	4	9.89E-07	[64, 49]	4	-2.39E-03	[50,134]	3.73E-04	[110,133]	
75	1.83E-04	[64,133]	4.80E-07	[70,122]	4	9.99E-07	[42, 49]	4	-2.23E-03	[50,134]	3.31E-04	[110,133]	
76	1.74E-04	[64, 92]	3.88E-07	[50,122]	4	9.98E-07	[64, 47]	4	-2.04E-03	[50,134]	2.76E-04	[111,133]	
77	1.70E-04	[64, 94]	-3.34E-07	[50, 87]	4	9.89E-07	[64, 51]	4	-1.82E-03	[50,134]	2.65E-04	[109,124]	
78	1.67E-04	[64, 94]	-3.33E-07	[50, 87]	4	9.93E-07	[56, 38]	4	-1.60E-03	[50,134]	2.79E-04	[110,125]	
79	1.62E-04	[64, 94]	-3.25E-07	[50, 87]	4	9.54E-07	[56, 37]	4	-1.36E-03	[50,126]	2.87E-04	[110,125]	
80	1.55E-04	[64, 94]	-3.33E-07	[50, 87]	4	1.00E-06	[56, 29]	4	-1.64E-03	[50,128]	2.67E-04	[110,125]	
81	1.49E-04	[64, 96]	-3.35E-07	[50, 87]	4	9.97E-07	[64, 50]	4	-1.71E-03	[50,128]	2.42E-04	[110,126]	
82	1.43E-04	[64, 96]	-3.27E-07	[50, 87]	4	9.97E-07	[48, 23]	4	-1.73E-03	[50,128]	2.13E-04	[110,126]	
83	1.40E-04	[64, 98]	-3.22E-07	[50, 98]	4	1.00E-06	[30, 57]	4	-1.68E-03	[50,128]	1.85E-04	[110,127]	
84	1.37E-04	[64, 98]	-3.32E-07	[50, 98]	4	9.99E-07	[56, 36]	3	-1.61E-03	[50,128]	1.64E-04	[110,128]	
85	1.34E-04	[64, 98]	-3.63E-07	[50,132]	4	9.94E-07	[64, 42]	3	-1.60E-03	[50,130]	1.48E-04	[110,128]	
86	1.30E-04	[64, 99]	-4.48E-07	[50,132]	4	9.98E-07	[54, 63]	3	-1.57E-03	[50,130]	1.24E-04	[110,128]	
87	1.25E-04	[64, 99]	-4.90E-07	[50,132]	4	9.62E-07	[64, 31]	3	-1.50E-03	[50,130]	1.07E-04	[95,124]	
88	1.20E-04	[64, 99]	-5.00E-07	[50,132]	4	9.94E-07	[56, 48]	3	-1.43E-03	[50,131]	9.90E-05	[94,124]	
89	1.13E-04	[64,100]	-4.75E-07	[50,132]	4	9.97E-07	[64, 36]	3	-1.39E-03	[50,134]	9.61E-05	[110,132]	
90	1.10E-04	[64,100]	-4.33E-07	[50,132]	4	9.96E-07	[56, 49]	3	-1.40E-03	[50,134]	9.45E-05	[110,132]	
91	1.04E-04	[64,100]	-3.91E-07	[50,132]	4	9.96E-07	[64, 49]	3	-1.38E-03	[50,134]	9.34E-05	[110,133]	
92	9.80E-05	[64,100]	-3.21E-07	[50,132]	4	9.90E-07	[56, 42]	3	-1.35E-03	[50,134]	9.25E-05	[110, 92]	

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CASES0101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

CHANNEL MASS BALANCE AND ENERGY BALANCE SUMMARY TIME = 0.000000 SECONDS

MASS BALANCE:

MASS STORAGE+ = 0.00000E+00 [KG/S]
MASS FLOW OUT+ = 0.22936E+02 [KG/S]
MASS FLOW IN- = -0.22936E+02 [KG/S]
MASS FLOW ERROR = 0.38637E-08 [KG/S]
% FLOW ERROR = 0.16822E-07 [%]

ENERGY BALANCE:

ENERGY STORAGE+ = 0.00000E+00 [KW]
FLOW ENERGY OUT+ = 0.34268E+05 [KW]
FLOW ENERGY IN- = -0.24724E+05 [KW]
ENERGY SOURCE- = -0.95439E+04 [KW]
ENERGY ERROR = -0.14912E-02 [KW]
% ENERGY ERROR = -0.43625E-04 [%]

CASE80101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

CHANNEL EXIT SUMMARY RESULTS TIME = 0.000000 SECONDS

AXIAL LOCATION = 594.36 cm | AXIAL LOCATION = 594.36 cm

SUB-CHANNEL NUMBER	RELATIVE PRESSURE [KPA]	LIQUID TEMP [DEG-C]	VAPOUR TEMP [DEG-C]	MIXTURE DENSITY [KG/M3]	VOID FRACTION	FLOW ENTHALPY [KJ/KG]	FLOW NON-EQUIL QUALITY	FLOW EQUILIB QUALITY	MASS FLOW [KG/S]	MASS FLUX [MG/M2-S]	FLOW VELOCITY [M/S]	AREA [CM2]
1	0.00	313.62	310.13	257.65	0.71561	1610.42	0.20667	0.21941	0.20440	4.4464	17.2577	0.45970
2	0.02	313.63	310.13	260.53	0.71141	1606.70	0.20340	0.21624	0.20611	4.4836	17.2096	0.45970
3	0.04	313.63	310.13	265.43	0.70426	1600.44	0.19797	0.21092	0.20952	4.5578	17.1712	0.45970
4	0.05	313.63	310.13	267.12	0.70179	1598.32	0.19614	0.20912	0.21160	4.6030	17.2319	0.45970
5	0.04	313.63	310.13	265.42	0.70427	1600.45	0.19798	0.21093	0.20953	4.5579	17.1722	0.45970
6	0.02	313.63	310.13	260.63	0.71126	1606.57	0.20329	0.21613	0.20615	4.4845	17.2067	0.45970
7	0.00	313.62	310.13	257.78	0.71543	1610.25	0.20653	0.21926	0.20447	4.4478	17.2545	0.45970
8	-0.04	313.67	310.13	346.74	0.58572	1519.82	0.12815	0.14238	0.43082	5.1701	14.9103	0.83330
9	-0.02	313.17	310.13	347.17	0.58608	1517.11	0.12810	0.14009	0.13316	4.6969	13.5290	0.28350
10	0.01	313.61	310.13	293.79	0.66299	1567.65	0.16976	0.18305	0.39433	4.7321	16.1072	0.83330
11	0.04	313.05	310.13	271.30	0.69654	1590.65	0.19196	0.20260	0.11732	4.1382	15.2532	0.28350
12	0.06	313.43	310.13	230.90	0.75479	1648.73	0.24047	0.25196	0.34946	4.1936	18.1620	0.83330
13	0.08	312.76	310.13	198.02	0.80327	1706.59	0.29287	0.30114	0.09969	3.5163	17.7569	0.28350
14	0.08	313.33	310.13	199.06	0.80123	1706.59	0.29079	0.30115	0.29553	3.9066	19.6251	0.83330
15	0.08	312.77	310.13	198.66	0.80254	1705.27	0.29172	0.30002	0.09987	3.5228	17.7332	0.28350
16	0.06	313.44	310.13	231.81	0.75346	1647.28	0.23822	0.25073	0.35012	4.2016	18.1249	0.83330
17	0.04	313.06	310.13	273.37	0.69032	1588.18	0.18980	0.20050	0.11781	4.1557	15.2016	0.28350
18	0.01	313.61	310.13	294.89	0.66138	1566.49	0.16876	0.18206	0.39510	4.7414	16.0784	0.83330
19	-0.02	313.24	310.13	347.73	0.58513	1517.01	0.12769	0.14001	0.13337	4.7046	13.5295	0.28350
20	-0.04	313.66	310.13	347.61	0.58448	1519.08	0.12757	0.14177	0.43154	5.1787	14.8880	0.83330
21	-0.06	313.31	310.13	391.09	0.52191	1486.95	0.10142	0.11446	0.14059	4.9589	12.6797	0.28350
22	0.00	311.96	310.13	477.47	0.40002	1435.15	0.06325	0.07043	0.17857	5.7678	12.0789	0.30960
23	0.02	313.03	310.13	432.79	0.46196	1461.70	0.08097	0.09300	0.43197	5.7604	13.3100	0.74890
24	0.04	313.00	310.13	418.17	0.48328	1469.40	0.08777	0.09954	0.16557	5.3480	12.7891	0.30960
25	0.07	313.56	310.13	405.68	0.50010	1479.28	0.09365	0.10794	0.24602	5.7333	14.1325	0.42910
26	0.08	313.27	310.13	419.62	0.48033	1469.90	0.08895	0.09997	0.16637	5.3738	12.8064	0.30960
27	0.12	313.64	310.13	358.16	0.56915	1510.97	0.12066	0.13487	0.38859	5.1953	14.5033	0.74890
28	0.16	313.36	310.13	330.85	0.60946	1531.36	0.13952	0.15221	0.14579	4.7091	14.2335	0.30960
29	0.17	313.90	310.13	315.16	0.63135	1547.83	0.15135	0.16621	0.21658	5.0472	16.0150	0.42910
30	0.20	313.41	310.13	343.31	0.59124	1521.30	0.13062	0.14366	0.14928	4.8218	14.0452	0.30960
31	0.22	313.53	310.13	279.62	0.68374	1582.93	0.18227	0.19604	0.34038	4.5470	16.2616	0.74890
32	0.24	313.14	310.13	244.34	0.73561	1626.82	0.22286	0.23443	0.12578	3.9081	16.3632	0.30960
33	0.24	313.61	310.13	209.68	0.78551	1646.52	0.27244	0.28406	0.17601	4.1019	19.5628	0.42910
34	0.25	313.12	310.13	223.05	0.76637	1660.48	0.25184	0.26196	0.11971	3.8665	17.3352	0.30960
35	0.25	313.36	310.13	190.74	0.80021	1705.29	0.28955	0.30004	0.29008	3.8683	19.3662	0.74890
36	0.25	313.12	310.13	223.66	0.76567	1659.44	0.25093	0.26107	0.11994	3.8740	17.3206	0.30960
37	0.24	313.61	310.13	210.68	0.78404	1684.61	0.27080	0.28246	0.17629	4.1084	19.5004	0.42910
38	0.24	313.14	310.13	245.92	0.73380	1624.63	0.22087	0.23148	0.12417	4.0107	16.3091	0.30960
39	0.22	313.53	310.13	281.74	0.68065	1580.50	0.18118	0.19397	0.34208	4.5617	16.1913	0.74890
40	0.19	313.40	310.13	346.73	0.58627	1518.55	0.12828	0.14132	0.15006	4.8470	13.9790	0.30960
41	0.17	313.89	310.13	318.65	0.62627	1544.55	0.14857	0.16342	0.21770	5.0734	15.9216	0.42910
42	0.16	313.31	310.13	335.79	0.60236	1526.95	0.13505	0.14845	0.14692	4.7456	14.1326	0.30960
43	0.12	313.55	310.13	363.56	0.56147	1506.60	0.11730	0.13116	0.39278	5.2378	14.4069	0.74890
44	0.08	313.06	310.13	426.16	0.47153	1465.32	0.08398	0.09607	0.16765	5.4215	12.7218	0.30960
45	0.07	313.89	310.13	408.40	0.49534	1479.33	0.09211	0.10798	0.24718	5.7604	14.1048	0.42910
46	0.04	312.58	310.13	425.93	0.47304	1463.08	0.08432	0.09417	0.16746	5.4091	12.6994	0.30960
47	0.02	312.88	310.13	438.17	0.45433	1458.16	0.07866	0.08999	0.43509	5.8020	13.2412	0.74890
48	0.00	311.88	310.13	479.63	0.39712	1433.80	0.06249	0.06929	0.17903	5.7825	12.0562	0.30960
49	0.01	313.85	310.13	460.46	0.41954	1452.22	0.06888	0.08494	0.29395	6.1374	13.2989	0.42910
50	-0.07	320.64	310.13	573.40	0.29678	1398.44	0.03453	0.04073	1.09317	7.8139	13.6251	1.39800
51	-0.04	310.91	310.13	552.01	0.29560	1401.73	0.03972	0.04203	1.02153	7.6007	13.7690	1.34400
52	0.00	312.41	310.13	524.03	0.33134	1419.01	0.04725	0.05671	0.89064	7.2552	13.8449	1.24000
53	0.06	312.81	310.13	503.39	0.36005	1428.79	0.05370	0.06502	0.76487	6.9344	13.7754	1.10900
54	0.13	313.20	310.13	476.85	0.39749	1441.63	0.06289	0.07594	0.61695	6.5154	13.6636	0.94690
55	0.20	313.31	310.13	447.07	0.44048	1455.88	0.07463	0.08805	0.47423	6.0121	13.4478	0.78880
56	0.26	313.11	310.13	421.12	0.47871	1468.33	0.08631	0.09864	0.35254	5.4930	13.0436	0.64180
57	0.31	312.69	310.13	380.74	0.53832	1490.62	0.10748	0.11758	0.25031	4.8434	12.7210	0.51680
58	0.34	312.23	310.13	328.29	0.61520	1528.37	0.14194	0.14966	0.17572	4.1640	12.6836	0.42200
59	0.36	311.92	310.13	265.27	0.70683	1593.27	0.19888	0.20483	0.12813	3.5307	13.3096	0.36200
60	0.37	311.82	310.13	222.93	0.76814	1655.48	0.25251	0.25771	0.10888	3.1762	14.2477	0.34280
61	0.36	311.92	310.13	266.43	0.70516	1591.82	0.19763	0.20360	0.12841	3.5383	13.2808	0.36200
62	0.34	312.23	310.13	330.28	0.61252	1526.66	0.14046	0.14821	0.17626	4.1767	12.6461	0.42200
63	0.31	312.68	310.13	383.94	0.53389	1488.49	0.10567	0.11576	0.25142	4.8649	12.6708	0.51680
64	0.26	313.07	310.13	426.43	0.47109	1465.25	0.08385	0.09602	0.35497	5.5308	12.9899	0.64180
65	0.20	313.15	310.13	455.25	0.42902	1451.14	0.07132	0.08402	0.47912	6.0741	13.3424	0.78880
66	0.13	312.79	310.13	488.49	0.38174	1434.65	0.05885	0.07000	0.62573	6.6082	13.5278	0.94690
67	0.06	311.99	310.13	518.30	0.34092	1418.94	0.04825	0.05666	0.77841	7.0572	13.6160	1.10300
68	0.00	311.09	310.13	540.51	0.31160	1406.48	0.04098	0.04606	0.91651	7.3912	13.6744	1.24000
69	-0.05	310.40	310.13	562.21	0.28253	1395.85	0.03715	0.03703	1.03811	7.6868	13.6725	1.34400
70	-0.08	309.50	310.13	577.10	0.26405	1386.64	0.03363	0.02920	1.00749	7.8448	13.5935	1.38800

CASE80101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

BUNDLE AVERAGED RESULTS TIME = 0.000000 SECONDS

AXIAL LOCATION [CM]	RELATIVE PRESSURE [KPA]	LIQUID TEMP [DEG-C]	VAPOUR TEMP [DEG-C]	MIXTURE DENSITY [KG/M3]	VOID FRACTION	AXIAL LOCATION [CM]	FLOW ENTHALPY [KJ/KG]	FLOW NON-EQUIL QUALITY	FLOW EQUILIB QUALITY	MASS FLOW [KG/S]	MASS FLUX [MG/M2-S]	FLOW VELOCITY [M/S]	AREA [CM2]
0.00	500.12	256.12	314.23	881.66	0.00000	0.00	1076.45	0.00000	-0.25696	22.96809	5.5350	6.2779	41.49610
0.38	493.68	256.12	314.19	881.66	0.00000	0.75	1076.45	0.00000	-0.25667	22.96809	5.5350	6.2780	41.49610
1.81	493.27	256.13	314.19	881.63	0.00000	2.88	1076.50	0.00000	-0.25661	22.96809	5.5350	6.2781	41.49610
4.58	492.52	256.17	314.18	881.56	0.00000	5.89	1076.68	0.00000	-0.25641	22.96809	5.5350	6.2786	41.49610
8.02	491.49	256.27	314.17	881.37	0.00000	10.15	1077.15	0.00000	-0.25596	22.96809	5.5350	6.2800	41.49610
13.18	488.79	256.50	314.16	880.95	0.00000	16.20	1078.20	0.00000	-0.25492	22.96809	5.5350	6.2830	41.49610
20.48	486.70	256.98	314.14	880.06	0.00000	24.77	1080.40	0.00000	-0.25291	22.96809	5.5350	6.2893	41.49610
29.05	481.95	257.60	314.11	878.88	0.00000	33.33	1083.31	0.00000	-0.25016	22.96809	5.5350	6.2978	41.49610
36.35	479.83	258.13	313.45	877.90	0.00000	39.38	1085.76	0.00000	-0.24798	22.96809	5.5350	6.3048	41.49610
41.51	477.11	258.54	314.07	877.13	0.00000	43.64	1087.67	0.00000	-0.24614	22.96809	5.5350	6.3104	41.49610
45.15	476.07	258.85	314.07	876.56	0.00000	46.65	1089.11	0.00000	-0.24484	22.96809	5.5350	6.3145	41.49610
47.72	475.40	259.08	314.06	876.17	0.00000	48.78	1090.17	0.00000	-0.24388	22.96809	5.5350	6.3173	41.49610
49.53	468.64	259.08	314.01	876.17	0.00000	50.28	1090.17	0.00000	-0.24358	22.96809	5.5350	6.3173	41.49610
51.34	468.13	259.32	314.01	875.72	0.00000	52.41	1091.29	0.00000	-0.24258	22.96809	5.5350	6.3205	41.49610
53.91	467.36	259.67	314.01	875.05	0.00000	55.42	1092.93	0.00000	-0.24112	22.96809	5.5350	6.3253	41.49610
57.55	466.27	260.19	314.00	874.07	0.00000	59.68	1095.37	0.00000	-0.23895	22.96809	5.5350	6.3324	41.49610
62.71	463.48	260.98	313.98	872.57	0.00000	65.73	1099.03	0.00000	-0.23563	22.96809	5.5350	6.3433	41.49610
70.01	461.29	262.17	313.96	870.30	0.00000	74.30	1104.63	0.00000	-0.23067	22.96809	5.5350	6.3598	41.49610
78.58	456.89	263.45	313.93	867.81	0.00000	82.86	1110.65	0.00000	-0.22522	22.96809	5.5350	6.3781	41.49610

85.88	454.18	264.40	313.91	865.96	0.00000	88.91	1115.14	0.00000	-0.22122	22.96809	5.5350	6.3917	41.49610
91.04	451.37	265.09	313.89	864.59	0.00000	93.17	1118.42	0.00000	-0.21824	22.96809	5.5350	6.4019	41.49610
94.68	450.27	265.59	313.89	863.61	0.00000	96.18	1120.79	0.00000	-0.21613	22.96809	5.5350	6.4091	41.49610
97.25	449.52	265.95	313.88	862.95	0.00000	98.31	1122.49	0.00000	-0.21462	22.96809	5.5350	6.4141	41.49610
99.06	449.04	265.95	313.88	863.04	0.00000	99.81	1122.49	0.00000	-0.21459	22.96809	5.5350	6.4134	41.49610
100.87	442.16	266.32	313.83	862.33	0.00000	101.94	1124.23	0.00000	-0.21279	22.96809	5.5350	6.4187	41.49610
103.44	441.38	266.84	313.82	861.28	0.00000	104.95	1126.72	0.00000	-0.21058	22.96809	5.5350	6.4263	41.49610
107.08	440.26	267.60	313.82	859.78	0.00000	109.21	1130.33	0.00000	-0.20741	22.96809	5.5350	6.4377	41.49610
112.24	437.39	268.69	313.15	857.53	0.00000	115.26	1135.56	0.00000	-0.20274	22.96809	5.5350	6.4546	41.49610
119.54	435.13	270.29	313.14	854.29	0.00001	123.83	1143.23	0.00000	-0.19599	22.96809	5.5350	6.4791	41.49610
128.11	430.09	271.93	313.10	850.81	0.00005	132.39	1151.16	0.00000	-0.18889	22.96809	5.5350	6.5056	41.49610
135.41	427.81	273.11	313.08	848.30	0.00010	138.44	1156.90	0.00000	-0.18380	22.96809	5.5350	6.5248	41.49610
140.57	424.92	273.96	313.06	846.45	0.00014	142.70	1161.03	0.00000	-0.18010	22.96809	5.5350	6.5391	41.49610
144.21	423.78	274.56	313.06	845.14	0.00018	145.71	1163.98	0.00000	-0.17749	22.96809	5.5350	6.5492	41.49610
146.78	423.00	274.99	313.05	844.28	0.00020	147.84	1166.07	0.00000	-0.17564	22.96809	5.5350	6.5564	41.49610
148.59	422.50	274.99	313.05	844.58	0.00001	149.34	1166.07	0.00000	-0.17562	22.96809	5.5350	6.5535	41.49610
150.40	415.47	275.42	313.00	843.55	0.00018	151.47	1168.18	0.00000	-0.17349	22.96809	5.5350	6.5615	41.49610
152.97	414.66	276.04	312.99	842.18	0.00023	154.48	1171.19	0.00000	-0.17085	22.96809	5.5350	6.5722	41.49610
156.61	413.50	276.91	312.98	840.22	0.00031	158.74	1175.48	0.00000	-0.16708	22.96809	5.5350	6.5875	41.49610
161.77	410.55	278.14	312.96	837.30	0.00047	164.79	1181.60	0.00000	-0.16165	22.96809	5.5350	6.6105	41.49610
169.07	408.20	279.89	312.95	833.19	0.00079	173.36	1190.29	0.00001	-0.15402	22.96809	5.5350	6.6431	41.49610
177.64	403.02	281.61	312.91	828.84	0.00126	181.92	1198.92	0.00002	-0.14633	22.96809	5.5350	6.6780	41.49610
184.94	400.65	282.80	312.89	825.78	0.00171	187.97	1204.95	0.00003	-0.14101	22.96809	5.5350	6.7028	41.49610
190.10	397.67	283.63	312.87	823.56	0.00210	192.23	1209.16	0.00005	-0.13724	22.96809	5.5350	6.7209	41.49610
193.74	396.50	284.21	312.86	822.09	0.00236	195.24	1212.11	0.00006	-0.13464	22.96809	5.5350	6.7329	41.49610
196.31	395.72	284.62	312.86	821.33	0.00242	197.37	1214.19	0.00007	-0.13281	22.96809	5.5350	6.7390	41.49610
198.12	398.51	284.62	312.81	822.15	0.00134	198.87	1214.19	0.00004	-0.13252	22.96809	5.5350	6.7323	41.49610
199.93	397.95	285.03	312.80	820.56	0.00222	201.00	1216.24	0.00005	-0.13071	22.96809	5.5350	6.7455	41.49610
202.50	397.09	285.59	312.80	818.83	0.00258	204.01	1219.14	0.00007	-0.12816	22.96809	5.5350	6.7597	41.49610
206.14	395.87	286.38	312.79	816.44	0.00333	208.27	1223.22	0.00010	-0.12459	22.96809	5.5350	6.7784	41.49610
211.30	392.82	287.48	312.77	812.76	0.00456	214.32	1228.94	0.00015	-0.11951	22.96809	5.5350	6.8102	41.49610
218.60	390.36	288.99	312.75	807.47	0.00678	222.80	1236.94	0.00028	-0.11249	22.96809	5.5350	6.8548	41.49610
227.17	374.94	290.47	312.71	801.48	0.00985	231.45	1244.85	0.00046	-0.10543	22.96809	5.5350	6.9060	41.49610
234.47	372.41	291.48	312.69	797.19	0.01230	237.50	1250.38	0.00063	-0.10056	22.96809	5.5350	6.9432	41.49610
239.63	369.27	292.18	312.67	793.94	0.01432	241.76	1254.25	0.00077	-0.09708	22.96809	5.5350	6.9716	41.49610
243.27	367.59	292.67	312.66	791.70	0.01575	244.77	1256.97	0.00088	-0.09468	22.96809	5.5350	6.9913	41.49610
245.84	367.11	293.01	312.66	790.36	0.01660	246.90	1258.88	0.00097	-0.09299	22.96809	5.5350	7.0052	41.49610
247.65	366.59	293.03	312.65	792.14	0.01439	248.40	1258.88	0.00091	-0.09297	22.96809	5.5350	6.9874	41.49610
249.46	359.09	293.36	312.60	789.86	0.01642	250.53	1260.79	0.00100	-0.09104	22.96809	5.5350	7.0076	41.49610
252.03	358.16	293.84	312.59	787.16	0.01842	253.54	1263.47	0.00114	-0.08867	22.96809	5.5350	7.0316	41.49610
255.67	356.83	294.50	312.58	783.38	0.02126	257.80	1267.26	0.00135	-0.08535	22.96809	5.5350	7.0655	41.49610
260.83	353.53	295.42	312.56	777.40	0.02607	263.85	1272.60	0.00170	-0.08061	22.96809	5.5350	7.1198	41.49610
268.13	350.78	296.67	312.54	768.97	0.03336	272.42	1280.10	0.00235	-0.07402	22.96809	5.5350	7.1979	41.49610
276.70	344.85	297.87	312.50	759.29	0.04239	280.98	1287.53	0.00314	-0.06738	22.96809	5.5350	7.2897	41.49610
284.00	341.96	298.68	312.48	752.55	0.04892	287.03	1292.74	0.00379	-0.06277	22.96809	5.5350	7.3550	41.49610
289.16	338.45	299.24	312.45	747.48	0.05317	291.29	1296.40	0.00429	-0.05948	22.96809	5.5350	7.4049	41.49610
292.80	336.97	299.63	312.44	744.07	0.05602	294.30	1298.98	0.00466	-0.05720	22.96809	5.5350	7.4389	41.49610
295.37	335.95	299.90	312.44	742.06	0.05846	296.43	1300.79	0.00494	-0.05559	22.96809	5.5350	7.4640	41.49610
297.18	335.35	300.91	312.43	743.62	0.05754	297.93	1300.79	0.00490	-0.05557	22.96809	5.5350	7.4438	41.49610
298.99	327.32	300.18	312.37	740.90	0.06044	300.06	1302.60	0.00519	-0.05471	22.96809	5.5350	7.4706	41.49610
301.56	326.23	300.55	312.37	736.85	0.06474	303.07	1305.16	0.00561	-0.05147	22.96809	5.5350	7.5117	41.49610
305.20	324.66	301.07	312.36	731.03	0.07100	307.33	1308.77	0.00625	-0.04820	22.96809	5.5350	7.5715	41.49610
310.36	320.89	301.78	312.33	721.95	0.08101	313.38	1313.87	0.00727	-0.04375	22.96809	5.5350	7.6668	41.49610
317.66	317.60	302.73	312.31	709.83	0.09481	321.95	1321.07	0.00892	-0.03742	22.96809	5.5350	7.7976	41.49610
326.23	310.77	303.62	312.26	696.40	0.11053	330.51	1328.24	0.01077	-0.03100	22.96809	5.5350	7.9481	41.49610
333.53	307.25	304.23	312.23	687.48	0.12114	336.56	1333.28	0.01219	-0.02652	22.96809	5.5350	8.0511	41.49610
338.69	303.17	304.65	312.20	681.04	0.12888	340.82	1336.84	0.01324	-0.02331	22.96809	5.5350	8.1273	41.49610
342.33	301.39	304.93	312.19	677.08	0.13367	343.83	1339.35	0.01402	-0.02109	22.96809	5.5350	8.1748	41.49610
344.90	300.20	305.13	312.18	675.29	0.13592	345.96	1341.11	0.01458	-0.01952	22.96809	5.5350	8.1964	41.49610
346.71	291.29	305.12	312.12	675.29	0.13604	347.46	1341.11	0.01465	-0.01921	22.96809	5.5350	8.1964	41.49610
348.52	290.44	305.32	312.11	671.90	0.14017	349.59	1342.88	0.01520	-0.01765	22.96809	5.5350	8.2378	41.49610
351.09	289.09	305.60	312.10	666.81	0.14640	352.60	1345.39	0.01602	-0.01545	22.96809	5.5350	8.3007	41.49610
354.73	287.16	305.98	312.09	659.75	0.15512	356.86	1348.93	0.01722	-0.01233	22.96809	5.5350	8.3895	41.49610
359.89	282.71	306.51	312.06	648.80	0.16858	362.91	1353.95	0.01903	-0.00795	22.96809	5.5350	8.5293	41.49610
367.19	278.69	307.20	312.03	635.19	0.18611	371.48	1361.07	0.02179	-0.00158	22.96809	5.5350	8.7139	41.49610
375.76	270.63	307.86	311.97	620.13	0.20549	380.04	1368.18	0.02475	0.00482	22.96809	5.5350	8.9255	41.49610
383.06	266.32	308.31	311.94	610.41	0.21813	386.09	1373.21	0.02693	0.00930	22.96809	5.5350	9.0677	41.49610
388.22	261.46	308.62	311.91	603.25	0.22746	390.35	1376.78	0.02853	0.01253	22.96809	5.5350	9.1753	41.49610
391.86	259.24	308.83	311.89	598.63	0.23350	393.36	1379.30	0.02968	0.01477	22.96809	5.5350	9.2460	41.49610
394.43	257.71	308.98	311.88	596.09	0.23686	395.49	1381.08	0.03051	0.01636	22.96809	5.5350	9.2955	41.49610
396.24	256.79	309.94	311.87	596.86	0.23622	396.99	1381.08	0.03073	0.01640	22.96809	5.5350	9.2745	41.49610
398.05	246.61	309.08	311.80	593.68	0.24037	399.12	1382.87	0.03155	0.01826	22.96809	5.5350	9.3232	41.49610
400.62	244.98	309.29	311.79	588.52	0.24714	402.13	1385.41	0.03274	0.02050	22.96809	5.5350	9.4050	41.49610
404.26	242.62	309.58	311.77	581.28	0.25668	406.39	1389.01	0.03448	0.02368	22.96809	5.5350	9.5220	41.49610
409.42	237.32	309.96	311.73	569.98	0.27168	412.44	1394.13	0.03704	0.02825	22.96809	5.5350	9.7108	41.49610
416.72	232.41	310.48	311.70	556.23	0.29015	421.01	1401.39	0.04086	0.03465	22.96809	5.5350	9.9510	41.49610
425.29	222.80	310.94	311.63	541.16	0.31051	429.57	1408.61	0.04487	0.04116	22.96809	5.5350	10.2280	41.49610
432.50	217.55	311.25	311.59	531.77	0.32331	435.62	1413.66	0.04776	0.04567	22.96809	5.5350	10.4087	41.49610
437.75	211.76	311.46	311.55	524.95	0.33200	439.88	1417.18	0.04982	0.04887	22.96809	5.5350	10.5438	41.49610
441.39	209.08	311.59	311.53	520.61	0.33832	442.89	1419.64	0.05129	0.05107	22.96809	5.5350	10.6315	41.49610
443.96	207.22	311.69	311.52	518.30	0.34173	444.92	1421.36	0.05233	0.05261	22.96809	5.5350	10.6791	41.49610
445.77	206.08	311.62	311.51	518.72	0.34158	446.52	1421.36	0.05270	0.05265	22.96809	5.5350	10.6704	41.49610
447.58	194.26	311.71	311.43	516.00	0.34525	448.65	1423.06	0.05370	0.05447	22.96809	5.5350	10.7267	41.49610
450.15	192.92	311.84	311.41	511.51	0.35139	451.66	1425.45	0.05514	0.05658	22.96809	5.5350	10.8210	41.49610
453.79	189.53	312.02	311.39	505.30	0.35992	455.92	1428.79	0.05720	0.05953	22.96809	5.5350	10.9540	41.49610
458.95	183.34	312.24	311.35	495.76	0.37305	461.97	1433.42	0.06015	0.06370	22.96809	5.5350	11.1647	41.49610
466.25	177.61	312.53	311.31	484.68	0.38848	470.54	1439.77	0.06432	0.06932	22.96809	5.5350	11.4200	41.49610
474.82	166.53	312.76	311.23	472.80	0.40506	479.10	1445.88	0.06849	0.07489	22.96809	5.5350	11.7070	41.49610
482.12	160.55	312.91	311.18	465.66	0.41509	485.15	1450.03	0.07139	0.07863	22.96809	5.5350	11.8865	41.49610
487.28	153.96	313.00	311.14	460.60	0.42218	489.41	1452.88	0.07343	0.08127	22.96809	5.5350	12.0169	41.49610
490.92	150.96	313.06	311.11	457.75	0.42622	492.42	1454.85	0.07485	0.08304	22.96809	5.5350	12.0918	41.49610
493.49	148.97	313.10	311.10	456.93	0.42746	494.55	1456.22	0.07584	0.08428	22.96809	5.5350	12.1134	41.49610
495.30	145.48	313.01	311.01	456.11	0.42846	496.05	1456.22	0.07628	0.08467	22.96809	5.5350	12.1353	41.49610
497.11	134.01	313.05	310.99	453.85	0.43204	498.18	1457.55	0.07725	0.08586	22.96809	5.5350	12.1958	41.49610
499.68	131.81	313.10	310.98	450.37	0.43694	501.19	1459.41	0.07861	0.08752	22.96809	5.5350	12.2900	41.49610
503.32	128.70	313.17	310.95	445.82	0.44337	505.45	1461.98	0.08051	0.08982	22.96809	5.5350	12.4154	41.49610
508.48	121.79	313.26	310.91	438.88	0.45318	511.50	1465.49	0.08316	0.09302	22.96809	5.5350	12.6116	41.49610
515.78	115.50	313.35	310.86	431.09	0.46432	520.07	1470.19	0.08681	0.09722	22.96809	5.5350	12.8896	41.49610
524.35	103.27	313.40	310.77	422.64	0.47640	528.63	1474.53	0.09034	0.10129	22.96809	5.5350	13.0963	41.49610
531.65	96.79	313.41	310.72	417.69	0.48355	534.68	1477.37	0.09273	0.10391	22.96809	5.5350	13.2516	41.49610
536.81	89.61	313.41	310.67	414.10	0.48873	538.94	1479.26	0.09437	0.10573	22.96809	5.5350	13.3664	41.49610
540.45	86.37	313.40	310.65	411.94	0.49188	541.95	1480.53	0.09550	0.10690	22.96809	5.5350	13.4366	41.49610
543.02	84.13	313.39	310.63	410.91	0.49341	544.08	1481.40	0.09628	0.10771	22.96809	5.5350	13.4700	41.49610
544.83	82.69	313.31	310.62	411.05	0.49346	545.58	1481.40	0.09671	0.10776	22.96809	5.5350	13.4654	41.49610
546.64	67.69	313.29	310.52	409.64	0.49545	547.71	1482.21	0.09744	0.10888	22.96809	5.5350	13.5119	41.49610
549.21	65.37	313.28	310.50	407.47	0.49862	550.72	1483.33	0.09848	0.10990	22.96809	5.5350	13.5837	41.49610
552.85	62.09	313.25	310.47	404.58	0.50288	554.98	1484.80	0.09990	0.11125	22.96809	5.5350	13.6810	41.49610
558.01	54.72	313.19	310.42	400.10	0.50945	561.03	1486.69	0.10180	0.11307	22.96809	5.5350	13.8341	41.49610
565.31	48.17	313.08	310.37	395.44	0.51643	569.60	1488.94	0.10425	0.11517	22.96809	5.5350	13.9970	41.49610
573.88	35.28	312.91	310.28	390.44	0.52393	578.16	1490.63	0.10643	0.11699	22.96809	5.5350	14.1764	41.49610
581.18	28.71	312.76	310.23	387.83	0.52799	584.21	1491.44	0.10781	0.11786	22.96809	5.5350	14.2715	41.49610
586.34	21.31	312.63	310.18	386.07	0.53077	588.47	1491.80	0.10870	0.11838	22.96809	5.5350	14.3367	41.49610
589.98	18.09	312.53	310.15	385.32	0.53205	591.48	1491.94	0.10928	0.11859	22.96809	5.5350	14.3646	41.49610
592.55	15.92	312.45	310.14	385.38	0.53214	593.61	1491.98	0.10967	0.11869	22.96809	5.5350	14.3625	41.49610
593.99	14.79	312.42	310.13	385.56	0.53194	594.36	1491.98	0.10980	0.11874	22.96809	5.5350	14.3559	41.49610
594.36	0.09												

BUNDLE AVERAGED AXIAL AVERAGE VOID = 16.328982 [%]

CASE=0101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

DATA FOR CHANNEL 6, ASSEMBLY SUBCHANNEL PRESSURE = 10.000 MPA TIME = 0.000000 SECONDS

AXIAL LOCATION [CM]	RELATIVE PRESSURE [KPA]	LIQUID TEMP [DEG-C]	VAPOUR TEMP [DEG-C]	MIXTURE DENSITY [KG/M3]	VOID FRACTION	AXIAL LOCATION [CM]	FLOW ENTHALPY [KJ/KG]	FLOW QUALITY	FLOW NON-EQUIL QUALITY	MASS EQUILIB QUALITY	MASS FLOW [KG/S]	FLUX [MG/M2-S]	FLOW VELOCITY [M/S]	AREA [CM2]
0.00	499.87	256.12	314.80	881.66	0.00000	0.00	1076.45	0.00000	-0.25696	0.25054	5.4501	6.1816	0.45970	
0.38	493.72	256.12	313.55	881.66	0.00000	0.75	1076.45	0.00000	-0.25657	0.25056	5.4506	6.1822	0.45970	
1.81	493.31	256.14	313.54	881.63	0.00000	2.88	1076.51	0.00000	-0.25690	0.25038	5.4510	6.1829	0.45970	
4.38	492.56	256.18	313.54	881.56	0.00000	5.89	1076.70	0.00000	-0.25640	0.25057	5.4508	6.1831	0.45970	
8.02	491.51	256.29	313.53	881.37	0.00000	10.15	1077.21	0.00000	-0.25591	0.25048	5.4489	6.1823	0.45970	
13.18	488.84	256.53	313.51	880.93	0.00000	16.20	1078.35	0.00000	-0.25479	0.25038	5.4467	6.1829	0.45970	
20.48	486.73	257.05	313.50	880.02	0.00000	24.77	1080.74	0.00000	-0.25261	0.25038	5.4465	6.1891	0.45970	
29.05	482.00	257.74	313.47	878.80	0.00000	33.33	1083.93	0.00000	-0.24962	0.25036	5.4462	6.1973	0.45970	
36.35	479.86	258.32	313.45	877.77	0.00000	39.38	1086.62	0.00000	-0.24718	0.25027	5.4443	6.2024	0.45970	
41.51	477.16	258.77	313.43	876.96	0.00000	43.64	1088.72	0.00000	-0.24523	0.25030	5.4449	6.2088	0.45970	
45.15	476.08	259.11	313.42	876.35	0.00000	46.65	1090.31	0.00000	-0.24380	0.25035	5.4460	6.2144	0.45970	
47.72	475.31	259.36	313.42	875.90	0.00000	48.78	1091.48	0.00000	-0.24274	0.24988	5.4358	6.2059	0.45970	
49.53	468.79	259.37	313.37	875.88	0.00000	50.28	1091.50	0.00000	-0.24242	0.25007	5.4399	6.2108	0.45970	
51.34	468.23	259.63	313.37	875.41	0.00000	52.41	1092.73	0.00000	-0.24132	0.25037	5.4463	6.2214	0.45970	
53.91	467.43	260.02	313.36	874.71	0.00000	55.42	1094.55	0.00000	-0.23971	0.25060	5.4515	6.2323	0.45970	
57.55	466.31	260.60	313.36	873.67	0.00000	59.68	1097.24	0.00000	-0.23732	0.25078	5.4552	6.2441	0.45970	
62.71	463.54	261.46	313.34	872.09	0.00000	65.73	1101.30	0.00000	-0.23367	0.25091	5.4581	6.2586	0.45970	
70.01	461.32	262.79	313.32	869.68	0.00000	74.30	1107.50	0.00000	-0.22817	0.25104	5.4609	6.2793	0.45970	
78.58	456.44	264.21	313.29	867.05	0.00000	82.86	1114.20	0.00000	-0.22213	0.25108	5.4618	6.2984	0.45970	
85.88	454.21	265.27	313.27	865.07	0.00000	88.91	1119.20	0.00000	-0.21769	0.25104	5.4609	6.3127	0.45970	
91.04	451.42	266.05	313.25	863.62	0.00000	93.17	1122.87	0.00000	-0.21438	0.25109	5.4620	6.3245	0.45970	
94.68	450.30	266.61	313.24	862.56	0.00000	96.18	1125.53	0.00000	-0.21202	0.25116	5.4635	6.3340	0.45970	
97.25	449.49	267.01	313.24	861.80	0.00000	98.31	1127.44	0.00000	-0.21033	0.25116	5.4635	6.3397	0.45970	
99.06	448.95	267.02	313.23	861.78	0.00000	99.81	1127.49	0.00000	-0.21026	0.25063	5.4519	6.3264	0.45970	
100.87	442.29	267.43	313.19	860.99	0.00000	101.94	1129.45	0.00000	-0.20826	0.25087	5.4572	6.3383	0.45970	
103.44	441.46	268.02	313.18	859.87	0.00000	104.95	1132.25	0.00000	-0.20579	0.25114	5.4630	6.3534	0.45970	
107.08	440.30	268.87	313.17	858.25	0.00000	109.21	1136.29	0.00000	-0.20224	0.25128	5.4661	6.3690	0.45970	
112.24	437.45	270.10	313.15	856.87	0.00000	115.26	1142.17	0.00000	-0.19701	0.25137	5.4681	6.3889	0.45970	
119.54	435.16	271.90	313.14	852.36	0.00000	123.83	1150.79	0.00000	-0.18942	0.25140	5.4688	6.4160	0.45970	
128.11	430.14	273.75	313.10	848.69	0.00000	132.39	1159.74	0.00000	-0.18144	0.25139	5.4686	6.4436	0.45970	
135.41	427.84	275.09	313.08	846.00	0.00000	138.44	1166.23	0.00000	-0.17571	0.25130	5.4667	6.4618	0.45970	
140.57	424.97	276.05	313.06	844.05	0.00000	142.70	1170.90	0.00000	-0.17154	0.25133	5.4673	6.4774	0.45970	
144.21	423.81	276.74	313.06	842.66	0.00000	145.71	1174.25	0.00000	-0.16859	0.25138	5.4683	6.4894	0.45970	
146.78	422.98	277.22	313.05	841.66	0.00000	147.84	1176.63	0.00000	-0.16649	0.25135	5.4677	6.4963	0.45970	
148.59	422.42	277.54	313.05	841.62	0.00000	149.34	1176.71	0.00000	-0.16638	0.25079	5.4556	6.4822	0.45970	
150.40	415.59	277.73	313.00	840.60	0.00000	151.47	1179.13	0.00000	-0.16401	0.25100	5.4602	6.4936	0.45970	
152.97	414.74	278.43	312.99	839.15	0.00000	154.48	1182.55	0.00000	-0.16101	0.25125	5.4655	6.5131	0.45970	
156.61	413.54	279.42	312.98	837.09	0.00000	158.74	1187.41	0.00000	-0.15674	0.25136	5.4679	6.5320	0.45970	
161.77	410.60	280.83	312.96	834.12	0.00000	164.79	1194.38	0.00000	-0.15058	0.25144	5.4696	6.5573	0.45970	
169.07	408.24	282.82	312.95	829.86	0.00000	173.36	1204.28	0.00000	-0.14190	0.25145	5.4699	6.5913	0.45970	
177.64	403.06	284.79	312.91	825.55	0.00000	181.92	1214.17	0.00000	-0.13312	0.25147	5.4703	6.6262	0.45970	
184.94	400.68	286.16	312.89	822.50	0.00002	187.97	1221.07	0.00000	-0.12705	0.25141	5.4689	6.6491	0.45970	
190.10	397.71	287.12	312.87	820.34	0.00005	192.23	1225.90	0.00000	-0.12274	0.25146	5.4702	6.6682	0.45970	
193.74	396.51	287.78	312.86	818.82	0.00007	195.24	1229.30	0.00000	-0.11975	0.25147	5.4702	6.6806	0.45970	
196.31	395.66	288.25	312.86	817.74	0.00009	197.37	1231.68	0.00000	-0.11766	0.25088	5.4574	6.6738	0.45970	
198.12	388.64	288.27	312.81	817.75	0.00009	198.87	1231.79	0.00000	-0.11728	0.25090	5.4578	6.6767	0.45970	
199.93	388.04	288.74	312.80	816.60	0.00011	201.00	1234.16	0.00000	-0.11520	0.25128	5.4662	6.6938	0.45970	
202.50	387.15	289.39	312.80	815.08	0.00015	204.01	1237.51	0.00000	-0.11227	0.25153	5.4717	6.7131	0.45970	
206.14	386.91	290.31	312.79	812.91	0.00021	208.27	1242.22	0.00000	-0.10814	0.25171	5.4755	6.7357	0.45970	
211.30	382.87	291.60	312.77	809.79	0.00032	214.32	1248.89	0.00000	-0.10225	0.25199	5.4816	6.7692	0.45970	
218.60	380.39	293.38	312.75	805.39	0.00054	222.89	1258.17	0.00000	-0.09413	0.25228	5.4879	6.8139	0.45970	
227.17	374.98	295.15	312.71	800.86	0.00085	231.45	1267.44	0.00000	-0.08588	0.25268	5.4967	6.8634	0.45970	
234.47	372.45	296.37	312.69	797.66	0.00112	237.50	1273.88	0.00000	-0.08022	0.25289	5.5012	6.8906	0.45970	
239.63	369.31	297.22	312.67	795.36	0.00135	241.76	1278.41	0.00000	-0.07619	0.25320	5.5079	6.9251	0.45970	
243.27	368.01	297.81	312.66	793.75	0.00153	244.77	1281.55	0.00000	-0.07342	0.25340	5.5123	6.9446	0.45970	
245.84	367.10	298.22	312.66	792.62	0.00166	246.90	1283.75	0.00000	-0.07149	0.25330	5.5101	6.9518	0.45970	
247.65	366.53	298.24	312.65	793.72	0.00008	248.40	1283.83	0.00000	-0.07139	0.25262	5.4953	6.9235	0.45970	
249.46	359.21	298.65	312.60	791.43	0.00178	250.53	1286.03	0.00001	-0.06921	0.25277	5.5029	6.9532	0.45970	
252.03	358.24	299.24	312.59	789.67	0.00213	253.54	1289.21	0.00001	-0.06643	0.25357	5.5161	6.9853	0.45970	
255.67	356.87	300.08	312.58	787.14	0.00262	257.80	1293.75	0.00001	-0.06245	0.25416	5.5289	7.0240	0.45970	
260.83	353.58	301.29	312.56	783.21	0.00368	263.85	1300.34	0.00002	-0.05664	0.25499	5.5469	7.0822	0.45970	
268.13	350.81	302.94	312.54	777.08	0.00609	272.42	1309.46	0.00006	-0.04866	0.25548	5.5575	7.1519	0.45970	
276.70	344.90	304.61	312.50	769.06	0.01018	280.98	1318.83	0.00019	-0.04034	0.25589	5.5666	7.2408	0.45970	
284.00	341.99	305.73	312.48	762.87	0.01535	287.03	1325.29	0.00036	-0.03466	0.25601	5.5692	7.3003	0.45970	
289.16	338.50	306.50	312.45	757.92	0.01930	291.29	1329.87	0.00055	-0.03058	0.25620	5.5731	7.3531	0.45970	
292.80	337.00	307.02	312.44	754.45	0.02216	294.30	1332.98	0.00071	-0.02784	0.25632	5.5758	7.3905	0.45970	
295.37	333.93	307.36	312.44	752.12	0.02409	296.43	1335.09	0.00082	-0.02599	0.25618	5.5727	7.4094	0.45970	
297.18	333.30	307.41	312.43	753.53	0.02191	297.93	1335.18	0.00081	-0.02588	0.25522	5.5518	7.3678	0.45970	
298.99	327.45	307.75	312.37	750.64	0.02459	300.06	1337.34	0.00086	-0.02374	0.25535	5.5546	7.3998	0.45970	
301.56	326.33	308.26	312.37	745.94	0.02923	303.07	1340.61	0.00117	-0.02067	0.25543	5.5565	7.4490	0.45970	
305.20	324.72	308.97	312.36	738.71	0.03667	307.33	1345.36	0.00175	-0.01672	0.25498	5.5467	7.5087	0.45970	
310.36	320.96	309.94	312.33	727.14	0.04925	313.38	1352.32	0.00290	-0.01058	0.25409	5.5273	7.6014	0.45970	
317.66	317.64	311.14	312.31	710.28	0.06854	321.95	1361.75	0.00499	-0.00233	0.25234	5.4893	7.7284	0.45970	
326.23	310.83	312.27	312.26	691.29	0.09135	330.51	1371.61	0.00782	0.00640	0.25047	5.4485	7.8817	0.45970	
333.53	307.29	312.98	312.23	677.81	0.10795	336.56	1378.40	0.01005	0.01238	0.24888	5.4140	7.9875	0.45970	
338.69	303.23	313.46	312.20	668.03	0.12022	340.82	1383.20	0.01177	0.01666	0.24783	5.3912	8.0704	0.45970	
342.33	301.39	313.76	312.19	661.44	0.12858	343.83	1386.39	0.01297	0.01946	0.24713	5.3760	8.1277	0.45970	
344.90	300.08	313.96	312.18	657.07	0.13414	345.96	1388.49	0.01378	0.02132	0.24601	5.3515	8.1444	0.45970	
346.71	291.52	313.94	312.12	655.90	0.13585	347.46	1388.70	0.01402	0.02179	0.24571	5.3451	8.1491	0.45970	
348.52	290.61	314.16	312.11	650.83	0.14237	349.59	1391.12	0.01499	0.02390	0.24518	5.3335	8.1948	0.45970	
351.09	289.19	314.47	312.10	643.08	0.15243	352.60	1394.73	0.01651	0.02706	0.24404	5.3086	8.2549	0.45970	
354.73	287.21	314.90	312.09	631.69	0.16742	356.86	1399.91	0.01884	0.03158	0.24213	5.2671	8.3381	0.45970	
359.89	282.80	315.46	312.06	614.39	0.19036	362.91	1407.53	0.02256	0.03829	0.23895	5.1979	8.4603	0.45970	
367.19	278.72	316.12	312.03	590.46	0.22322	371.48	1417.80	0.02810	0.04727	0.23357	5.1241	8.6767	0.45970	
373.36	270.70	316.71	311.97	565.36	0.25800	380.04	1428.55	0.03444	0.05678	0.23187	5.0439	8.9215	0.45970	
383.06	266.35	317.08	311.94	548.34	0.28183	386.09	1435.98	0.03903	0.06331	0.22963	4.9952	9.1066	0.45970	
388.22	261.53	317.32	311.91	536.37	0.29871	390.35	1441.29	0.04245	0.06802	0.22794	4.9585	9.2446	0.45970	
391.86	259.26	317.47	311.89	528.31	0.31012	393.36	1444.90	0.04484	0.07120	0.22696	4.9370	9.3448	0.45970	
394.43	257.61	317.56	311.88	522.99	0.31769	395.49	1447.30	0.04647	0.07331	0.22660	4.9293	9.4252	0.45970	
396.24	256.46	317.46	311.87	521.24	0.32062	396.99	1447.42	0.04708	0.07345	0.22634	4.9236	9.4458	0.45970	
398.05	246.95	317.55	311.80	515.81	0.32832	399.12	1449.85	0.04873	0.07584	0.22598	4.9158	9.5303	0.45970	
400.62	245.14	317.69	311.79	507.85	0.33967	402.13	1453.55	0.05129	0.07907	0.22483	4.8908	9.6303	0.45970	
404.26	242.67	317.86	311.77	496.43	0.35607	406.39	1458.91	0.05513	0.08375	0.22316	4.8546	9.7790	0.45970	
409.42	237.42	318.07	311.73	479.88	0.38001	412.44	1466.77	0.06101	0.09067	0.22018	4.7896	9.9807	0.45970	
416.72	232.42	318.27	311.70	458.13	0.41178	421.01	1477.46	0.06944	0.09999	0.21784	4.7388	10.3437	0.45970	
425.29	222.87	318.39	311.63	436.84	0.44310	429.57	1488.40	0.07847	0.10967	0.21494	4.6757	10.7084	0.45970	
432.59	217.57	318.44	311.59	422.96	0.46366	435.62	1495.89	0.08485	0.11625	0.21351	4.6446	10.9812	0.45970	
437.75	211.83	318.46	311.55	413.49	0.47771	439.88	1501.14	0.08942	0.12092	0.21233	4.6189	11.1705	0.45970	
441.39	209.08	318.46	311.53	407.19	0.48710	442.89	1504.72	0.09259	0.12407	0.21170	4.6051	11.3097	0.45970	
443.96	207.09	318.45	311.52	403.03	0.49352	445.02	1507.11	0.09474	0.12617	0.21169	4.6050	11.4261	0.45970	
445.77	205.64	318.27	311.51	401.36	0.49627	446.52	1507.17	0.09570	0.12627	0.21192	4.6100	11.4857	0.45970	
447.58	194.66	318.26	311.43	397.23	0.50237	448.65	1509.49	0.09777	0.12857	0.21196	4.6108	11.6074	0.45970	
450.15	192.49	318.25	311.41	391.60	0.51078	451.66	1512.90	0.10083	0.13156	0.21141	4.6088	11.7437	0.45970	
453.79	189.56	318.24	311.39	383.83	0.52238	455.92	1517.72	0.10518	0.13577	0.21070	4.5934	11.9413	0.45970	
458.95	183.42	318.20	311.35	373.05	0.53850	461.97	1524.62	0.11147	0.14185	0.20911	4.5588	12.1934	0.45970	
466.25	177.62	318.12	311.31	359.36	0.55907	470.54	1533.83	0.12001	0.14990	0.20831	4.5315	12.6101	0.45970	
474.82	166.60	318.01	311.23	346.43	0.57849	479.10	1542.90	0.12855	0.15797	0.20688	4.5003	12.9008	0.45970	
482.12	160.55	317.92	311.18	338.11	0.59103	485.15	1548.99	0.13437	0.16334	0.20634	4.4886	13.2758	0.45970	
487.28	154.02	317.84	311.14	332.50	0.59949	489.41	1553.16	0.13841	0.16708	0.20585	4.4779	13.4672	0.45970	
490.92	150.91	317.78	311.11	328.81	0.60509	492.42	1555.96	0.14117	0.16956	0.20581	4.4770	13.6158	0.45970	
493.49	148.64	317.73	311.10	326.44	0.60868	494.55	1557.76	0.14297	0.17116	0.20625	4.4868	13.7446	0.45970	
495.30	135.86	317.53	311.01	325.09	0.61098	496.05	1557.77	0.14388	0.17150	0.20652	4.4924	13.8190	0.45970	
497.11	134.21	317.49	310.99	322.76	0.61451	498.18	1559.60	0.14568	0.17311	0.20657	4.4936	13.9223	0.45970	
499.68	131.91	317.43	310.98	319.50	0.61943	501.19	1562.19	0.14825	0.17538	0.20680	4.4986	14.0520	0.45970	
503.32	128.71	317.34	310.95	315.05	0.62620	505.45	1565.70	0.15183	0.17854	0.20624	4.4863	14.2388	0.45970	
508.48	121.87	317.21	310.91	308.89	0.63554	511.50	1570.83	0.15689	0.18302	0.20555	4.4714	14.4754	0.45970	
515.78	115.51	317.00	310.86	301.05	0.64749	520.07	1577.46	0.16365	0.18884	0.20545	4.4691	14.8149	0.45970	
524.35	103.33	316.76	310.77	293.66	0.65875	528.63	1583.71	0.17019	0.19449	0.20483	4.4558	15.1732	0.45970	
531.65	96.80	316.57	310.72	288.92	0.66603	534.68	1587.77	0.17458	0.19812	0.20467	4.4522	15.4100	0.45970	
536.81	89.66	316.42	310.67	285.91	0.67098	538.94	1590.48	0.17759	0.20060	0.20447	4.4480	15.5692	0.45970	
540.45	86.96	316.32	310.65	283.55	0.67429	541.95	1592.30	0.17966	0.20223	0.20440	4.4464	15.6815	0.45970	

343.02	84.01	316.24	310.63	282.16	0.67646	544.08	1593.46	0.18101	0.20328	0.20456	4.4499	15.7711	0.45970
344.83	82.31	316.06	310.62	281.44	0.67778	545.58	1593.45	0.18178	0.20332	0.20466	4.4521	15.8189	0.45970
346.64	68.00	315.97	310.52	279.96	0.67897	547.71	1594.45	0.18297	0.20452	0.20500	4.4595	15.9292	0.45970
349.21	65.50	315.85	310.50	278.21	0.68270	550.72	1595.89	0.18472	0.20580	0.20518	4.4634	16.0429	0.45970
352.85	62.12	315.69	310.47	275.90	0.68634	554.98	1597.77	0.18709	0.20749	0.20537	4.4675	16.1926	0.45970
358.01	54.78	315.44	310.42	272.75	0.69129	561.03	1600.24	0.19030	0.20978	0.20525	4.4649	16.3699	0.45970
365.31	48.17	315.07	310.37	268.88	0.69746	569.60	1603.16	0.19441	0.21242	0.20548	4.4699	16.6240	0.45970
373.88	35.34	314.65	310.28	265.39	0.70307	578.16	1605.36	0.19827	0.21460	0.20536	4.4673	16.8327	0.45970
381.18	28.71	314.31	310.23	263.28	0.70659	584.21	1606.41	0.20038	0.21565	0.20538	4.4678	16.9697	0.45970
386.34	21.34	314.04	310.18	261.88	0.70894	588.47	1606.87	0.20188	0.21622	0.20538	4.4677	17.0605	0.45970
389.98	18.05	313.84	310.15	261.11	0.71032	591.48	1606.92	0.20275	0.21633	0.20560	4.4724	17.1286	0.45970
392.55	15.68	313.68	310.14	260.77	0.71100	593.61	1606.65	0.20313	0.21616	0.20609	4.4831	17.1918	0.45970
393.99	14.22	313.63	310.13	260.63	0.71126	594.36	1606.57	0.20329	0.21613	0.20615	4.4845	17.2067	0.45970
394.36	0.02												

SUBCHANNEL AXIAL AVERAGE VOID = 21.800002 [%]

1
CASE80101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

MIXTURE CROSSFLOW BETWEEN ADJACENT CHANNELS, W(I,J,J) TIME = 0.00000 SECONDS

AXIAL ZONE [CM]		W(0, 0) [KG/M-S]	W(2, 10)	W(2, 3)	W(3, 12)	W(3, 4)	W(4, 14)	W(48, 49)	W(1, 7)	W(5, 6)
0.0 -	0.8	0.00000	0.01020	-0.07043	-0.04571	-0.02964	-0.06489	-0.04264	0.00003	0.07045
0.8 -	2.9	0.00000	0.01130	-0.06479	-0.03983	-0.02729	-0.05760	-0.03463	0.00003	0.06481
2.9 -	5.9	0.00000	0.00790	-0.04163	-0.02534	-0.01716	-0.03577	-0.02344	0.00003	0.04165
5.9 -	10.2	0.00000	-0.00107	0.01391	0.01233	0.00710	0.02117	0.01998	0.00004	-0.01389
10.2 -	16.2	0.00000	0.00655	-0.03246	-0.01908	-0.01301	-0.02751	-0.02511	0.00004	0.03248
16.2 -	24.8	0.00000	-0.01075	0.05585	0.03266	0.02481	0.05187	0.03060	0.00006	-0.05581
24.8 -	33.3	0.00000	0.00469	-0.02646	-0.01656	-0.01137	-0.02501	-0.01807	0.00008	0.02652
33.3 -	39.4	0.00000	-0.00667	0.03661	0.02218	0.01652	0.03535	0.01785	0.00007	-0.03657
39.4 -	43.6	0.00000	-0.01381	0.05784	0.02513	0.02650	0.04431	-0.00051	0.00008	-0.05779
43.6 -	46.7	0.00000	-0.03070	0.16886	0.09132	0.07609	0.14971	0.04767	0.00009	-0.16879
46.7 -	48.8	0.00000	-0.03272	0.25425	0.19016	0.11003	0.27626	0.21705	0.00010	-0.25417
48.8 -	50.3	0.00000	-0.05460	0.19190	0.10227	0.08136	0.15641	0.10131	0.00009	-0.19183
50.3 -	52.4	0.00000	-0.03275	0.08169	0.02844	0.03198	0.03923	0.00780	0.00010	-0.08161
52.4 -	55.4	0.00000	-0.00975	-0.01000	-0.01626	-0.00786	-0.03265	-0.02642	0.00012	0.01008
55.4 -	59.7	0.00000	-0.00385	-0.02545	-0.01395	-0.01418	-0.03059	-0.02890	0.00013	0.02554
59.7 -	65.7	0.00000	0.00702	-0.07780	-0.04604	-0.03590	-0.07692	-0.04231	0.00014	0.07790
65.7 -	74.3	0.00000	-0.00923	0.00840	0.00625	0.00226	0.00523	0.00497	0.00011	-0.00831
74.3 -	82.9	0.00000	0.00318	-0.05533	-0.03192	-0.02505	-0.05239	-0.03340	0.00012	0.05544
82.9 -	88.9	0.00000	-0.00529	-0.00045	0.00222	-0.00088	0.00042	0.00057	0.00010	0.00056
88.9 -	93.2	0.00000	-0.00847	0.00044	-0.00476	-0.00024	-0.00704	-0.02048	0.00010	-0.00052
93.2 -	96.2	0.00000	-0.02636	0.07689	0.03482	0.03475	0.05999	0.00168	0.00007	-0.07679
96.2 -	98.3	0.00000	-0.04507	0.17445	0.10309	0.07801	0.16607	0.07501	0.00007	-0.17434
98.3 -	99.8	0.00000	-0.01788	0.21363	0.18185	0.09337	0.25047	0.20036	0.00008	-0.21349
99.8 -	101.9	0.00000	-0.04899	0.13486	0.06748	0.05683	0.10335	0.05770	0.00007	-0.13475
101.9 -	104.9	0.00000	-0.01958	0.01305	-0.00547	0.00274	-0.01346	-0.02482	0.00011	-0.01291
104.9 -	109.2	0.00000	-0.00567	-0.03483	-0.02000	-0.01771	-0.03840	-0.01705	0.00013	0.03499
109.2 -	115.3	0.00000	0.00734	-0.09448	-0.05526	-0.04255	-0.08948	-0.05521	0.00015	0.09466
115.3 -	123.8	0.00000	-0.00842	-0.01147	-0.00470	-0.00548	-0.00908	-0.00587	0.00010	0.01165
123.8 -	132.4	0.00000	0.00319	-0.06943	-0.04013	-0.03015	-0.06174	-0.04361	0.00010	0.06963
132.4 -	138.4	0.00000	-0.00617	-0.01607	-0.00700	-0.00649	-0.00999	-0.01130	0.00008	0.01627
138.4 -	142.7	0.00000	-0.02841	-0.01444	-0.01351	-0.00570	-0.01806	-0.03134	0.00007	0.01464
142.7 -	145.7	0.00000	-0.02600	0.06065	0.02529	0.02902	0.04959	-0.00799	0.00002	-0.06044
145.7 -	147.8	0.00000	-0.04488	0.15582	0.09217	0.07183	0.15643	0.06257	0.00000	-0.15561
147.8 -	149.3	0.00000	-0.01650	0.19330	0.16918	0.08656	0.24679	0.19215	0.00001	-0.19307
149.3 -	151.5	0.00000	-0.04425	0.11398	0.05511	0.04885	0.08838	0.04379	0.00000	-0.11318
151.5 -	154.5	0.00000	-0.01750	-0.00638	-0.01660	-0.00440	-0.02643	-0.03600	0.00005	0.00660
154.5 -	158.7	0.00000	-0.00371	-0.05328	-0.03082	-0.02436	-0.05057	-0.02850	0.00007	0.05354
158.7 -	164.8	0.00000	0.00924	-0.11125	-0.06551	-0.04852	-0.10073	-0.06481	0.00009	0.11153
164.8 -	173.4	0.00000	-0.00673	-0.02885	-0.01554	-0.01164	-0.02089	-0.01629	0.00000	0.02912
173.4 -	181.9	0.00000	0.00495	-0.08549	-0.05063	-0.03585	-0.07815	-0.05256	0.00001	0.08580
181.9 -	188.0	0.00000	-0.00531	-0.02812	-0.01570	-0.01060	-0.01899	-0.01993	-0.00005	0.02842
188.0 -	192.2	0.00000	-0.01197	-0.00615	-0.01188	-0.00055	-0.00946	-0.03279	-0.00007	0.00648
192.2 -	195.2	0.00000	-0.03548	0.09857	0.04895	0.04801	0.09568	0.01171	-0.00010	-0.09823
195.2 -	197.4	0.00000	-0.02598	0.17780	0.14575	0.08250	0.22638	0.15846	-0.00005	-0.17737
197.4 -	198.9	0.00000	-0.04443	0.11236	0.05888	0.05142	0.10257	0.05408	-0.00014	-0.11262
198.9 -	201.0	0.00000	-0.02343	-0.00029	-0.01961	-0.00135	-0.02660	-0.03343	-0.00023	0.00052
201.0 -	204.0	0.00000	0.00051	-0.08836	-0.06142	-0.04103	-0.09727	-0.06198	-0.00012	0.08970
204.0 -	208.3	0.00000	0.00781	-0.10727	-0.06984	-0.04830	-0.09740	-0.04286	-0.00000	0.10765
208.3 -	214.3	0.00000	0.02050	-0.13544	-0.09420	-0.07051	-0.14660	-0.07600	-0.00008	0.13854
214.3 -	222.9	0.00000	0.00442	-0.07536	-0.04891	-0.03251	-0.06436	-0.02762	-0.00021	0.07548
222.9 -	231.5	0.00000	0.01921	-0.14157	-0.08502	-0.06123	-0.12672	-0.06415	-0.00021	0.14197
231.5 -	237.5	0.00000	0.01051	-0.09117	-0.05891	-0.03853	-0.07648	-0.03331	-0.00028	0.09155
237.5 -	241.8	0.00000	0.00887	-0.09238	-0.06332	-0.04011	-0.09179	-0.05237	-0.00028	0.09238
241.8 -	244.8	0.00000	-0.01101	-0.00541	-0.01798	0.00026	-0.01408	-0.02629	-0.00021	0.00592
244.8 -	246.9	0.00000	-0.03189	0.11104	0.06679	0.05608	0.12892	0.04679	0.00008	-0.11020
246.9 -	248.4	0.00000	-0.00272	0.15233	0.15282	0.07581	0.24484	0.17436	-0.00018	-0.15167
248.4 -	250.5	0.00000	-0.02486	0.02111	-0.00165	0.00955	0.01195	0.01264	-0.00092	-0.02111
250.5 -	253.5	0.00000	0.01260	-0.13958	-0.09721	-0.06545	-0.15184	-0.06454	-0.00073	0.13976
253.5 -	257.8	0.00000	0.03347	-0.20586	-0.12040	-0.09241	-0.18591	-0.05892	-0.00066	0.20620
257.8 -	263.8	0.00000	0.05414	-0.28189	-0.16657	-0.12313	-0.24968	-0.09525	-0.00075	0.28203
263.8 -	272.4	0.00000	0.03583	-0.17486	-0.10005	-0.07135	-0.13411	-0.04556	-0.00094	0.17444
272.4 -	281.0	0.00000	0.05900	-0.24676	-0.14296	-0.10254	-0.19881	-0.08172	-0.00109	0.24676
281.0 -	287.0	0.00000	0.04610	-0.17994	-0.10106	-0.07108	-0.12884	-0.05018	-0.00120	0.17990
287.0 -	291.3	0.00000	0.04707	-0.18543	-0.11259	-0.07451	-0.14738	-0.07007	-0.00133	0.18533
291.3 -	294.3	0.00000	0.02206	-0.08422	-0.06223	-0.02770	-0.06251	-0.04067	-0.00123	0.08424
294.3 -	296.4	0.00000	-0.00792	0.05703	0.02948	0.04305	0.10211	0.04074	-0.00101	-0.05737
296.4 -	297.9	0.00000	0.01766	0.14950	0.16378	0.08675	0.28421	0.17449	-0.00020	-0.14844
297.9 -	300.1	0.00000	0.01111	-0.03953	-0.03114	-0.01052	-0.01702	-0.00744	-0.00094	0.03888
300.1 -	303.1	0.00000	0.06178	-0.23809	-0.13485	-0.09855	-0.18973	-0.09128	-0.00161	0.23803
303.1 -	307.3	0.00000	0.05387	-0.23420	-0.14052	-0.12107	-0.20772	-0.08619	-0.00173	0.23407
307.3 -	313.4	0.00000	0.11255	-0.37006	-0.19864	-0.15115	-0.26817	-0.12388	-0.00186	0.37006
313.4 -	321.9	0.00000	0.08100	-0.21840	-0.10719	-0.08090	-0.12677	-0.06614	-0.00131	0.21863
321.9 -	330.5	0.00000	0.10251	-0.23092	-0.14915	-0.11212	-0.19136	-0.10426	-0.00121	0.23123
330.5 -	336.6	0.00000	0.08936	-0.19251	-0.09293	-0.06813	-0.10411	-0.06714	-0.00085	0.19328
336.6 -	340.8	0.00000	0.07847	-0.16058	-0.08964	-0.05838	-0.09360	-0.08184	-0.00090	0.17058
340.8 -	343.8	0.00000	0.03705	-0.09377	-0.00840	0.01926	0.04280	-0.02344	-0.00046	0.00491
343.8 -	346.0	0.00000	0.01011	0.19575	0.16229	0.10578	0.26709	0.15469	0.00126	-0.19409
346.0 -	347.5	0.00000	0.02388	0.02093	0.00972	0.02566	0.06344	0.01530	0.00005	-0.01931
347.5 -	349.6	0.00000	0.07441	-0.17240	-0.09189	-0.06195	-0.10480	-0.06501	-0.00023	0.17471
349.6 -	352.6	0.00000	0.11368	-0.29611	-0.14532	-0.11435	-0.19011	-0.13631	-0.00015	0.29746
352.6 -	356.9	0.00000	0.11716	-0.29148	-0.13162	-0.10997	-0.16926	-0.11489	0.00026	0.29315
356.9 -	362.9	0.00000	0.14051	-0.34382	-0.16243	-0.13034	-0.21426	-0.15440	0.00019	0.34547
362.9 -	371.5	0.00000	0.09389	-0.18355	-0.08471	-0.06229	-0.09316	-0.08206	0.00068	0.18359
371.5 -	380.0	0.00000	0.11604	-0.23069	-0.12704	-0.09496	-0.15818	-0.12549	0.00062	0.23165
380.0 -	386.1	0.00000	0.09234	-0.18866	-0.08198	-0.05682	-0.08870	-0.08204	0.00088	0.17305
386.1 -	390.4	0.00000	0.09389	-0.17823	-0.08957	-0.05778	-0.10012	-0.10951	0.00083	0.17588
390.4 -	393.4	0.00000	0.06372	-0.06715	-0.04360	-0.01086	-0.02502	-0.07427	0.00096	0.06948
393.4 -	395.5	0.00000	0.01396	0.09400	0.03654	0.06312	0.11781	0.02745	0.00144	-0.09411
395.5 -	397.0	0.00000	-0.00613	0.21041	0.15740	0.10389	0.27740	0.23585	0.00265	-0.20946
397.0 -	399.1	0.00000	0.02405	0.02709	-0.00227	0.02858	0.04823	-0.01697	0.00148	-0.02422
399.1 -	402.1	0.00000	0.08091	-0.15622	-0.08446	-0.05232	-0.09378	-0.12589	0.00161	0.15900
402.1 -	406.4	0.00000	0.09113	-0.20672	-0.10039	-0.07387	-0.11907	-0.11461	0.00198	0.20674
406.4 -	412.4	0.00000	0.11897	-0.25726	-0.13501	-0.10051	-0.17213	-0.16161	0.00204	0.25724
412.4 -	421.0	0.00000	0.07190	-0.14950	-0.07894	-0.04929	-0.08284	-0.07958	0.00131	0.15209
421.0 -	429.6	0.00000	0.09358	-0.21970	-0.11589	-0.07886	-0.13950	-0.12446	0.00105	0.22201
429.6 -	435.6	0.00000	0.06816	-0.14617	-0.08058	-0.04827	-0.08433	-0.07596	0.00078	0.14834
435.6 -	439.9	0.00000	0.07040	-0.14502	-0.08509	-0.04707	-0.09132	-0.10440	0.00079	0.14717
439.9 -	442.9	0.00000	0.04407	-0.05519	-0.04627	-0.00756	-0.02798	-0.06747	0.00062	0.05750

442.9 - 445.0	0.00000	-0.00039	0.07671	0.01771	0.05182	0.09022	0.04004	0.00034	-0.07461
445.0 - 446.5	0.00000	-0.02070	0.14430	0.10486	0.07290	0.20764	0.27158	0.00028	-0.14208
446.5 - 448.6	0.00000	0.00275	0.03066	-0.01366	0.02773	0.03385	-0.00656	0.00074	-0.02842
448.6 - 451.7	0.00000	0.04984	-0.11969	-0.09053	-0.08835	-0.08376	-0.11091	0.00133	0.12223
451.7 - 455.9	0.00000	0.05824	-0.16984	-0.09716	-0.06007	-0.10894	-0.09215	0.00139	0.17238
455.9 - 462.0	0.00000	0.08023	-0.22854	-0.12772	-0.08339	-0.15551	-0.13794	0.00169	0.23118
462.0 - 470.5	0.00000	0.04493	-0.13308	-0.08193	-0.04389	-0.08245	-0.05923	0.00029	0.13484
470.5 - 479.1	0.00000	0.06435	-0.19386	-0.11382	-0.06921	-0.13133	-0.10641	0.00035	0.19551
479.1 - 485.1	0.00000	0.04201	-0.12715	-0.08010	-0.04149	-0.07983	-0.05616	-0.00033	0.12856
485.1 - 489.4	0.00000	0.03872	-0.10579	-0.07441	-0.03099	-0.07041	-0.07338	-0.00038	0.10501
489.4 - 492.4	0.00000	0.00383	0.00517	-0.02312	0.01882	0.02162	-0.01121	-0.00129	-0.00451
492.4 - 494.6	0.00000	-0.02505	0.08864	0.06467	0.05395	0.13819	0.24096	-0.00280	-0.08888
494.6 - 496.1	0.00000	-0.01778	0.04203	-0.01080	0.03110	0.04088	0.05031	-0.00171	-0.04168
496.1 - 498.2	0.00000	0.01521	-0.06774	-0.06629	-0.01809	-0.05787	-0.06950	-0.00048	0.06885
498.2 - 501.2	0.00000	0.04010	-0.15250	-0.10174	-0.05400	-0.11356	-0.10331	0.00028	0.15402
501.2 - 505.5	0.00000	0.03985	-0.16293	-0.09949	-0.05856	-0.11000	-0.09850	0.00013	0.16425
505.5 - 511.5	0.00000	0.05503	-0.20075	-0.12124	-0.07319	-0.14320	-0.10868	0.00054	0.20228
511.5 - 520.1	0.00000	0.02857	-0.11928	-0.07789	-0.03873	-0.07664	-0.04053	-0.00112	0.11966
520.1 - 528.6	0.00000	0.04585	-0.17512	-0.10838	-0.06303	-0.12311	-0.08616	-0.00079	0.17564
528.6 - 534.7	0.00000	0.03058	-0.12195	-0.07874	-0.04119	-0.07937	-0.04219	-0.00160	0.12185
534.7 - 538.9	0.00000	0.03045	-0.11660	-0.08219	-0.03846	-0.08491	-0.06629	-0.00148	0.11662
538.9 - 542.0	0.00000	0.01114	-0.04580	-0.04858	-0.00727	-0.03126	-0.03626	-0.00212	0.04541
542.0 - 544.1	0.00000	-0.01681	0.03216	0.00881	0.03712	0.07081	0.06143	-0.00350	-0.05337
544.1 - 545.6	0.00000	-0.01587	0.08647	0.08405	0.04558	0.16906	0.25360	-0.00459	-0.08843
545.6 - 547.7	0.00000	-0.01975	0.02491	-0.01716	0.02089	0.02210	0.03646	-0.00292	-0.02595
547.7 - 550.7	0.00000	0.01248	-0.08812	-0.07529	-0.02891	-0.07529	-0.05940	-0.00147	0.08807
550.7 - 555.0	0.00000	0.02243	-0.13147	-0.09892	-0.04785	-0.09899	-0.04795	-0.00129	0.13138
555.0 - 561.0	0.00000	0.03820	-0.17833	-0.11856	-0.06611	-0.13944	-0.08717	-0.00065	0.17865
561.0 - 569.6	0.00000	0.01825	-0.10056	-0.07345	-0.03577	-0.07312	-0.03163	-0.00217	0.10073
569.6 - 578.2	0.00000	0.03373	-0.15067	-0.10220	-0.05858	-0.11677	-0.07271	-0.00179	0.15004
578.2 - 584.2	0.00000	0.01929	-0.10364	-0.08029	-0.03400	-0.08027	-0.05488	-0.00262	0.10435
584.2 - 588.5	0.00000	0.01147	-0.07138	-0.06115	-0.02107	-0.05556	-0.04416	-0.00271	0.07007
588.5 - 591.5	0.00000	-0.02248	0.05057	-0.00336	0.03515	0.04811	0.00561	-0.00426	-0.05277
591.5 - 593.6	0.00000	-0.06417	0.19427	0.09332	0.09627	0.20276	0.18539	-0.00636	-0.19797
593.6 - 594.4	0.00000	-0.04479	0.20204	0.15678	0.09252	0.27897	0.29488	-0.00707	-0.20621

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CASE80101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

CRITICAL HEAT FLUX SUMMARY: TABLE CHF CORRELATION TIME = 0.000000 SECONDS

MINIMUM CRITICAL HEAT FLUX RATIO (MCHFR) RESULTS

AXIAL ZONE [CM.]	HEAT FLUX [MW/M2]	MCHFR RATIO	ROD [NO.]	CHANNEL [NO.]
0.0 - 0.8	0.00000	99.0000	0	0
0.8 - 2.9	0.00000	99.0000	0	0
2.9 - 5.9	0.09541	83.1879	33	60
5.9 - 10.2	0.17450	45.6539	33	60
10.2 - 16.2	0.27683	28.5232	34	60
16.2 - 24.8	0.40914	19.4257	33	60
24.8 - 33.3	0.54243	14.4201	34	60
33.3 - 39.4	0.64634	12.0973	34	60
39.4 - 43.6	0.71521	10.8818	33	60
43.6 - 46.7	0.76258	10.2809	33	60
46.7 - 48.8	0.79541	10.1467	33	60
48.8 - 50.3	0.00000	99.0000	0	0
50.3 - 52.4	0.85898	9.5936	33	60
52.4 - 55.4	0.86979	9.1515	34	60
55.4 - 59.7	0.91207	8.6480	33	60
59.7 - 65.7	0.96778	7.9356	34	60
65.7 - 74.3	1.04184	7.3097	33	60
74.3 - 82.9	1.12150	6.5815	33	60
82.9 - 88.9	1.18491	6.1522	33	60
88.9 - 93.2	1.22741	5.8539	33	60
93.2 - 96.2	1.25681	5.6825	33	60
96.2 - 98.3	1.27605	5.6274	34	60
98.3 - 99.8	0.00000	99.0000	0	0
99.8 - 101.9	1.30295	5.6325	33	60
101.9 - 104.9	1.32187	5.4739	33	60
104.9 - 109.2	1.34701	5.2876	33	60
109.2 - 115.3	1.38190	4.9967	33	60
115.3 - 123.8	1.42750	4.6740	33	60
123.8 - 132.4	1.47709	4.2905	33	60
132.4 - 138.4	1.51676	4.0549	33	60
138.4 - 142.7	1.54357	3.8818	33	60
142.7 - 145.7	1.56015	3.7822	33	60
145.7 - 147.8	1.57109	3.7538	33	60
147.8 - 149.3	0.00000	99.0000	0	0
149.3 - 151.5	1.58644	3.7793	33	60
151.5 - 154.5	1.59433	3.6643	33	60
154.5 - 158.7	1.60413	3.5057	33	60
158.7 - 164.8	1.61483	3.2725	33	60
164.8 - 173.4	1.61880	3.0211	33	60
173.4 - 181.9	1.60739	2.7949	33	60
181.9 - 188.0	1.58881	2.7001	33	60
188.0 - 192.2	1.57545	2.6527	34	60
192.2 - 195.2	1.56434	2.6271	33	60
195.2 - 197.4	1.55648	2.6367	34	60
197.4 - 198.9	0.00000	99.0000	0	0
198.9 - 201.0	1.54497	2.6307	34	60
201.0 - 204.0	1.53053	2.5939	34	60
204.0 - 208.3	1.52461	2.5489	34	60
208.3 - 214.3	1.50947	2.4847	34	60
214.3 - 222.9	1.48050	2.3863	34	60
222.9 - 231.5	1.47264	2.3114	34	60
231.5 - 237.5	1.45825	2.2516	33	60
237.5 - 241.8	1.44819	2.2132	33	60
241.8 - 244.8	1.44111	2.1844	34	60
244.8 - 246.9	1.43611	2.1651	34	60
246.9 - 248.4	0.00000	99.0000	0	0
248.4 - 250.5	1.42905	2.1658	34	60
250.5 - 253.5	1.42405	2.1428	33	60
253.5 - 257.8	1.41722	2.1061	34	60
257.8 - 263.8	1.40834	2.0638	34	60
263.8 - 272.4	1.39684	2.0000	33	59
272.4 - 281.0	1.38472	1.9588	33	59
281.0 - 287.0	1.37509	1.9293	33	59
287.0 - 291.3	1.36958	1.9106	33	59
291.3 - 294.3	1.36441	1.8799	33	59
294.3 - 296.4	1.36156	1.8533	34	60
296.4 - 297.9	0.00000	99.0000	0	0
297.9 - 300.1	1.35756	1.8268	33	59
300.1 - 303.1	1.35476	1.8169	33	59
303.1 - 307.3	1.35115	1.7964	32	59
307.3 - 313.4	1.34622	1.7839	33	59
313.4 - 321.9	1.34057	1.7361	34	35
321.9 - 330.5	1.33497	1.6463	34	35
330.5 - 336.6	1.33133	1.5926	33	35
336.6 - 340.8	1.32945	1.5345	33	35
340.8 - 343.8	1.32843	1.5026	32	33
343.8 - 346.0	1.32781	1.4965	32	33
346.0 - 347.5	0.00000	99.0000	0	0
347.5 - 349.6	1.32808	1.4734	32	33

349.6 - 352.6	1.32655	1.4504	32	33	
352.6 - 356.9	1.32610	1.4220	32	33	
356.9 - 362.9	1.32547	1.3792	32	33	
362.9 - 371.5	1.32467	1.3156	32	33	
371.5 - 380.0	1.32480	1.2496	32	33	
380.0 - 386.1	1.32866	1.2029	32	33	
386.1 - 390.4	1.33278	1.1807	32	33	
390.4 - 393.4	1.33631	1.1628	32	33	
393.4 - 395.5	1.33881	1.1504	32	33	
395.5 - 397.0	0.00000	99.0000	0	0	
397.0 - 399.1	1.34213	1.1449	32	33	
399.1 - 402.1	1.34433	1.1289	32	33	
402.1 - 406.4	1.34742	1.1068	32	33	
406.4 - 412.4	1.35047	1.0823	32	33	
412.4 - 421.0	1.35204	1.0459	32	33	
421.0 - 429.6	1.34595	1.0169	32	33	
429.6 - 435.6	1.33168	1.0119	32	33	
435.6 - 439.9	1.31578	1.0121	32	33	
439.9 - 442.9	1.30286	1.0134	32	33	
442.9 - 445.0	1.29315	1.0150	32	33	
445.0 - 446.5	0.00000	99.0000	0	0	
446.5 - 448.6	1.27689	1.0255	32	33	
448.6 - 451.7	1.26533	1.0365	32	33	
451.7 - 455.9	1.24827	1.0296	32	33	
455.9 - 462.0	1.22202	1.0396	33	33	
462.0 - 470.5	1.18373	1.0430	33	33	
470.5 - 479.1	1.13734	1.0541	34	33	
479.1 - 485.1	1.09619	1.0692	34	33	
485.1 - 489.4	1.06472	1.0797	34	33	
489.4 - 492.4	1.04223	1.0923	34	33	
492.4 - 494.6	1.02591	1.0980	34	33	
494.6 - 496.1	0.00000	99.0000	0	0	
496.1 - 498.2	1.00280	1.1212	34	33	
498.2 - 501.2	0.98632	1.1285	33	33	
501.2 - 505.5	0.96157	1.1388	34	33	
505.5 - 511.5	0.92599	1.1576	33	33	
511.5 - 520.1	0.87389	1.1919	33	33	
520.1 - 528.6	0.80161	1.2545	33	33	
528.6 - 534.7	0.75033	1.3310	34	33	
534.7 - 538.9	0.70604	1.4045	34	33	
538.9 - 542.0	0.67273	1.4709	34	33	
542.0 - 544.1	0.64855	1.5230	34	33	
544.1 - 545.6	0.00000	99.0000	0	0	
545.6 - 547.7	0.61437	1.6012	34	33	
547.7 - 550.7	0.58882	1.6711	34	33	
550.7 - 555.0	0.55203	1.7726	34	33	
555.0 - 561.0	0.49862	1.9532	34	33	
561.0 - 569.6	0.41843	2.3146	34	33	
569.6 - 578.2	0.31576	3.0788	34	33	
578.2 - 584.2	0.21359	4.5748	34	33	
584.2 - 588.5	0.13453	7.3532	34	33	
588.5 - 591.5	0.07355	13.6143	34	33	
591.5 - 593.6	0.03043	33.0972	34	33	
593.6 - 594.4	0.00000	99.0000	0	0	

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CASE=0101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

CRITICAL HEAT FLUX SUMMARY: TABLE CHF CORRELATION TIME = 0.000000 SECONDS

SUBSEQUENT CHFR RESULTS

AXIAL ZONE (CM.)	RADIAL LOCATION (CHFR - ROD - SUBCHANNEL)					
0.0 - 0.8	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
0.8 - 2.9	99.000- 29- 29	99.000- 0- 0	99.000- 29- 30	99.000- 29- 56	99.000- 30- 31	99.000- 30- 57
2.9 - 5.9	83.188- 34- 60	84.278- 32- 59	84.278- 33- 59	84.278- 35- 61	84.278- 34- 61	87.327- 31- 58
5.9 - 10.2	45.654- 34- 60	46.233- 35- 61	46.233- 34- 61	46.233- 33- 59	46.233- 32- 59	47.856- 32- 58
10.2 - 16.2	28.523- 33- 60	28.888- 34- 61	28.888- 35- 61	28.888- 33- 59	28.888- 32- 59	29.958- 35- 62
16.2 - 24.8	19.426- 34- 60	19.666- 34- 61	19.666- 35- 61	19.666- 32- 59	19.666- 33- 59	20.362- 36- 62
24.8 - 33.3	14.420- 33- 60	14.608- 34- 61	14.608- 35- 61	14.608- 32- 59	14.608- 33- 59	15.178- 36- 62
33.3 - 39.4	12.007- 33- 60	12.253- 34- 61	12.253- 35- 61	12.253- 32- 59	12.253- 33- 59	12.729- 36- 62
39.4 - 43.6	10.882- 34- 60	11.020- 34- 61	11.020- 35- 61	11.020- 33- 59	11.020- 32- 59	11.461- 35- 62
43.6 - 46.7	10.281- 34- 60	10.384- 34- 61	10.384- 35- 61	10.384- 32- 59	10.384- 33- 59	10.783- 35- 62
46.7 - 48.8	10.147- 34- 60	10.211- 34- 61	10.211- 35- 61	10.211- 32- 59	10.211- 33- 59	10.519- 36- 62
48.8 - 50.3	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
50.3 - 52.4	9.594- 34- 60	9.670- 34- 61	9.670- 35- 61	9.670- 32- 59	9.670- 33- 59	9.972- 36- 62
52.4 - 55.4	9.152- 33- 60	9.238- 35- 61	9.238- 34- 61	9.238- 32- 59	9.238- 33- 59	9.554- 36- 62
55.4 - 59.7	8.648- 34- 60	8.740- 34- 61	8.740- 35- 61	8.740- 32- 59	8.740- 33- 59	9.058- 35- 62
59.7 - 65.7	7.956- 33- 60	8.058- 35- 61	8.058- 34- 61	8.058- 33- 59	8.058- 32- 59	8.402- 35- 62
65.7 - 74.3	7.310- 34- 60	7.410- 34- 61	7.410- 35- 61	7.410- 32- 59	7.410- 33- 59	7.737- 36- 62
74.3 - 82.9	6.582- 34- 60	6.687- 34- 61	6.687- 35- 61	6.687- 32- 59	6.687- 33- 59	7.038- 35- 62
82.9 - 88.9	6.152- 34- 60	6.249- 34- 61	6.249- 35- 61	6.249- 32- 59	6.249- 33- 59	6.569- 36- 62
88.9 - 93.2	5.854- 34- 60	5.948- 34- 61	5.948- 35- 61	5.948- 33- 59	5.948- 32- 59	6.291- 35- 62
93.2 - 96.2	5.683- 34- 60	5.770- 35- 61	5.770- 34- 61	5.770- 33- 59	5.770- 32- 59	6.106- 35- 62
96.2 - 98.3	5.627- 33- 60	5.700- 35- 61	5.700- 34- 61	5.700- 33- 59	5.700- 32- 59	6.022- 35- 62
98.3 - 99.8	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
99.8 - 101.9	5.638- 34- 60	5.698- 34- 61	5.698- 35- 61	5.698- 32- 59	5.698- 33- 59	5.968- 32- 58
101.9 - 104.9	5.474- 34- 60	5.534- 34- 61	5.534- 35- 61	5.534- 32- 59	5.534- 33- 59	5.820- 32- 58
104.9 - 109.2	5.288- 34- 60	5.350- 35- 61	5.350- 35- 61	5.350- 32- 59	5.350- 33- 59	5.634- 32- 58
109.2 - 115.3	4.997- 34- 60	5.063- 34- 61	5.063- 35- 61	5.063- 32- 59	5.063- 33- 59	5.359- 32- 58
115.3 - 123.8	4.674- 34- 60	4.730- 32- 59	4.730- 33- 59	4.730- 34- 61	4.730- 35- 61	5.017- 32- 58
123.8 - 132.4	4.390- 34- 60	4.369- 32- 59	4.369- 33- 59	4.369- 34- 61	4.369- 35- 61	4.723- 31- 58
132.4 - 138.4	4.055- 34- 60	4.133- 32- 59	4.133- 33- 59	4.133- 35- 61	4.133- 34- 61	4.490- 32- 58
138.4 - 142.7	3.882- 34- 60	3.960- 32- 59	3.960- 33- 59	3.960- 35- 61	3.960- 34- 61	4.321- 32- 58
142.7 - 145.7	3.782- 34- 60	3.859- 32- 59	3.859- 33- 59	3.859- 35- 61	3.859- 34- 61	4.223- 32- 58
145.7 - 147.8	3.754- 34- 60	3.821- 32- 59	3.821- 33- 59	3.821- 35- 61	3.821- 34- 61	4.178- 32- 58
147.8 - 149.3	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
149.3 - 151.5	3.779- 34- 60	3.830- 33- 59	3.830- 32- 59	3.830- 35- 61	3.830- 34- 61	4.165- 32- 58
151.5 - 154.5	3.664- 34- 60	3.733- 33- 59	3.733- 32- 59	3.733- 35- 61	3.733- 34- 61	4.079- 32- 58
154.5 - 158.7	3.506- 34- 60	3.577- 33- 59	3.577- 32- 59	3.577- 35- 61	3.577- 34- 61	3.970- 32- 58
158.7 - 164.8	3.272- 34- 60	3.346- 33- 59	3.346- 32- 59	3.346- 35- 61	3.346- 34- 61	3.790- 32- 58
164.8 - 173.4	3.021- 34- 60	3.094- 33- 59	3.094- 32- 59	3.094- 34- 61	3.094- 35- 61	3.586- 31- 58
173.4 - 181.9	2.795- 34- 60	2.860- 33- 59	2.860- 32- 59	2.860- 35- 61	2.860- 34- 61	3.351- 31- 58
181.9 - 188.0	2.700- 34- 60	2.742- 33- 59	2.742- 32- 59	2.742- 35- 61	2.742- 34- 61	3.228- 31- 58
188.0 - 192.2	2.653- 33- 60	2.691- 34- 59	2.691- 32- 59	2.691- 34- 61	2.691- 35- 61	3.140- 31- 58
192.2 - 195.2	2.627- 34- 60	2.664- 32- 59	2.664- 33- 59	2.664- 34- 61	2.664- 35- 61	3.097- 31- 58
195.2 - 197.4	2.637- 33- 60	2.664- 33- 59	2.664- 32- 59	2.664- 35- 61	2.664- 34- 61	3.109- 32- 58
197.4 - 198.9	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
198.9 - 201.0	2.631- 33- 60	2.657- 33- 59	2.657- 32- 59	2.657- 35- 61	2.657- 34- 61	3.081- 31- 58
201.0 - 204.0	2.595- 33- 60	2.621- 32- 59	2.621- 33- 59	2.621- 34- 61	2.621- 35- 61	3.037- 31- 58
204.0 - 208.3	2.548- 33- 60	2.572- 32- 59	2.572- 33- 59	2.572- 34- 61	2.572- 35- 61	2.980- 31- 58
208.3 - 214.3	2.485- 33- 60	2.508- 32- 59	2.508- 33- 59	2.508- 35- 61	2.508- 34- 61	2.892- 32- 58
214.3 - 222.9	2.386- 33- 60	2.407- 33- 59	2.407- 32- 59	2.407- 34- 61	2.407- 35- 61	2.773- 32- 58
222.9 - 231.5	2.311- 33- 60	2.328- 33- 59	2.328- 32- 59	2.328- 34- 61	2.328- 35- 61	2.617- 31- 58
231.5 - 237.5	2.252- 34- 60	2.269- 32- 59	2.269- 33- 59	2.269- 34- 61	2.269- 35- 61	2.538- 33- 34
237.5 - 241.8	2.219- 34- 60	2.231- 32- 59	2.231- 33- 59	2.231- 34- 61	2.231- 35- 61	2.488- 33- 34
241.8 - 244.8	2.184- 33- 60	2.202- 32- 59	2.202- 33- 59	2.202- 35- 61	2.202- 34- 61	2.453- 32- 34
244.8 - 246.9	2.165- 33- 60	2.180- 32- 59	2.180- 33- 59	2.180- 34- 61	2.180- 35- 61	2.404- 33- 34
246.9 - 248.4	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
248.4 - 250.5	2.166- 33- 60	2.171- 32- 59	2.171- 33- 59	2.172- 34- 61	2.172- 35- 61	2.405- 33- 34
250.5 - 253.5	2.143- 34- 60	2.149- 32- 59	2.149- 33- 59	2.149- 34- 61	2.149- 35- 61	2.368- 33- 34
253.5 - 257.8	2.106- 33- 60	2.112- 33- 59	2.112- 32- 59	2.112- 34- 61	2.112- 35- 61	2.319- 33- 34

257.8 - 263.8	2.064- 33- 60	2.068- 33- 59	2.068- 32- 59	2.068- 34- 61	2.068- 35- 61	2.245- 33- 34
263.8 - 272.4	2.000- 32- 59	2.000- 34- 61	2.000- 35- 61	2.001- 33- 60	2.001- 34- 60	2.160- 33- 34
272.4 - 281.0	1.960- 32- 59	1.960- 34- 61	1.960- 35- 61	1.963- 34- 60	1.963- 33- 60	2.083- 32- 34
281.0 - 287.0	1.920- 32- 59	1.920- 34- 61	1.920- 35- 61	1.925- 34- 60	1.925- 33- 60	2.028- 33- 34
287.0 - 291.3	1.900- 32- 59	1.900- 34- 61	1.900- 35- 61	1.904- 34- 60	1.904- 33- 60	1.987- 32- 34
291.3 - 294.3	1.880- 32- 59	1.880- 34- 61	1.880- 35- 61	1.882- 34- 60	1.882- 33- 60	1.959- 32- 34
294.3 - 296.4	1.853- 33- 60	1.854- 33- 59	1.854- 32- 59	1.854- 35- 61	1.854- 34- 61	1.939- 33- 34
296.4 - 297.9	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
297.9 - 300.1	1.827- 32- 59	1.827- 35- 61	1.827- 34- 61	1.829- 33- 60	1.829- 34- 60	1.930- 33- 34
300.1 - 303.1	1.817- 32- 59	1.817- 35- 61	1.817- 34- 61	1.820- 33- 60	1.820- 34- 60	1.902- 33- 34
303.1 - 307.3	1.796- 33- 59	1.797- 35- 61	1.797- 34- 61	1.801- 34- 60	1.801- 33- 60	1.865- 33- 34
307.3 - 313.4	1.784- 32- 59	1.784- 35- 61	1.784- 34- 61	1.790- 34- 60	1.790- 33- 60	1.816- 32- 34
313.4 - 321.9	1.736- 33- 35	1.736- 32- 59	1.736- 33- 59	1.736- 34- 61	1.736- 35- 61	1.740- 33- 34
321.9 - 330.5	1.646- 33- 35	1.671- 33- 34	1.671- 32- 34	1.671- 35- 36	1.671- 34- 36	1.673- 32- 33
330.5 - 336.6	1.583- 34- 35	1.599- 32- 33	1.599- 35- 37	1.616- 33- 34	1.616- 32- 34	1.616- 34- 36
336.6 - 340.8	1.535- 34- 35	1.543- 32- 33	1.543- 35- 37	1.584- 32- 34	1.584- 33- 34	1.584- 34- 36
340.8 - 343.8	1.503- 35- 37	1.511- 33- 35	1.511- 34- 35	1.559- 33- 34	1.559- 32- 34	1.559- 34- 36
343.8 - 346.0	1.497- 35- 37	1.504- 34- 35	1.504- 33- 35	1.540- 33- 34	1.540- 32- 34	1.540- 35- 36
346.0 - 347.5	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
347.5 - 349.6	1.473- 35- 37	1.485- 33- 35	1.485- 34- 35	1.529- 32- 34	1.529- 33- 34	1.529- 34- 36
349.6 - 352.6	1.450- 35- 37	1.463- 33- 35	1.463- 34- 35	1.512- 32- 34	1.512- 33- 34	1.513- 34- 36
352.6 - 356.9	1.422- 35- 37	1.436- 33- 35	1.436- 34- 35	1.488- 32- 34	1.488- 33- 34	1.488- 34- 36
356.9 - 362.9	1.379- 35- 37	1.397- 33- 35	1.397- 34- 35	1.455- 32- 34	1.455- 33- 34	1.456- 35- 36
362.9 - 371.5	1.316- 35- 37	1.335- 34- 35	1.335- 33- 35	1.398- 33- 34	1.398- 32- 34	1.399- 35- 36
371.5 - 380.0	1.250- 35- 37	1.273- 34- 35	1.273- 33- 35	1.346- 32- 34	1.346- 33- 34	1.346- 34- 36
380.0 - 386.1	1.203- 35- 37	1.230- 34- 35	1.230- 33- 35	1.300- 32- 34	1.300- 33- 34	1.300- 34- 36
386.1 - 390.4	1.181- 35- 37	1.206- 33- 35	1.206- 34- 35	1.274- 32- 34	1.274- 33- 34	1.274- 34- 36
390.4 - 393.4	1.163- 35- 37	1.187- 34- 35	1.187- 33- 35	1.254- 33- 34	1.254- 32- 34	1.254- 34- 36
393.4 - 395.5	1.151- 35- 37	1.174- 34- 35	1.174- 33- 35	1.236- 33- 34	1.236- 32- 34	1.236- 35- 36
395.5 - 397.0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
397.0 - 399.1	1.145- 35- 37	1.167- 33- 35	1.167- 34- 35	1.221- 33- 34	1.221- 32- 34	1.221- 35- 36
399.1 - 402.1	1.128- 35- 37	1.150- 34- 35	1.150- 33- 35	1.205- 32- 34	1.205- 33- 34	1.206- 34- 36
402.1 - 406.4	1.109- 35- 37	1.129- 34- 35	1.129- 33- 35	1.186- 33- 34	1.186- 32- 34	1.186- 35- 36
406.4 - 412.4	1.083- 35- 37	1.102- 34- 35	1.102- 33- 35	1.163- 33- 34	1.163- 32- 34	1.163- 34- 36
412.4 - 421.0	1.046- 35- 37	1.062- 34- 35	1.062- 33- 35	1.123- 32- 34	1.123- 33- 34	1.123- 35- 36
421.0 - 429.6	1.017- 35- 37	1.030- 34- 35	1.030- 33- 35	1.093- 32- 34	1.093- 33- 34	1.094- 35- 36
429.6 - 435.6	1.012- 35- 37	1.023- 34- 35	1.023- 33- 35	1.077- 33- 34	1.077- 32- 34	1.077- 35- 36
435.6 - 439.9	1.013- 35- 37	1.021- 34- 35	1.021- 33- 35	1.077- 32- 34	1.077- 33- 34	1.077- 34- 36
439.9 - 442.9	1.014- 35- 37	1.021- 34- 35	1.021- 33- 35	1.076- 33- 34	1.076- 32- 34	1.076- 34- 36
442.9 - 445.0	1.015- 35- 37	1.022- 34- 35	1.022- 33- 35	1.074- 32- 34	1.074- 33- 34	1.074- 34- 36
445.0 - 446.5	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
446.5 - 448.6	1.026- 35- 37	1.033- 33- 35	1.033- 34- 35	1.081- 32- 34	1.081- 33- 34	1.081- 34- 36
448.6 - 451.7	1.027- 35- 37	1.032- 33- 35	1.032- 34- 35	1.082- 32- 34	1.082- 33- 34	1.083- 34- 36
451.7 - 455.9	1.030- 35- 37	1.033- 33- 35	1.033- 34- 35	1.086- 32- 34	1.086- 33- 34	1.086- 35- 36
455.9 - 462.0	1.037- 34- 35	1.037- 32- 33	1.037- 35- 37	1.095- 33- 34	1.095- 32- 34	1.096- 35- 36
462.0 - 470.5	1.043- 34- 35	1.048- 32- 33	1.049- 35- 37	1.105- 33- 34	1.105- 32- 34	1.106- 35- 36
470.5 - 479.1	1.054- 33- 35	1.069- 32- 33	1.070- 35- 37	1.129- 33- 34	1.129- 32- 34	1.130- 35- 36
479.1 - 485.1	1.066- 33- 35	1.086- 32- 33	1.088- 35- 37	1.154- 33- 34	1.154- 32- 34	1.155- 34- 36
485.1 - 489.4	1.080- 33- 35	1.105- 32- 33	1.105- 35- 37	1.176- 32- 34	1.176- 33- 34	1.177- 34- 36
489.4 - 492.4	1.092- 33- 35	1.120- 32- 33	1.122- 35- 37	1.183- 33- 60	1.183- 34- 60	1.191- 33- 34
492.4 - 494.6	1.098- 33- 35	1.123- 32- 33	1.125- 35- 37	1.174- 33- 60	1.174- 34- 60	1.201- 33- 34
494.6 - 496.1	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
496.1 - 498.2	1.121- 33- 35	1.150- 32- 33	1.152- 35- 37	1.208- 34- 60	1.208- 33- 60	1.220- 33- 34
498.2 - 501.2	1.129- 34- 35	1.162- 32- 33	1.165- 35- 37	1.217- 33- 60	1.217- 34- 60	1.240- 33- 34
501.2 - 505.5	1.139- 33- 35	1.179- 32- 33	1.182- 35- 37	1.227- 34- 60	1.227- 33- 60	1.258- 32- 34
505.5 - 511.5	1.158- 34- 35	1.209- 32- 33	1.212- 35- 37	1.248- 33- 60	1.248- 34- 60	1.290- 32- 34
511.5 - 520.1	1.192- 34- 35	1.257- 32- 33	1.261- 35- 37	1.293- 33- 60	1.293- 34- 60	1.338- 32- 34
520.1 - 528.6	1.256- 34- 35	1.338- 32- 33	1.342- 35- 37	1.353- 33- 60	1.353- 34- 60	1.424- 32- 34
528.6 - 534.7	1.331- 33- 35	1.428- 32- 33	1.434- 35- 37	1.446- 33- 60	1.446- 34- 60	1.509- 5- 13
534.7 - 538.9	1.404- 33- 35	1.514- 32- 33	1.520- 35- 37	1.530- 33- 60	1.530- 34- 60	1.578- 5- 13
538.9 - 542.0	1.471- 33- 35	1.589- 32- 33	1.595- 35- 37	1.607- 34- 60	1.607- 33- 60	1.638- 5- 13
542.0 - 544.1	1.523- 33- 35	1.646- 32- 33	1.653- 35- 37	1.668- 34- 60	1.668- 33- 60	1.688- 5- 13
544.1 - 545.6	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0
545.6 - 547.7	1.601- 33- 35	1.727- 32- 33	1.735- 35- 37	1.773- 33- 60	1.773- 34- 60	1.835- 5- 13
547.7 - 550.7	1.671- 33- 35	1.809- 32- 33	1.818- 35- 37	1.856- 33- 60	1.856- 34- 60	1.899- 5- 13
550.7 - 555.0	1.773- 33- 35	1.930- 32- 33	1.939- 35- 37	1.981- 34- 60	1.981- 34- 60	2.010- 5- 13
555.0 - 561.0	1.953- 33- 35	2.145- 32- 33	2.156- 35- 37	2.198- 5- 13	2.210- 6- 15	2.231- 34- 60
561.0 - 568.6	2.315- 33- 35	2.563- 32- 33	2.577- 35- 37	2.608- 5- 13	2.624- 6- 15	2.663- 14- 13
568.6 - 578.2	3.079- 34- 35	3.429- 32- 33	3.448- 35- 37	3.454- 5- 13	3.477- 6- 15	3.529- 15- 13
578.2 - 584.2	4.575- 34- 35	5.102- 32- 33	5.133- 35- 37	5.145- 5- 13	5.182- 6- 15	5.255- 15- 13
584.2 - 588.5	7.353- 33- 35	8.186- 32- 33	8.227- 5- 13	8.236- 35- 37	8.289- 6- 15	8.402- 15- 13
588.5 - 591.5	13.614- 33- 35	15.100- 32- 33	15.203- 35- 37	15.234- 5- 13	15.330- 6- 15	15.560- 15- 13
591.5 - 593.6	33.097- 33- 35	36.668- 32- 33	36.902- 35- 37	37.647- 5- 13	37.905- 6- 15	38.432- 15- 13
593.6 - 594.4	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0	99.000- 0- 0

1
CASES0101 ASSERT-PV V2R8 Input Modelling : RUFIC(CANFLEX-RU) CANDU Base DATE 101- 1-18 TIME 18:28:27

--- No Dryout Predicted ---

ITERATIONS = 92

SPECIFIED NUMBER OF TIME STEPS COMPLETED

서 지 정 보 양 식

수행기관보고서번호	위탁기관보고서번호	표준보고서번호	INIS 주제코드
KAERI/TR-1756/2001			

제목/부제	순환우라늄 핵연료다발의 ASSERT-PV V2R8M1 코드 입력자료 모형

연구책임자 및 부서명 (TR, AR인 경우 주저자)	박주환 (핵연료설계기술 개발팀)
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출 판 지		발행기관	한국원자력연구소	발행년	2001.2
페 이 지	62 p.	도 표	있음(0), 없음( )	크 기	26 Cm.
참고사항					

비밀여부	공개(o), 대외비( ), __ 급비밀, 소내만 공개 ( )	보고서종류	Technical Report
연구위탁기관		계약 번호	

초록 (15-20줄내외)

본 보고서는 ASSERT-PV V2R8M1 코드를 이용하여 CANDU 용 개량핵연료다발의 하나로 개발되고 있는 CANFLEX-RU (RUFIC) 핵연료다발의 부수로 해석을 수행할 경우 그 적용성 검토 및 해석을 위해 필요한 입력자료 모형 개발 보고서로 작성되었다. 본 ASSERT는 KAERI/AECL의 JRDC 협정에 의해 캐나다 AECL로부터 binary file 형태로 입수되었다.

ASSERT 코드는 COBRA-IVi 코드와는 달리 CANDU-6 용 핵연료다발의 부수로 방법에 의한 열수력 해석을 위해 개발되었으며, 43개 핵연료봉을 갖는 CANDU 다발에 적용될 수 있도록 수정되었다. 따라서, ASSERT 코드를 RUFIC 핵연료 채널에 적용하는데 있어서 문제가 없으며, 이에 따라 ASSERT 코드를 순환우라늄 핵연료다발 적용시 요구되는 RUFIC 핵연료의 ASSERT 입력자료 모형을 제시하였다. 또한, ASSERT는 입력자료를 준비할 경우 사용자가 원하는 바에 따라 자신의 모형식을 이용할 수 있도록 되어 있으므로 사용자의 사용 방법에 따라 결과가 상이할 수 있다. 따라서, 본 보고서를 작성하므로써 입력자료의 근거와 사용의 정확성 및 계산 결과에 대한 신뢰성을 얻고자 함이었다.

주제명키워드 (10단어내외)	ASSERT, CANDU, 부수로 해석, RUFIC

BIBLIOGRAPHIC INFORMATION SHEET

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KAERI/TR-1756/2001			

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Project Manager and Department	Joohwan Park, Fuel Design Technology Development Team
Researcher and Department	Hochun Suk, Fuel Design Technology Development Team

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Sponsoring Org.		Contract No.	

Abstract (15-20 Lines)

This report describes the input modelling for subchannel analysis of CANFLEX-RU (RUFIC) fuel bundle which has been developed for an advanced fuel bundle of CANDU-6 reactor, using ASSERT-PV V2R8M1 code. Execution file of ASSERT-PV V2R8M1 code was recently transferred from AECL under JRDC agreement between KAERI and AECL.

ASSERT-PV V2R8M1 which is quite different from COBRA-IV-i code has been developed for thermalhydraulic analysis of CANDU-6 fuel channel by subchannel analysis method and updated so that 43-element CANDU fuel geometry can be applied. Hence, ASSERT code can be applied to the subchannel analysis of RUFIC fuel bundle. The present report was prepared for ASSERT input modelling of RUFIC fuel bundle. Since the ASSERT results highly depend on user's input modelling, the calculation results may be quite different among the user's input models. The objective of the present report is the preparation of detail description of the background information for input data and gives credibility of the calculation results.

Subject Keywords (About 10 words)	ASSERT, CANDU, Subchannel Analysis, RUFIC