**BRIC - AN
IBM-704 TWO-DIMENSIONAL
NUCLEAR-THERMAL DEPLETION
PROGRAM WITH
DISTRIBUTED VOID EFFECTS**

January 1961
CONTRACT AT-11-1-GEN-14

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PITTSBURGH, PENNSYLVANIA**

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BRIC is a two-dimensional nuclear-thermal depletion program to study the effects of moderator boiling on the neutron flux distribution and the depletion of the time-dependent isotopes. The program requires an IBM-704 with a memory of 32,768 words and ten tape units.

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I. INTRODUCTION

BRIC-1 is an IBM-704 program to study the effects of moderator boiling on the neutron flux distribution and depletion of time-dependent isotopes in an x-y slice of a water cooled and moderated reactor. Flow is assumed to take place in the axial direction.

The program is essentially a modification of TURBO-1* (Ref. 1). Using input water densities, the diffusion equations are solved in x-y geometry to obtain a neutron flux shape and a corresponding power shape. A thermal and hydraulic calculation yields a new water density distribution corresponding to the power shape. The power shape can be recalculated based on these densities until a converged density distribution is obtained, then a depletion of the time-dependent isotopes can be calculated.

II. CALCULATION

A. Spatial Iteration

A modification of the PDQ-3 (Ref. 3) as incorporated in the revised TURBO program** is used to compute the neutron flux, Φ_1 , and criticality factor, λ .

* No provisions are made for r-z calculations or for maximum xenon studies.

** The revised TURBO program will be described in an addendum to WAPD-TM-95.

The two- or four-group parameters required in the diffusion equations are obtained by combining isotopic number densities and thermal self-shielding factors with fitted few-group microscopic cross sections. A library of fast cross sections is available for use which can be corrected to obtain a more accurate fit for individual problems.

The flux shapes obtained from the spatial calculation are normalized by computing a power shape from these flux values and the fission cross sections and by comparing the integral of this power with a specified power output. The depletion or the variation in the water density is computed for each rectangle of the mesh by using an average flux computed from the four surrounding pointwise flux values. See Reference 1 for a more complete description of the depletion scheme.

Water must be carried as a single element, number 30, in the fueled regions where the water densities are to be varied as a function of the local power densities. For non-fuel bearing regions, water may be carried as elements 1 and 2, hydrogen and oxygen. The BRIC-1 library contains the following microscopic cross sections for element 30, (H_2O).

<u>Group</u>	<u>σ_{tr}</u>	<u>σ_r</u>	<u>σ_a</u>
1	4.4095	3.1381	0.0425
2	9.1124	4.5145	0.0004
3	16.9331	4.5536	0.0284

B. Thermal and Hydraulic Calculation

The normal TURBO-1 calculation is discontinued prior to the solution of the isotopic density equations. In each mesh rectangle containing fissionable isotopes (i.e., non-zero power) the power normalized to the output power is calculated by the expression

$$P(r) = \beta \sum_{i=1}^k \sum_{m=18,20,21,23} K^{m,i} (\nu \Sigma_f)^{m,i} \bar{\Phi}^i(r) \quad (1)$$

where r refers to the rectangle defined by its four values $x, y, x+1, y+1$, β is the TURBO power normalization factor, K is the energy produced per fission, $\nu \Sigma_f$ is the macroscopic fission cross section, $\bar{\Phi}$ is the average flux, i is the lethargy group, k is the thermal group, and M is the element number. Only rectangles with $P(r) \neq 0$ are considered in the thermal and hydraulic calculation.

The mass flow rate, $G(r)$ is calculated by linear interpolation in a table of P , power density versus G . The table is composition-dependent input supplied by the requestor and is used to approximate the flow redistribution effects which result from boiling. No detailed calculation of flow distribution is possible at this point, because such a calculation requires a knowledge of the power distribution along the channel in the axial direction.

An average coolant enthalpy is calculated for each mesh rectangle from the expression

$$h(r,t) = \alpha(h_0)_n + \gamma \frac{k_n P(r,t)}{G(r,t)} + \delta h(r,t-1) \quad (2)$$

where t is the time step number, h_0 is the inlet enthalpy, k_n is a composition-dependent power conversion factor, and α , γ , and δ are input constants which are described below.

Water number densities are determined from the coolant enthalpy by linear interpolation in a composition-dependent input table of N_{30} versus h .

1. Nuclear-Thermal Iteration

The type of heat balance to be considered is determined by α , γ , and δ . If $\alpha = \gamma = 1$, $\delta = 0$, a nuclear-thermal iteration is specified, i.e., the water

number densities are determined solely by the immediately preceding power iteration. The constant δ may be used to accelerate convergence of density shapes. For example, if the coolant densities tend to oscillate in the process of convergence, one might set γ equal to some fractional value and let $\delta = 1 - \alpha$ where $\gamma = \alpha$. This will tend to damp oscillations and may speed convergence.

Two convergence criteria are calculated, one on the integrated change in water density over the entire fueled region, and one on the maximum change in water density at any mesh point. The following expressions are used to calculate the convergence criteria:

$$\left| \frac{\sum_r [N_{30}(r,t) - N_{30}(r,t-1)] A_R}{\sum_r N_{30}(r,t-1) A_R} \right| = \epsilon_1 \quad (3)$$

where A_R is the area of the rectangle, r .

$$\max_r \left| \frac{N_{30}(r,t) - N_{30}(r,t-1)}{N_{30}(r,t-1)} \right| = \epsilon_2 \quad (4)$$

These are compared with the input quantities ϵ_1 and ϵ_2 to determine convergence.

After edited values have been inspected, the requestor can proceed to another iteration (time-step) or a depletion. Current time-step values of coolant enthalpy are saved on punched cards. These binary cards are part of the input for the next time-step calculation. The time-step number in the TURBO-1 deck must be increased by 1 in order to do another iteration.

If the water number densities calculated in the current iteration are satisfactory, it is possible to do a depletion of the time-dependent isotopes with element 30 held constant. This is done by initiating a restart. It should be

noted that the most recently calculated number densities are not used. This should not be considered as a limitation, because convergence of the iteration scheme implies that the time-step $(t-1)$ number densities are just as good as time-step (t) .

2. Sequential Heat Additions

If $\alpha = 0$, $\gamma = \delta = 1$ in equation 2, heat may be added sequentially to an x-y plane slice. This would correspond to examining power, enthalpy, and density distribution at several heights in the core. One might set the value of k_n to correspond to 20% of core power; the water density and power shapes calculated in the first step then correspond to that height in the core where 20% of the total heat has been added. The second step would add an additional 20% heat load, based on the power shape and enthalpies existing at the first step. The process would be repeated five times, and on the last step the power distribution at the top of the core and the exit coolant enthalpies would be calculated. With this procedure, $G(r)$ is calculated for the first time-step (i.e., at the bottom of the core) and is held constant through the remainder of the heat addition steps. The time-step number in the TURBO-1 deck must be increased by 1 as each slice is added. The sequential addition of heat is the most realistic method of calculating density shapes in a three-dimensional core, but may be subject to significant inaccuracies where the local flow rate $G(r)$ is a strong function of the channel thermal conditions.

Although the procedure involves cumbersome tape manipulations, it is possible to do a depletion of the time-dependent isotopes. However, this will not be described here.

III. INPUT AND OUTPUT

A. Input

In general, control information (including card numbers) is punched in fixed point notation and data information in floating point notation.

Fixed decimal integers are represented by a sign followed by a sequence of decimal digits. The decimal point is not punched, but is assumed to be to the right of the last digit of the field.

Floating decimal numbers are represented by a sign and a two digit characteristic, C, followed by a fraction of up to eight (8) digits. If $N = \pm 0.XXXX.10^Y$, then N is punched as +CCXXXX where $CC = 50+y$. The fraction must always be in normalized form, i.e., the left-most digit must not be zero. Floating point zeros are represented by a + sign followed by at least three zeros.

Each card in the input deck except the title card has a four-digit card number. All numbers on the cards are separated, one from the other by a sign punch. Every column must be punched. There must be a 12 punch in the column immediately following the last data digit, followed by zeros to fill out the 72 columns of the card. All numbers are floating decimal numbers unless otherwise specified. If more numbers than needed are specified for a card, fill the remaining columns after the last data digit with +000-----0 through column 72.

The BRIC-1 input deck consists of a TURBO-1 deck, a blank card, a thermal and hydraulic deck, a blank card, and the binary deck punched by the previous time-step. There is, of course, no binary check for time-step 00.

1. TURBO-1 Deck

Prepared precisely as described in WAPD-TM-95 and in the addendum to that report.

2. Thermal and Hydraulic Deck

Caution must be exercised by the requestor in the construction of all input tables. In the process of interpolating in these tables the program will halt if the range of the table is exceeded in either direction.

Water number densities may be held constant over a fueled composition by setting the values of N_{30} in the 4000 series equal to zero. The enthalpy values in this series and all other input values associated with the composition must be reasonable values. If they are not, the program will halt while attempting to interpolate in these tables.

Title card - Anything may be punched in columns 1-66. Unlike the title card in the TURBO-1 deck, this title card may be different for each time-step.

<u>Card Number</u>	<u>Symbol</u>	<u>Description</u>
+1001	α	
	γ	Parameters in equation (2).
	m	Number of fueled compositions - fixed point.
	G-Edit	0 for no flow edit or 1 for flow edit - fixed point.
	H-Edit	0 for no enthalpy edit or 1 for enthalpy edit - fixed point.
	N-Edit	0 for no density edit or 1 for density edit - fixed point.
	ϵ_1	Convergence criterion.
	ϵ_2	Convergence criterion.
		(Although ϵ_1 and ϵ_2 are not used in sequential heat addition problems, two floating point numbers must be punched on the card.)
+2001	n_1	Composition number - fixed point.
	$(h_0)_{n_1}$	Inlet enthalpy.

Card
Number

Symbol

Description

k_{n_1}

Conversion factor.

n_2

Composition number - fixed point.

$(h_0)_{n_2}$

Enthalpy.

k_{n_2}

Conversion factor.

+2002

n_3

$(h_0)_{n_3}$

k_{n_3}

n_4

$(h_0)_{n_4}$

k_{n_4}

+2003

(etc.)

where the composition numbers are in ascending order, specifying one for each of m fueled compositions. There must be six and only six words on each card with the exception of the last card in the series, if m is odd.

+3001 P Power versus Flow tables for first fueled composition.

G

P

G

P

G

+3002

P

G

P

G

Card Number	Symbol	Description
	P	
	G	
+3003	etc.	
+3011	P	Table for second fueled composition.
	G	
	P	
	G	
	P	
	G	
+3012	P	
	G	
	P	
	G	
	P	
	G	
	etc.	

where up to twenty pairs of P and G values may be specified for each fueled composition. The P values must be in increasing order and there must be input for m tables. The first card number for each table is $2991 + 10 \times N$ where $N = y - m$. There must be six and only six words on each card except the last one in each table.

+4001 h Average coolant enthalpy versus N_{30} for first fueled composition.

N_{30}

Card Number	Symbol	Description
	h	
	N ₃₀	
	h	
	N ₃₀	
+4002	h	
	N ₃₀	
	h	
	N ₃₀	
	h	
	N ₃₀	
+4003	etc.	
+4011	h	Table for second fueled composition.
	N ₃₀	
	h	
	N ₃₀	
	h	
	N ₃₀	
	h	
	N ₃₀	

where the 4000 series are specified in the same manner as the 3000 series.

3. For all time steps except 00, the binary deck punched by the previous time-step follows the blank card after the thermal and hydraulic deck. The binary deck contains the previous time-step enthalpies and for sequential heat addition problems, the constant flows.

B. Output

For each time-step a binary deck is punched which is part of the input for the next time-step. If $\alpha = 0$ (sequential heat additions) the deck consists of the mass flow rates, $G(r)$ for each rectangle, three blank cards, and the enthalpy values for each rectangle. If $\alpha \neq 0$ (nuclear-thermal iteration) the punched deck consists only of enthalpy values. On both flow and enthalpy cards the 9L-row contains the time-step number in columns 13-18, columns 19-21 are blank, and the card number is punched in columns 22-36. Enthalpy and flow cards are identified by the punches in columns 1-12. Enthalpy cards have a punch in every column; flow cards have a punch in every other column.

At the end of each time-step, $G(r)$, $h(r)$, and $N_{30}(r)$ are edited off-line if they were specified by the requestor in the input.

For nuclear-thermal iteration problem, the two convergence criteria are calculated and compared with the input criteria ϵ_1 and ϵ_2 . If the problem is not converged, this fact is printed on-line and the calculated ϵ_1 and the ten maximum values of ϵ_2 are printed on-line. When the desired convergence has been obtained, this fact is noted on-line.

IV. OPERATING INSTRUCTIONS

Only the basic operating instructions are outlined here. More detailed operating instructions and the program and error stop listings associated with TURBO-0, 1, and 5, the end of tape 7 procedure and the restart procedure are given in WAPD-TM-95 (Ref. 1) and the addendum (to be published) to it. In addition this addendum will contain new TURBO-1 input options and with these changes will be associated additional operating instructions.

Card Reader

72-72 card reader board

Card Punch

80-80 card punch board

On-Line Printer

SHARE-2 board

Off-Line Printer

Carriage control set to "program"

Tapes

- 1 BRIC-1 program tape (includes TURBO-0, 1, and 5)
- 2-6 Blank
- 7 History (blank for time-step 00)
- 8,9 Blank
- 10 Blank or flux tape from previous problem

Sense Switches

- 1 Down - stops iteration at best point if forced to remove problem
- 2 Restart
- 3-5 Up always
- 6 Down - brings in NYDSIB octal dump for restart failures

Starting Procedure

Mount the tapes as indicated above, ready the input deck in the card reader, set the sense switches, ready the printer, clear and ready the card punch, CLEAR and LOAD TAPE. At program stop (0001)₈. Manually enter 1 (TURBO-1) into the address portion of the MQ. START.

Restart

If the TURBO-1 deck has been read prior to the stop which caused the restart, rewind tape 1 and depress sense switch 2. Remove the TURBO-1 input deck (i.e., remove all cards up to the second title card) and follow the starting procedure. All tapes must have been saved for a restart. If the TURBO-1 deck has not been read, rewind all tapes and start the problem again.

Edits (TURBO-5)

Follow TURBO-5 instructions (Ref. 1). The BRIC-1 program tape contains TURBO-5.

Instruction Tape Preparation

A) Copy BRIC-1

Mount a blank on logical 1, BRIC-1 program tape on logical 2, ready the deck (WBBRC000-WBBRC029) in the card reader CLEAR and LOAD CARDS. The normal stop is at $(00067)_8$. All other stops are machine errors.

B) Write BRIC-1

Mount a blank on logical 1, the New TURBO program tape on logical 10, ready the deck (WBBR1000-WBBR1228) in the card reader, CLEAR and LOAD CARDS.

When the machine stops at location $(00343)_8$, switch logical 1 to logical 2, mount a blank on logical 1. CLEAR and LOAD CARDS. The normal stop is at $(00067)_8$. All other stops are machine errors. The tape on logical 1 is the BRIC-1 program tape.

Program Stops

A) Normal Stops

$(00150)_8$ - Program has been successfully completed. Always save tapes 7 and 9. Save tape 6 (converged flux tape) if requested. If a depletion is

contemplated, save all tapes. Print tape 10 (BCD Tape) on the off-line printer. Remove output cards from the card punch and give to the requestor.

B) Error Stops

Most error stops are identical with the TURBO-1 stops and may be found in Reference 1 and the addendum to Reference 1.

The following stops occur in the thermal and hydraulic calculation:

<u>Location</u>	<u>What to Do and Why</u>
00150	Normal end of problem.
00252	False EOR -- card reader.
01531	Copied card image doesn't match card image computed from BCD (WH001).
01564	Original BCD doesn't match BCD reconverted from binary (WH001).
01647	Double punch, blank column (WH001).
02062	Range error (WH001).
04154	No input deck.
04155	Machine error -- probably arithmetic.
04241	Input error -- input is inconsistent. There are tables for non-fueled composition.
04251	Input error -- too many cards.
04305	Input error -- input is inconsistent. There are tables for non-fueled composition.
04317	Input cards out of order.
04327	An enthalpy value specified in the 4000 series is in error.
04343	False EOR -- card reader.
04352	False EOF -- card reader.
04366	False EOF -- card reader.
04403	EOF writing tape 4.

<u>Location</u>	<u>What to Do and Why</u>
04404	Error tape 4 -- see Kiehl card.*
04420	False EOR -- card reader.
04430	False EOF -- card reader.
04463	Checksum error -- tape 2.
04464	Unwanted EOF -- tape 2.
04545	Checksum error -- tape 5.
04546	Unwanted EOF -- tape 5.
04566	Unwanted EOF -- tape 7.
04567	Error tape 7 -- see Kiehl card.
04652	Unwanted EOF -- tape 4.
04653	Error tape 4 -- see Kiehl card.
05004	EOF writing tape 7.
05005	Error tape 7 -- see Kiehl card.
05022	Error tape 8 -- see Kiehl card.
05144	EOF writing tape 7.
05145	Error tape 7 -- see Kiehl card.
05351	Improper binary input -- may be checksum, or cards out of order.
05352	Input error -- probably card numbering.
05353	Table range exceeded.
66055	End of tape -- follow TURBO-1 procedure.

* A Kiehl card is a tape error diagnostic card punched in accordance with the tape routine WBRWT-5.

BRIC-01 TEST PROBLEM 1

XY1

STRB01

+01001+2+04+05+05+1+1+1+0+5112022500+4850000+00+000000000+563730248+00
+01002+5110000000+0000000000+0000000000+0000000000+0000000000+0000000000
+01003+5222536400+5140263000+5162734000+0000000000+0000000000+0000000000
+01004+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+01005+0000000000+0000000000+0000000000+0000000000+0000000000+5343517200
+01006+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+01007+0000000000+5574770000+5722630000+5265000000+5426417000+5249099100
+01008+5021840000+4713160000+5011840000+0000000000+0000000000+0000000000
+01009+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+01010+0000000000+0000000000+0000000000+0000000000+0000000000+5342520000
+01011+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+01012+0000000000+5574770000+5722630000+5265000000+5426417000+5043093000
+01013+5335890000+0000000000+0000000000+0000000000+0000000000+0000000000
+01014+5387462000+0000000000+0000000000+0000000000+0000000000+0000000000
+01015+4960000000+0000000000+0000000000+0000000000+0000000000+0000000000
+02001+5120000000+01+5135000000+04+5170000000+05+0000000000+00+0000000000
+04000+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+04001+01+00+05+00+05+02+01+05+01+05+03+01+04+01+04+04+01+03+01+03+000000
+05000+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+05011+5410000000+5410000000+5410000000+5410000000+0000000000+0000000000
+05021+5310000000+5310000000+5310000000+5310000000+0000000000+0000000000
+06001+4785300000+0000000000+0000000000+0000000000+0000000000+0000000000
+06002+4824400000+4824400000+4824400000+4824400000+0000000000+0000000000
+07001+5110000000+5110000000+5110000000+5110000000+0000000000+0000000000
+08001+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09001+01+01+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09002+4949500000+0000000000+0000000000+0000000000+0000000000+0000000000
+09003+02+01+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09004+4924750000+0000000000+0000000000+0000000000+0000000000+0000000000
+09005+03+02+03-04+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09006+4919000000+4919000000+4919000000+0000000000+0000000000+0000000000
+09007+18+02+03+04+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09008+4699257000+4699257000+4699257000+0000000000+0000000000+0000000000
+09009+29+02+03+04+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09010+4552488000+4552488000+4552488000+0000000000+0000000000+0000000000
+09011+30+02+03+04+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+09012+4914123000+4914088500+4913968100+0000000000+0000000000+0000000000
+10000+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+11000+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000
+12000+0000000000+0000000000+0000000000+0000000000+0000000000+0000000000

BRIC-01 TEST PROBLEM 1 ITERATION 1

+1001+511+511+000+3+1+1+1+485+485+0000000000+0000000000+0000000000+0000000000

17

BRIC-01 TEST PROBLEM 1

XY1 8TRBC1

FLUX TAPE HAS BEEN COPIED. REMOVE TAPE 10.

COLUMN

0 1 2 3 4 5

ROW

0	.	.	.	.	.	.
	.1	1	1	1	1	.
1	.	.	.	.	.	.
	.1	.4	4	.3	.2	.
2	.	.	.	.	.	.
	.1	.4	4	.3	.2	.
3	.	.	.	.	.	.
	.1	.3	3	3	.2	.
4	.	.	.	.	.	.
	.1	.2	2	2	2	.
5	.	.	.	.	.	.

BRIC-01 TEST PROBLEM 1

XY1 8TEB01

TIME STEP NUMBER 00

BUCKLING COMP	GROUP1	GROUP2	GROUP3	GROUP4
1	-3 853000	-3 853000	-2 244000	000000
2	-3 853000	-3 853000	-2 244000	000000
3	-3 853000	-3 853000	-2 244000	000000
4	-3 853000	-3 853000	-2 244000	000000

COMP	GROUP	DIFFUSION	ABSORPTION	NU FISSION	REMOVAL
1	1	1.8215300	.00060033	.00000000	.03569823
1	2	.2743027	.01081406	.00000000	...
2	1	1.8490624	.00187581	.00221208	.01948598
2	2	.3832694	.06449045	.08681216	...
3	1	1.8517914	.00187481	.00221188	.01943433
3	2	.3840304	.06447512	.08681216	...
4	1	1.8612148	.00187140	.00221121	.01925715
4	2	.3866638	.06442251	.08681216	...

BEGIN ITERATION ROUTINE.

OUTER ITERATION 1

GROUP 1 MAX. = +145565+01 OMEGA = +142510+01 MIN. = +139577+01
NO. IT. PERFORMED = 2 N MAX. = 7 N MIN. = 4

GROUP 1 R(1) = +618652-02 NO. IT. = 8 R(N) = +282688-03

GROUP 2 MAX. = +115606+01 OMEGA = +111141+01 MIN. = +103317+01
NO. IT. PERFORMED = 1 N MAX. = 3 N MIN. = 2

GROUP 2 R(1) = +570449-02 NO. IT. = 3 R(N) = +250141-03

MAX. = +120225+01 LAMBDA = +120225+01 MIN. = +120224+01

EPS. = +886202-06 RENORM. = +100000+01

BINARY OUTPUT ON TAPE 6

COMPOSITION-INTEGRATED AREA

0.290000E 02 0.857500E 02 0.612500E 02 0.490000E 02

COMPOSITION-INTEGRATED FLUX - GROUP 1

0.946557E 04 0.293730E 05 0.208374E 05 0.162936E 05

COMPOSITION-AVERAGED FLUX - GROUP 1

0.326399E 03 0.342543E 03 0.340203E 03 0.332523E 03

COMPOSITION-INTEGRATED FLUX - GROUP 2

0.475842E 04 0.996601E 04 0.742639E 04 0.693726E 04

COMPOSITION-AVERAGED FLUX - GROUP 2

0.164084E 03 0.116222E 03 0.121247E 03 0.141577E 03

COMPOSITION-INTEGRATED ABSORPTION

0. 0. 0. 0.

COMPOSITION-AVERAGED ABSORPTION

0. 0. 0. 0.

POWER

COMPOSITION
TOTAL/REACTOR
TOTAL

COMPOSITION PERCENTAGES	18	20	21	23	
1	00000	00000	00000	00000	00000
2	1. 10000	00000	00000	00000	41170
3	1 10000	00000	00000	00000	30576
4	1 10000	00000	00000	00000	28254

NORMALIZATION FACTOR 14 12802356

BRIC-01 TEST PROBLEM 1 ITERATION 1

THE PROBLEM IS NOT CONVERGED

INTEGRATED CHANGE IN WATER CONTENT= -2 11022688

MAX CHANGES IN NUMBER DENSITY AT CORR. RECTANGLES-

-2 11804406	23	-2 23056076	18
-2 11804406	15	-2 23056076	14
-2 14317825	24	-2 27562960	19
-2 14317825	20	-2 37836792	7
-2 14783945	25	-2 58655466	13

PROBLEM COMPLETED.

BRIC-01 TEST PROBLEM 1 ITERATION 1

FLOW

PAGE 1

	1	2	3	4	5
1	0000	0000	0000	0000	0000
2	0000	6 7394	6 8723	7 1629	7 2369
3	0000	6 8723	7 1086	7 1939	7 2437
4	0000	7 1629	7 1939	7 1991	7 2446
5	0000	7 2369	7 2437	7 2446	7 2448

EDIT COMPLETED

BRIC-01 TEST PROBLEM 1 ITERATION 1

ENTH.

PAGE 1

	1	2	3	4	5
	0000	0000	0000	0000	0000
1	0000	3 5323	3 5273	3 5205	3 5182
2	0000	3 5273	3 5228	3 5183	3 5173
3	0000	3 5205	3 5183	3 5180	3 5171
4	0000	3 5182	3 5173	3 5171	3 5170
5					

EDIT COMPLETED

BRIC-01 TEST PROBLEM 1 ITERATION 1

N-H2O

PAGE 1

	1	2	3	4	5
	0000	0000	0000	0000	0000
1	0000	-1 1392	-1 1398	-1 1408	-1 1412
2	0000	-1 1398	-1 1405	-1 1412	-1 1414
3	0000	-1 1408	-1 1412	-1 1413	-1 1414
4	0000	-1 1412	-1 1414	-1 1414	-1 1414
5					

EDIT COMPLETED

PROBLEM COMPLETED.

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