EUR 4603 e

COMMISSION OF THE EUROPEAN COMMUNITIES

XBWR
A ONE DIMENSIONAL XENON TRANSIENT PROGRAMME FOR BOILING NUCLEAR REACTORS

by

G. FORTI

1971

Joint Nuclear Research Centre
Ispra Establishment - Italy
Reactor Physics Department
Reactor Theory and Analysis

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of each time step a new distribution of fluxes, power, voids and temperatures is obtained, which is consistent with the reactor critical condition as it is got by variation of the control parameter taking into account the feedbacks. The new flux distribution is used as input for Xenon and Iodine concentrations evolution in the next time step.

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ABSTRACT

XBWR is a FORTRAN programme for the analysis of Xenon transients in axial geometry. It couples a two group neutron diffusion calculation in plane geometry with a two phase flow cooling channel calculation and the heat conduction in the typical fuel rod. The programme allows to follow any given power time schedule, such as shut-down and restart, day-night power variation etc., while the reactor is being kept critical by control rod movement, variable poisoning of the core, or coolant flow recirculation rate. The Xenon and Iodine concentrations variation is evaluated pointwise (up to 100 points) by analytical solution for successive fixed time steps. At the end of each time step a new distribution of fluxes, power, voids and temperatures is obtained, which is consistent with the reactor critical condition as it is got by variation of the control parameter taking into account the feedbacks. The new flux distribution is used as input for Xenon and Iodine concentrations evolution in the next time step.

KEYWORDS

BOILING WATER REACTORS
FORTRAN
XENON
TRANSIENTS
PROGRAMMING
NEUTRONS
DIFFUSION
GEOMETRY
TWO PHASE FLOW
COOLING
COOLANT LOOPS
THERMAL CONDUCTIVITY
FUEL RODS
CONTROL ROD DRIVES
POISONING
IODINE
DISTRIBUTION
FLUXES
POWER
VOIDS
TEMPERATURE

CONTENTS

1 - Purpose *)

In BWR power reactors, the axial power shape is strongly dependent on void distribution, and this leads generally to fairly peaked and rather asymmetric distributions. Another consequence is that the power shape may be significantly altered when the total power is changed. The effectiveness of control rod banks may be significantly affected, up to the point that in some instances it may even change sign (actually insertion of a rod may cause, through void feedback, a positive net reactivity effect). In such situation, it is clear that Xenon spatial effects may sometimes add up to the void effects and lead to unacceptable power peaking beyond the safety margin.
The problem facing the power plant operator concerning Xenon is therefore not so much that of stability in the theoretical sense, as that of evaluating the actual consequences of specific operations, and therefore the operative limitations that spatial Xenon effects may introduce.
To cope with such problems a simulation by a somewhat detailed model is needed, and this was the motivation for the present XBWR code, which may anyway also be used, with or without coolant channel, for classical stability assessment.

2 - Nature of the programme

XBWR is built as a succession of stationary calculations in which the criticality of the reactor is restored, by means of the variation of a control parameter (see control options) after a given time step in which the Xenon and Iodine concentrations at every point of a discrete meshes are obtained by the analytical solution of the equations :

$$\frac{dI}{dt} = \gamma_I \left(\Sigma_{f_1} \phi_1 + \Sigma_{f_2} \phi_2 \right) - \lambda_I I$$

$$\frac{dX}{dt} = \gamma_X \left(\Sigma_{f_1} \phi_1 + \Sigma_{f_2} \phi_2 \right) + \lambda_I I - \lambda_X X - \sigma_X X \phi_2$$

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*) Manuscript received on October 14, 1970

in which the value of the fluxes and the initial conditions for Xenon and Iodine concentrations are taken as given by the last time step.
When a problem is started, an initial criticality search is made, which gives the starting conditions as the equilibrium conditions for the reactor with Xenon and Iodine concentrations at equilibrium for the given power, and taking into account the fuel, liquid coolant, and void fraction feedbacks corresponding to the average channel conditions evaluated by the code, according to the given feedback coefficients. The search is made on $\lambda = \frac{1}{k_{eff}} - 1$ and the corresponding value found is multiplied into all the $\nu\Sigma_f$ coefficients so as to make the reactor critical in the stationary condition.
After the initialization, a space dependent perturbation may be introduced into Xenon and Iodine concentrations and the transient is started. The total power of the reactor may be changed at each time step, according to any given time schedule. If zero power is specified for any given time interval, the code will evaluate in a single jump the Xenon and Iodine evolution during the shut down time.

The neutronic diffusion calculation is performed by the finite differences direct method for the two group time dependent diffusion equations developed for the Costanza series of dynamic codes, to which the reader is referred for detailed information (EUR 3633 e - EUR 596 e, see References).
There is one difference in the present code, in the fact that the fluxes calculated pointwise correspond to the centre of each mesh, and not to the boundaries. This has been found to be more quick and exact for the problem at hand, where the calculation is finally a stationary one. The criticality is considered reached when the reciprocal of the period of the reactor (without considering the delayed neutrons) is lesser than a given amount in absolute value.
This method of treating the stationary problem as a dynamical one has been found to be a convenient one, as it allows to modify the control parameter at each

step, corresponding to a finite time increment, thereby avoiding to iterate to convergence for each successive control condition.

The thermohydraulic channel calculation is performed according to the FRANCESCA one dimensional finite difference model (EUR 4052 e and EUR 4241 e) which is essentially based on Bankoff slip correlation for two phase flow, and Bowring treatment of subcooled boiling. The mesh description of the core is uniform, and the same meshes apply to the neutronic and thermohydraulic calculation. Upper and bottom reflectors of arbitrary thikness may be represented in neutron calculation. Three independent types of feedback are represented in the code.

- The liquid temperature feedback. δk is given as a quadratic function of the difference between the actual temperature in the point and a specified reference temperature.
- The fuel temperature (Doppler) feedback. It is evaluated at each axial point as function of the average temperature across the fuel rod at each level. Three forms are available

$$\delta k_D = b\left(e^{a(\sqrt{T}-\sqrt{TREF})}-1\right)e^{\tau\alpha} \qquad (\alpha \text{ is the void fraction})$$

$$\delta k_D = a\,(T-TREF) + b\,(T-TREF)^2$$

$$\delta k_D = a\left(\sqrt{T}-\sqrt{TREF}\right)$$

- The void coefficient feedback. It is evaluated pointwise. The form may be a quadratic in the void fraction

  $$\delta k_v = a\alpha + b\alpha^2$$

  or a 20 point table may be given of δk_v as a function of α . In this latter case the code will interpolate linearly in the table for a given value of α .

  The inlet enthalpy subcooling of the coolant is evaluated as it results from the mixing of recirculated water and feed water according to the formula :

$$H_{inlet} = u\, H_{fdw} + (1-u) \times \text{carry under ratio} \times \text{latent heat of vaporization.}$$

where u is the ratio of feed water to total flow.
The enthalpy of feedwater is supposed to depend on power, according to a quadratic formula:

$$H_{fdw} = H_0 + aP + bP^2$$

3 - Control options

Three levels of control are available at each time step to keep the reactor in critical conditions.

a) Recirculation flow control (optional)
If the corresponding option is checked, the recirculation flow rate is varied between specified limits, to get the reactor critical. The upper limit is fixed, while the inferior limit is taken as a fraction of nominal flow given by:
1. - a (1. - relative power), provided the value obtained is not smaller than a fixed limit.
If the criticality cannot be achieved within the prescribed limits, the control search is performed by neutronic poisoning.

b) Neutronic poisoning control - One can choose between two alternative ways: the neutronic poison may be diluted in the whole reactor, varying the concentration between 0 and an upper limit, or a control rod bank may be represented as a movable boundary between poisoned and unpoisoned regions. If the criticality cannot be reached by the complete extraction of the available poison, the control shifts to the power reduction option; if the reactor is still overcritical with fully inserted poison, the calculation stops with a warning.

c) Power reduction control. If at a given time the reactivity of the reactor available is not sufficient to reach the critical condition for the scheduled power, a search is made to find out the maximum power attainable in the current conditions. By this mean, one can evaluate, for instance, the minimum time required to reach full power after a shut down or a power reduction at the end of the life of a fuel charge.

4 - Output

A flexible output routine (see input key) allows to control the display of the principal items at the different times, so as to obtain the relevant data without having too many prints. An example of the output for the sample case is given in appendix.
The output includes :
- a map of input data
- a description of the average coolant channel
- a first complete map of results referring to a preliminary adjustment obtained by iterating neutronic and thermal calculation with equilibrium Xenon concentrations. This map has no physical meaning but may be useful when convergence problems arise
- the record of the initial criticality search and the complete map of the converged results :
- the prints referring to the transient: average values and complete map of results at wanted times according to the specifications of the user

The headings appearing in the output are interpreted as follows :

P1, P2	Fast and thermal fluxes
CI, CX	Iodine and Xenon concentrations
HFL	Heat flux from the average fuel rod
DK	δk feedback reactivity
VF	Void fraction
TS	Surface temperature of the cladding
TIC	Inner cladding temperature
TL	Liquid coolant temperature
TFMAX, AVTF	Central (maximum) and average fuel temperatures
IT	Time step numeral
INT	Number of iterations for convergence
VINLET	Inlet velocity of the coolant
REP	Reciprocal of the period
MASSFL	Mass flow rate relative to starting nominal condition.

5 - Input form

Many problems may be executed in one run. For every problem the first input card is a title card, in which any alphamerical information may appear in columns from 7 to 70 included. This title will appear in the output - a 1 in column 6 means that the problem is the last of the run.
A vector of 3500 memory positions DATA (1) to DATA (3500) contains all the data in floating point form (Internal conversion is performed by the code when needed). Since entire groups of memory positions are zero, it is possible to read different sets of significant data; each set must be preceded by a card containing the integers Ki_1, Ki_2 defining the first and last datum of the set. Ki_1 and Ki_2 are given in integer form adjusted to the right at columns 12 and 24. The last set of a problem is indicated by -1 in columns 1 and 2. The data of each set are all in floating form (FORTRAN FORMAT E 12.8). Any number of problems may be run in sequence and only the data changing from the preceding problem need to be given. A title card must be present for each problem. The key to the input is given in appendix A.

6 - Programme's performance, computer specifications and user's directions

The XBWR programme has been written in FORTRAN 360 and assembled in FORTRAN H level O under the IBM 360 O.S., and the total lenghth of the programme resulted 18A04 bytes.
Little can be said about the computer time required, as it is strictly dependent on convergence rates and thereby on physical conditions for the problem at hand. An average case of 30 to 50 mesh points, with boiling channel and recirculation flow control will take about 10 minutes of IBM 360 for 150 time steps. The speed of calculation is very much increased when there is no channel and no feedback.
In many occasions, a time step of half an hour may be quite sufficient to give acceptable results. When the physical situation is near to instability threshold a quarter of an hour or 10 minutes may be required.

The code has been extensively tested and generally performs satisfactorily; the reader should anyway be aware that not all the possible uses of the code, which embodies so many options, have been explored and some difficulty may arise in practical use. In our experience the difficulties can be overcome, sometimes with some ingenuity on the part of the user. Furthermore it should be remembered that the convergence process of the iterative procedure that leads to criticality is not theoretically proved. Actually, when a rod bank search is made, there are cases in which the process may not converge. Theese correspond to the situations in which there is a maximum of reactivity for a certain insertion of the bank, as it was mentioned in the introduction. In such cases, a provision is made in the logic of the iterative process to stop the iterations and force the insertion to a reasonable value. The consequence is that the configuration of the reactor reached by the code is not really critical. Such cases are detected by observing that the reciprocal of the period is higher than the convergence criterium, while the number of iterations is smaller than the maximum. This may happen also when the iterative process is not really divergent, but the convergence is so slow that the code forces the exit from the iteration process to save machine time. The user should be aware that such occurrences do not really impair the validity of the results, as the only consequence is that the configuration of the reactor is not perfectly critical, but the flux shape is nearly correct. As in the calculations there is no representation of delayed neutrons, a reciprocal of the period of the order of 100, as the prompt neutron lifetime is of the order of 10^{-4} sec. corresponds to a reactivity as low as 1000 pcm.
The same considerations apply when the maximum number of iterations available is reached and the convergence process is stopped before reaching the convergence criterium.

References

EUR 3633 e — The codes COSTANZA for the dynamics of liquid-cooled nuclear reactors.
G.FORTI and E.VINCENTI, 1967

EUR 596 e — Finite difference method for solving the spatio-temporal diffusion equations in the two-group approximation
R.MONTEROSSO and E.VINCENTI, 1964

EUR 4052 e — A dynamci model for the cooling channels of a boiling nuclear reactor with forced circulation and high pressure level
G.FORTI, 1968

EUR 4241 e — FRANCESCA, A dynamic program for boiling cooling channels
G.FORTI, 1969

APPENDIX A

INPUT KEY for XBWR code

TITLE CARD bbbbbb ANY TITLE to column 70 (1 in column 6 for the last problem of the run)

DATA n°	NAME	Description	Unit	Notes
1	ICORE	Number of meshes (intervals) in the core	-	up to 94 (98 if no reflector)
2	NRCORE	Number of regions of different composition in the core	-	up to 10
3	DT	Time interval for calculation	Sec	600.=10 minutes gives very accurate results
4	IDST	Put 1. if initialization of the problem is required 0. for a restarted problem	-	
5	IBAR	0. diffused poison control 1. Banked rods control-Rods entering as coolant flow -1. Banked rods control-Rods entering apposite to coolant	-	
6	PØWFAC	Energy release per fission	Joule	
7	IXE	0. Power time table given in input 1. After equilibrium a shut down is imposed (see DATA (35)) -1. Iodine and Xenon concentrations perturbed in input	-	

DATA n°	NAME	Description	Unit	Notes
8	GAI	Iodine yeld per fission	-	
9	GAXE	Xenon 135 yeld per fission	-	
10	DLI	Iodine decay constant	sec^{-1}	
11	DLXE	Xenon decay constant	sec^{-1}	
12	SAXE	σ_{Xe_0} Xenon microscopic capture cross section (effective thermal) (no voids - see DATA 29 and 30 for void effects)	cm^2	
13	SI	Total power of the reactor in the nominal condition	watt	
14	HCØRE	Height of the core	cm	
15	AREA	Core horizontal cross section area	cm^2	
16	HR1	First reflector thickness (inlet of coolant)	cm	put 0. if no reflector
17	HR2	Second reflector thickness (outlet of coolant)	cm	has to be represented
18	BU	Radial Buckling B^2	cm^{-2}	
19	DELT	Generally omitted (10^{-4} is chosen by the code) Time step for dynamic iterations	sec	A smaller time step may be required for convergence in some cases. A wider time step will speed up calculations when convergence is good.

DATA n°	NAME	Description	Unit	Notes
20	CHANN	Number of coolant subchannels (fuel rods) in the core	-	Put 0. if no channel. In this case there will be no feedback
21	IDOPP	Doppler feedback indicator: $0. \rightarrow \delta k_D = e^{0.542\alpha}\, b\left(e^{a(\sqrt{T_f}-\sqrt{TDOP})}-1\right)$ $1. \rightarrow \delta k_D = a\,(T_f - TDOP) + b\,(T_f - TDOP)^2$ $-1. \rightarrow \delta k_D = a\left(\sqrt{T_f} - \sqrt{TDOP}\right)$	-	
22	TDOP	Reference temperature for Doppler feedback	Kelvin	°C may be used for IDOPP=1 All temperatures in the input must then be given in ° Celsius
23	TREF	Reference temperature for liquid coolant feedback $\delta k = a\,(T_\ell - TREF) + b\,(T_\ell - TREF)^2$	Kelvin	
24	DINS	Control poison position at the beginning of the problem Depth of insertion for control rod in core (IBAR = ± 1) Insertion fraction for diluted poison (IBAR = 0)	 cm -	

DATA n°	NAME	Description	Unit	Notes
25	SAP1	Fast group poison cross section of rods in core	cm^{-1}	
26	SAP2	Thermal group poison cross section of rods in core	cm^{-1}	
27	SAPR1	Fast group poison cross section of rods in reflector	cm^{-1}	Only for banked rods IBAR = ± 1
28	SAPR2	Thermal group poison cross section of rods in reflector	cm^{-1}	
29		a) in formula for void dependence of Xenon absorption cross section	-	
30		b) $\sigma_{Xe} = \sigma_{Xe_0}(1.+a\alpha+b\alpha^2)$	-	
31	ITV	Control indicator 0. Recirculation flow control 1. Only poison control		
32	FVMAX	Maximum mass flow for recirculation control (relative to nominal)	-	Only if ITV = 0.
33	FVMIN	Minimum mass flow for control (relative value)	-	Idem
34		a in formula FVMIN = = 1.+a(1 - relative power) a should be of course negative and in this case the minimum flow admitted is the higher value between DATA (33) and formula. If a is zero or positive, the formula is neglected.		Idem

DATA n°	NAME	Description	Unit	Notes
35	TEMPØ	Time of shut down for initial shut down	hours	Only if IXE = 1
37	SI	Total power of the reactor at the beginning of the transient	watt	If omitted, nominal values will be used
38	FVIN	Relative value of coolant flow at the beginning of the transient	-	

– <u>Iteration process parameters</u> –

DATA n°	NAME	Description	Unit	Notes
40	LF	Maximum number of iterations for criticality Generally omitted. The code will take 50		Generally omitted
41	DAPF	Convergence criterium for criticality (if omitted the code takes 0.01)		Generally omitted
42	SPRG	Second guess of $-\delta k$ for initial criticality search if omitted the code takes ± 0.01		Generally omitted
43	ITCR	Maximum number of steps for period evaluation in iterations		Generally omitted
44	-	0. No operation 1. Channel calculation repeated in iterations		

DATA n°	NAME	Description	Unit	Notes
		- Regions Specification -		
61 to 70		Number of intervals in the successive core regions (First region corresponds to entry of the coolant)		There must be as many data as there are regions (NR CØRE = DATA (2)) and the sum must agree with ICORE = DATA (1)
		- Nuclear constants in core regions -		
80 + 1	D1(1)	D_1 Diffusion coefficient for fast group - First zone	cm	For each region the nuclear constants are given in two cards, one for fast group, and the second for thermal group. Of course, for successive problems, only the data changed are to be given.
+ 2	-	Σ_{a_1} Absorption cross section - fast group - idem	cm^{-1}	
+ 3	SSD(1)	Σ_{sd} Slowing down cross section	cm^{-1}	
+ 4	SF1(1)	$\nu\Sigma_{f_1}$ Neutron production cross section - fast group	cm^{-1}	
+ 5	SN1(1)	Σ_{f_1} Fission cross section - Fast group	cm^{-1}	
+ 6	-	Dummy		
+ 7	DZ(1)	D_2 Diffusion coefficient - Thermal group	cm	
+ 8	SA(1)	Σ_{a_2} Absorption cross section - Thermal group	cm^{-1}	

DATA n°	NAME	Description	Unit	Notes
80 + 9	SF(1)	$\nu\Sigma_{f_2}$ Neutron production cross section – Thermal group	cm^{-1}	
+ 10	SN2(1)	Σ_{f_2} Fission cross section – thermal group	cm^{-1}	
+ 11	–	Dummy		
+ 12	–	Dummy		
92 + i i=1,12		Same for 2^{nd} region		
114+i		Same for 3^{rd} region etc		

– Feedback parameters –

200	–	If left blank, the feedback coefficients will be the same in the whole core. Put 1. if they are given regionwise		

DATA n°	NAME	Description	Unit	Notes
		- <u>First region</u> -		
201	ALDOP	a in Doppler feedback formula (see IDØP DATA (21))		Unit depend on formula
202	BEDOP	b in Doppler formula		Same
203	AVOID	a in void feedback formula	-	Omit if void feedback is tabulated - see DATA (1000) -
204	BVOID	b in same formula	-	
205	ACOCO	a in coolant temperature feedback formula	$°C^{-1}$	See TREF = DATA (23)
206	BCOCO	b in same formula	$°C^{-2}$	
207-212		Same for 2[nd] region if DATA (200) is checked		
etc.		etc.		
		- <u>Void feedback tabulations</u> -		20 values of are given for each table (4 cards. The last values of the last card are dummy). Either one table applies to the whole core or different tables for each region are given according to DATA (200) value
1000		Put 1. if void feedback is tabulated 0. if the quadratic formula is employed		
1001 to 1020		values for first region (or whole core) corresponding to = 0.05 modulus 0.05 up to 1.		
1021 to 1024		Dummy		

DATA n°	NAME	Description	Unit	Notes
1025 to 1048 etc.		Same for second region if DATA (200) is checked etc.		
		- Reflector constants -		First reflector corresponds to inlet of coolant. Second to outlet.
281	D1R1	D_1 Diffusion coefficient - fast group - first reflector	cm	
282	SA1R1	Σ_{a_1} Absorption cross section - fast group - idem	cm^{-1}	
283	SSDR1	Σ_{sd} Slowing down cross section - idem	cm^{-1}	
284	D2R1	D_2 Diffusion coefficient - Thermal group - idem	cm	
285	SAR1	Σ_{a_2} Absorption cross section - Thermal group - idem	cm^{-1}	
286	-	Dummy		
287	D1R2	D_1 } Same for 2^{nd} reflector		
288		Σ_{a_1}		
289		Σ_{sd}		
290		D_2		
291		Σ_{a_2}		
292		Dummy		

DATA n°	NAME	Description	Unit	Notes
		- Initial Data for restarted problem -		Only for IDST = 0
301-400	CI(I)	Iodine concentrations in core mesh points	atoms/cm^3	
401-500	CXE(I)	Xenon concentrations in core mesh points	atom/cm^3	
1401-1500	P1(I)	Fast fluxes in reactor mesh points	neut/sec cm^2	The first values are always zero. If any reflector exists three meshes are allocated for it
1501-1600	P2(I)	Thermal fluxes in reactor mesh points	neut/sec cm^2	
		- Perturbation values for Iodine and Xenon -		Only if IXE = -1
501-600	FRI(I)	Fraction that multiplies equilibrium values of Iodine concentration in each core point		
601-700	FRXE(I)	Same for Xenon		

DATA n°	NAME	Description	Unit	Notes
		- <u>Power Tabulation</u> -		
701-750	-	Times for Power tabulation	hours	The first time must be 0. Giving two times the same value in succession, a step in power is introduced After the last time given the power is kept constant.
751-800	SI	Corresponding Power values The code will interpolate linearly among values given. If two successive 0. values for power are given, the code will calculate a shut down period in a single step and restart at the next value of <u>time</u> and power	watt	
		- <u>Cooling channel specifications</u> -		Only if CHANN > 0
2901	NF	Number of radial meshes in the fuel rod ≤ 10.		see DATA (20)
2902	ISTD	1. Standard formulae for water are selected 0. Heat transfer constants given in input		
2903	ITIPØ	0. or blank Cylindrical fuel rods 1. Slab fuel element -1. General geometry		

DATA n°	NAME	Description	Unit	Notes
2904	IVAR	0. Thermal conductivity in fuel elements are constant 1. Variable conductivity (exponential formula) 2. Variable conductivity (quadratic formula)		See DATA (3021)to(3023)
2905	JPØW	0. Constant power density along the thickness of the fuel rod 1. Power shape in radial zones given in input		
2906	ITET	0. θ calculated by the code 1. θ given in input		
		- <u>Channel data</u> -		Only if CHANN > 0 + See DATA (20)
3001	A	Coolant cross section area (referred to a single rod)	cm^2	
3002	DIAF	Diameter of the fuel rod (or thickness of the slab)	cm	
3003	GAPTH	Thickness of the gap	cm	May be taken 0.
3004	CLTH	Thickness of the cladding	cm	Always > 0.
3005	AKF	Thermal conductivity of the fuel (at reference temperature if variable)	watt/cm°C	
3006	RGAP	Thermal resistance of the gap	cm^2°C/watt	

DATA n°	NAME	Description	Unit	Notes
3007	AKCL	Thermal conductivity of the cladding (at ref.temp.)	watt/cm°C	
3008	FLØW	Coolant total mass flow into core in initial conditions	m.ton/hour	
3009	FMDFØ	Feedwater mass flow in initial condition (During transient it will be taken proportional to power)	m.ton/hour	Used to evaluate inlet enthalpy of coolant (see later)
3010	TSAT	Saturation temperature of the coolant	Kelvin	
3011	RO	Liquid coolant density	gr/cm^3	
3012	ROVAP	Vapour density	gr/cm^3	
3013	CP	Liquid coolant specific heat	Joule/gr°C	
3014	HLAT	Latent heat of vaporization	Joule/gr	
		- Heat transfer parameters -		Only if ISTD = 0.
3015	HC	Convective heat transfer coefficient (omit if standard)	$watt/cm^2 °C$	Omit if standard
3016	HB	Boiling heat transfer parameter $\phi = HB \Delta T^n$ (idem)	$watt/cm^2 °C$	Omit if standard
3017	AN	Exponent in the boiling heat transfer correlation (idem)	-	
3018	TAU	Bowring ratio of heat transmitted through vapour bubbles to total heat transmitted by boiling mechanism	-	Omit if standard

DATA n°	NAME	Description	Unit	Notes
3019	AK	Benkoff's K slip constant ($S = \frac{v_s}{v_l} = \frac{1-\alpha}{k-\alpha}$)	-	Omit if standard
3020	ZE	Relaxation parameter for void profile in diabatic two phase flow	cm	Omit lacking information

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- Variable conductivity in fuel -

DATA n°	NAME		Description	Unit	Notes
3021	TKF	To	in formula $K = AKF + a \exp\left[(T-To)/b\right]$	Kelvin	If To is omitted in one of the formulae,
3022	AKF1	a	or formula $K = AKF\left[1 + a\,(T-To) + b(T-To)^2\right]$	watt/cm°C or $°C^{-1}$	the value is kept constant to AKF = DATA (3005)
3023	AKF2	b	for fuel conductivity	°C or $°C^{-2}$	
3024	TKCL	To	in same formulae for cladding conductivity		The formula chosen
3025	AKCL1	a		same	depends on IVAR =
3026	AKCL2	b			DATA (2904)

- Parameters for special geometries -

DATA n°	NAME	Description	Unit	Notes
3027	SWID	Slab width (only for slab elements ITIPO=1)	cm	For slab geometry
3028	TINPUT	Value of θ parameter (only if ITET=1.)	°C	
3029	ELSUR	Area of the heating surface per cm of height	cm	Only for general geometry

DATA n°	NAME	Description	Unit	Notes
3030	ACONCL	Thermal conductance of cladding per cm of height	watt/cm°C	ITIPO = -1
3031 to 3040	CONF(I)	Thermal conductance from one zone to the following in the outer direction (per cm of height)	watt/cm°C	idem
3041 to 3050	FMASS(I)	Mass/cm in every zone in the fuel (Center to periphery)	gr/cm	idem
		- <u>Data for standard water formula</u> -		Only if ISTD=1
3051	PRESS	Average pressure	Kg/cm^2	
3052	VISC	Liquid water viscosity	poise	
3053	WCØN	Liquid water heat conductivity	watt/cm°C	
3054	DIAH	Hydraulic diameter of the coolant channel	cm	
		- <u>Inlet enthalpy parameters</u> -		
3055	HENO	H_o In formula for feed water enthalpy subcooling	Joule/gr	The inlet subcooling of the coolant is calculated as:
3056	a	$HFDW = Ho + a\ P + b\ P^2$	Joule/gr MW	$H_{in} = U \cdot HFDW +$
3057	b	where P is Power in MW	Joule gr MW^2	$(1-U)\ XDR \cdot HLAT$

DATA n°	NAME	Description	Unit	Notes
3058	XDR	Carry under ratio, i.e. quality of coolant in downcorner at the mixing point with feed water		where U is the ratio $\frac{FMDF}{FL\emptyset W}$ between feed-water flow and total flow

- <u>Printing and calculation specifications</u> -

DATA n°	NAME	Description	Unit	Notes
1851	KTP	Number of time steps for the first printing pattern		Any number of successive printing patterns may be given. The problem will stop when the last is completed. A new problem is then started unless the title card of the problem has 1 in column 6, in which case the run is stopped.
1852	I1P	Number of time steps for restricted print (Only average values)		
1853	I2P	Number of time steps for extended print (Complete map of fluxes, concentrations, voids etc)		
1854	IDST	if checked 1 gives special print of convergence steps - generally left blank		
1855 1856		Dummy		
1857-1862 etc		Same for 2nd printing pattern		

END OF DATA

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APPENDIX B

INPUT FOR SAMPLE PROBLEM

```
      1               SAMPLE PROBLEM FOR XBWR
            1            36
30.           2.            1800.         30.           1.            0.32         -10
1.            0.0635        0.004         0.287      -040.211      -040.2          -17
800.       +06300.          60000.        40.           40.
              13000.                      560.          560.          100.
0.0004        0.005         0.0004        0.005         -0.15        -0.42
1.            1.            1.            -2.           100.
           43            43
5.
           61            62
15.           15.
           81           104
2.2           0.015         0.037         0.005         0.0023
0.4           0.061         0.087         0.035
2.2           0.015         0.037         0.005         0.0023
0.4           0.061         0.087         0.035
          201           204
0.006         -0.175        -0.09         -0.1
          281           292
2.3           0.0005        0.075         0.29          0.01
2.3           0.0005        0.075         0.29          0.01
         2901          2902
3.            1.
         3001          3014
1.8           1.25          0.001         0.09          0.023         1.5
0.16          14000.        1000.         560.          0.74          0.0366
5.16          1500.
         3051          3056
73.           0.0001        0.0056        1.25          -1150.
-1       1851          1856
20.           2.            4.
```

COSTANZA AXIAL XENON-BOILING CHANNEL
T.C.R. EURATOM-ISPRA

SAMPLE PROBLEM FOR XBWR

1	0.300000E 02	2	0.200000E 01	3	0.180000E 04	4	0.300000E 02	5	0.100000E 01	6	0.320000E-10
7	0.100000E 01	8	0.635000E-01	9	0.400000E-02	10	0.287000E-04	11	0.211000E-04	12	0.200000E-17
13	0.800000E 09	14	0.300000E 03	15	0.600000E 05	16	0.400000E 02	17	0.400000E 02	18	0.0
19	0.0	20	0.130000E 05	21	0.0	22	0.560000E 03	23	0.560000E 03	24	0.100000E 03
25	0.400000E-03	26	0.500000E-02	27	0.400000E-03	28	0.500000E-02	29	-0.150000E 00	30	-0.420000E 00
31	0.100000E 01	32	0.100000E 01	33	0.100000E 01	34	-0.200000E 01	35	0.100000E 03	36	0.0
43	0.500000E 01										
61	0.150000E 02	62	0.150000E 02								
81	0.220000E 01	82	0.150000E-01	83	0.370000E-01	84	0.500000E-02	85	0.230000E-02	86	0.0
87	0.400000E 00	88	0.610000E-01	89	0.870000E-01	90	0.350000E-01	91	0.0	92	0.0
93	0.220000E 01	94	0.150000E-01	95	0.370000E-01	96	0.500000E-02	97	0.230000E-02	98	0.0
99	0.400000E 00	100	0.610000E-01	101	0.870000E-01	102	0.350000E-01	103	0.0	104	0.0
201	0.600000E-02	202	-0.175000E 00	203	-0.900000E-01	204	-0.100000E 00				
281	0.230000E 01	282	0.500000E-03	283	0.750000E-01	284	0.290000E 00	285	0.100000E-01	286	0.0
287	0.230000E 01	288	0.500000E-03	289	0.750000E-01	290	0.290000E 00	291	0.100000E-01	292	0.0
2901	0.300000E 01	2902	0.100000E 01								
3001	0.180000E 01	3002	0.125000E 01	3003	0.100000E-02	3004	0.900000E-01	3005	0.230000E-01	3006	0.150000E 01
3007	0.160000E 00	3008	0.140000E 05	3009	0.100000E 04	3010	0.560000E 03	3011	0.740000E 00	3012	0.366000E-01
3013	0.516000E 01	3014	0.150000E 04								
3051	0.730000E 02	3052	0.100000E-03	3053	0.560000E-02	3054	0.125000E 01	3055	-0.115000E 04	3056	0.0
1851	0.200000E 02	1852	0.200000E 01	1853	0.400000E 01	1854	0.0	1855	0.0	1856	0.0

FUEL DATA

```
FUEL RADIUS     CLAD RADIUS     EXT.RADIUS
0.62500E 00     0.62600E 00     0.71600E 00

   3REGIONS IN FUEL
 RADII
   0.36084       0.51031      0.62500
RELATIVE POWER
   0.33333       0.33333      0.33333


   TEMPERATURE INDEPENDENT CONSTANTS

         KF                 KCL
 0.230000E-01   0.160000E 00

 TOTAL MASS FLOW 0.14000E 05TON/HOUR
 FEEDWATER MASS FLOW 0.10000E 04TON/HOUR
 FEEDWATER SUBCOOLING HFDW =-0.11500E 04+ 0.0        *POWER(MW) + 0.0        *POWER**2 =-0.11500E 04 JOULE/GR
 INLET SUBCOOLING=U*HFDW+(1.-U)*CARRYUNDER*VAP.HEAT=-0.82143E 02

 HEAT TRANSFER CONSTANTS
   HC 0.44958E 01           HB 0.25615E-01              AN      4.000              TAU    0.43500
   TETA        3.53         TETAF        2.56            K      0.858              ZE       0.0


  HOURS   0.0   POWER 0.80000E 09  MASSFL 0.10000E 01  ROD INSERTION 0.10000E 03  INT******

 AVERAGE VOID FRACTION 0.2807
 EXIT QUALITY    0.0824
 FIRST SUBCOOLED BOILING NODE     10
 FIRST BULK BOILING NODE     16

 POWER/CM OF CHANNEL IN CORE REGIONS
0.2328E 03   0.1775E 03


  HOURS    0.0    IT      0    INT ******    POWER = 0.80000E 09    REP = 0.13387E 03


            P1              P2
  2    0.10764D 12    0.78775D 12
  3    0.11246D 13    0.51670D 13
  4    0.98195D 13    0.55565D 13
  5    0.15910D 14    0.86928D 13
  6    0.21994D 14    0.11970D 14
  7    0.28307D 14    0.15369D 14
  8    0.35132D 14    0.19036D 14
  9    0.42827D 14    0.23167D 14
 10    0.51850D 14    0.28012D 14
 11    0.62782D 14    0.33886D 14
 12    0.76377D 14    0.41209D 14
```

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13	0.93606D 14	0.50694D 14
14	0.11557D 15	0.66485D 14
15	0.12872D 15	0.74322D 14
16	0.13362D 15	0.77281D 14
17	0.13197D 15	0.76436D 14
18	0.12546D 15	0.72768D 14
19	0.11552D 15	0.67139D 14
20	0.10374D 15	0.60428D 14
21	0.91731D 14	0.53544D 14
22	0.80396D 14	0.47019D 14
23	0.70129D 14	0.41092D 14
24	0.61028D 14	0.35825D 14
25	0.53027D 14	0.31186D 14
26	0.45983D 14	0.27094D 14
27	0.39718D 14	0.23447D 14
28	0.34045D 14	0.20138D 14
29	0.28786D 14	0.17061D 14
30	0.23772D 14	0.14119D 14
31	0.18856D 14	0.11226D 14
32	0.13908D 14	0.83144D 13
33	0.87949D 13	0.55110D 13
34	0.10116D 13	0.68607D 13
35	0.97232D 11	0.12630D 13
AVERAGES	0.62113D 14	0.35601D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.0	0.4548E 15	0.7126E 01	-0.1444E-02	0.0	0.5459E 03	0.5502E 03	0.5443E 03	0.6743E 03	0.6267E 03
0.0	0.5978E 15	0.1119E 02	-0.2428E-02	0.0	0.5471E 03	0.5538E 03	0.5446E 03	0.7488E 03	0.6740E 03
0.0	0.7037E 15	0.1541E 02	-0.3424E-02	0.0	0.5485E 03	0.5577E 03	0.5451E 03	0.8263E 03	0.7233E 03
0.0	0.7852E 15	0.1980E 02	-0.4429E-02	0.0	0.5500E 03	0.5619E 03	0.5456E 03	0.9068E 03	0.7745E 03
0.0	0.8522E 15	0.2453E 02	-0.5485E-02	0.0	0.5518E 03	0.5665E 03	0.5464E 03	0.9938E 03	0.8299E 03
0.0	0.9102E 15	0.2985E 02	-0.6642E-02	0.0	0.5539E 03	0.5718E 03	0.5472E 03	0.1092E 04	0.8924E 03
0.0	0.9625E 15	0.3610E 02	-0.7957E-02	0.0	0.5563E 03	0.5780E 03	0.5483E 03	0.1207E 04	0.9657E 03
0.0	0.1010E 16	0.4368E 02	-0.9498E-02	0.0	0.5593E 03	0.5855E 03	0.5496E 03	0.1346E 04	0.1055E 04
0.0	0.1055E 16	0.5312E 02	-0.1135E-01	0.0	0.5629E 03	0.5948E 03	0.5511E 03	0.1520E 04	0.1165E 04
0.0	0.1096E 16	0.6532E 02	-0.1597E-01	0.4686E-01	0.5671E 03	0.6063E 03	0.5511E 03	0.1744E 04	0.1308E 04
0.0	0.1136E 16	0.8512E 02	-0.2494E-01	0.1011E 00	0.5676E 03	0.6187E 03	0.5522E 03	0.2102E 04	0.1533E 04
0.0	0.1152E 16	0.9512E 02	-0.3314E-01	0.1541E 00	0.5678E 03	0.6249E 03	0.5535E 03	0.2282E 04	0.1646E 04
0.0	0.1157E 16	0.9889E 02	-0.4047E-01	0.2022E 00	0.5679E 03	0.6272E 03	0.5551E 03	0.2350E 04	0.1689E 04
0.0	0.1156E 16	0.9779E 02	-0.4665E-01	0.2441E 00	0.5679E 03	0.6266E 03	0.5567E 03	0.2330E 04	0.1677E 04
0.0	0.1149E 16	0.9309E 02	-0.5158E-01	0.2796E 00	0.5678E 03	0.6236E 03	0.5583E 03	0.2245E 04	0.1623E 04
0.0	0.1136E 16	0.8587E 02	-0.5791E-01	0.3415E 00	0.5676E 03	0.6191E 03	0.5600E 03	0.2115E 04	0.1541E 04
0.0	0.1119E 16	0.7727E 02	-0.6537E-01	0.3891E 00	0.5674E 03	0.6138E 03	0.5600E 03	0.1960E 04	0.1444E 04
0.0	0.1098E 16	0.6845E 02	-0.7088E-01	0.4249E 00	0.5672E 03	0.6083E 03	0.5600E 03	0.1801E 04	0.1343E 04
0.0	0.1073E 16	0.6010E 02	-0.7483E-01	0.4525E 00	0.5670E 03	0.6030E 03	0.5600E 03	0.1650E 04	0.1248E 04
0.0	0.1045E 16	0.5251E 02	-0.7769E-01	0.4742E 00	0.5667E 03	0.5982E 03	0.5600E 03	0.1513E 04	0.1162E 04
0.0	0.1015E 16	0.4577E 02	-0.7978E-01	0.4914E 00	0.5665E 03	0.5940E 03	0.5600E 03	0.1391E 04	0.1086E 04
0.0	0.9813E 15	0.3984E 02	-0.8131E-01	0.5053E 00	0.5663E 03	0.5902E 03	0.5600E 03	0.1284E 04	0.1018E 04
0.0	0.9450E 15	0.3460E 02	-0.8242E-01	0.5166E 00	0.5661E 03	0.5868E 03	0.5600E 03	0.1190E 04	0.9584E 03
0.0	0.9054E 15	0.2994E 02	-0.8321E-01	0.5259E 00	0.5658E 03	0.5837E 03	0.5600E 03	0.1105E 04	0.9053E 03
0.0	0.8613E 15	0.2571E 02	-0.8372E-01	0.5336E 00	0.5655E 03	0.5809E 03	0.5600E 03	0.1029E 04	0.8570E 03
0.0	0.8108E 15	0.2178E 02	-0.8399E-01	0.5398E 00	0.5651E 03	0.5782E 03	0.5600E 03	0.9575E 03	0.8120E 03
0.0	0.7509E 15	0.1802E 02	-0.8401E-01	0.5448E 00	0.5645E 03	0.5753E 03	0.5600E 03	0.8892E 03	0.7688E 03
0.0	0.6762E 15	0.1432E 02	-0.8376E-01	0.5487E 00	0.5631E 03	0.5717E 03	0.5600E 03	0.8212E 03	0.7255E 03
0.0	0.5779E 15	0.1060E 02	-0.8327E-01	0.5515E 00	0.5624E 03	0.5687E 03	0.5600E 03	0.7534E 03	0.6826E 03
0.0	0.4478E 15	0.6996E 01	-0.8258E-01	0.5533E 00	0.5616E 03	0.5658E 03	0.5600E 03	0.6876E 03	0.6409E 03

INITIAL CRITICALITY SEARCH

SPRG = 0.10000E-01 DAPF = 0.10000E-01 LF = 50

ITERN	SPCR	REP
1	0.0	0.1008E 03
2	-0.1000E-01	-0.1008F 03
3	-0.4999E-02	-0.1700E 02
4	-0.3985E-02	-0.2746F 01
5	-0.3790E-02	-0.1259E 01
6	-0.3624E-02	0.7813E 00
7	-0.3688E-02	-0.9047E 00
8	-0.3654E-02	-0.5266E 00
9	-0.3606E-02	0.2339E 00
10	-0.3621E-02	-0.9878E-01
11	-0.3617E-02	-0.4747E-01
12	-0.3613E-02	0.1191E-01

KEFF 1.003626

HOURS 0.0 IT 0 INT 13 POWER = 0.80000F 09 REP =-0.85840E-02

	P1	P2
2	0.12885D 12	0.97698D 12
3	0.13462D 13	0.63598D 13
4	0.11755D 14	0.66994D 13
5	0.18972D 14	0.10436D 14
6	0.26095D 14	0.14304D 14
7	0.33359D 14	0.18251D 14
8	0.41029D 14	0.22414D 14
9	0.49444D 14	0.26979D 14
10	0.59028D 14	0.32176D 14
11	0.70329D 14	0.38303D 14
12	0.84069D 14	0.45762D 14
13	0.10119D 15	0.55261D 14
14	0.12282D 15	0.71239D 14
15	0.13446D 15	0.78247D 14
16	0.13707D 15	0.79851D 14
17	0.13265D 15	0.77353D 14
18	0.12309D 15	0.71884D 14
19	0.11061D 15	0.64710D 14
20	0.97414D 14	0.57081D 14
21	0.84772D 14	0.49747D 14
22	0.73281D 14	0.43065D 14
23	0.63131D 14	0.37152D 14
24	0.54296D 14	0.31996D 14
25	0.46644D 14	0.27526D 14
26	0.40000D 14	0.23639D 14
27	0.34177D 14	0.20227D 14
28	0.28993D 14	0.17185D 14
29	0.24277D 14	0.14414D 14
30	0.19875D 14	0.11822D 14

31	0.15646D 14	0.93273D 13
32	0.11468D 14	0.68640D 13
33	0.72166D 13	0.45238D 13
34	0.83002D 12	0.55499D 13
35	0.79783D 11	0.10004D 13
AVERAGES	0.61905D 14	0.35615D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.5786E 15	0.5117E 15	0.8585E 01	-0.1799E-02	0.0	0.5462E 03	0.5514E 03	0.5443E 03	0.7010E 03	0.6436E 03
0.9047E 15	0.6576E 15	0.1342E 02	-0.2956E-02	0.0	0.5477E 03	0.5558E 03	0.5447E 03	0.7896E 03	0.6999E 03
0.1240E 16	0.7613E 15	0.1841E 02	-0.4109E-02	0.0	0.5494E 03	0.5604E 03	0.5453E 03	0.8810E 03	0.7581E 03
0.1583E 16	0.8384E 15	0.2349E 02	-0.5251E-02	0.0	0.5512E 03	0.5653E 03	0.5459E 03	0.9745E 03	0.8175E 03
0.1945E 16	0.8998E 15	0.2885E 02	-0.6422E-02	0.0	0.5532E 03	0.5705E 03	0.5468E 03	0.1073E 04	0.8804E 03
0.2341E 16	0.9514E 15	0.3473E 02	-0.7668E-02	0.0	0.5555E 03	0.5764E 03	0.5478E 03	0.1181E 04	0.9494E 03
0.2792E 16	0.9968E 15	0.4143E 02	-0.9043E-02	0.0	0.5582E 03	0.5831E 03	0.5490E 03	0.1305E 04	0.1028E 04
0.3324E 16	0.1038E 16	0.4932E 02	-0.1061E-01	0.0	0.5616E 03	0.5910E 03	0.5506E 03	0.1450E 04	0.1121E 04
0.3972E 16	0.1076E 16	0.5893E 02	-0.1245E-01	0.0	0.5653E 03	0.6006E 03	0.5522E 03	0.1627E 04	0.1233E 04
0.4794E 16	0.1119E 16	0.7114E 02	-0.1721E-01	0.5080E-01	0.5673E 03	0.6100E 03	0.5522E 03	0.1849E 04	0.1374E 04
0.6142E 16	0.1167E 16	0.9113E 02	-0.2661E-01	0.1081E 00	0.5677E 03	0.6224E 03	0.5533E 03	0.2210E 04	0.1601E 04
0.6744E 16	0.1196E 16	0.1001E 03	-0.3499E-01	0.1627E 00	0.5679E 03	0.6280E 03	0.5548E 03	0.2371E 04	0.1702E 04
0.6881E 16	0.1215E 16	0.1021E 03	-0.4225E-01	0.2112E 00	0.5679E 03	0.6292E 03	0.5564E 03	0.2408E 04	0.1726E 04
0.6665E 16	0.1226E 16	0.9890E 02	-0.4813E-01	0.2525E 00	0.5679E 03	0.6272E 03	0.5581E 03	0.2350E 04	0.1689E 04
0.6193E 16	0.1245E 16	0.9189E 02	-0.5524E-01	0.3209E 00	0.5677E 03	0.6229E 03	0.5600E 03	0.2224E 04	0.1610E 04
0.5574E 16	0.1254E 16	0.8271E 02	-0.6351E-01	0.3751E 00	0.5675E 03	0.6172E 03	0.5600E 03	0.2058E 04	0.1505E 04
0.4916E 16	0.1251E 16	0.7294E 02	-0.6971E-01	0.4151E 00	0.5673E 03	0.6111E 03	0.5600E 03	0.1882E 04	0.1394E 04
0.4284E 16	0.1237E 16	0.6356E 02	-0.7405E-01	0.4454E 00	0.5671E 03	0.6052E 03	0.5600E 03	0.1713E 04	0.1288E 04
0.3708E 16	0.1213E 16	0.5502E 02	-0.7709E-01	0.4687E 00	0.5668E 03	0.5998E 03	0.5600E 03	0.1558E 04	0.1191E 04
0.3198E 16	0.1182E 16	0.4746E 02	-0.7924E-01	0.4870E 00	0.5666E 03	0.5950E 03	0.5600E 03	0.1422E 04	0.1105E 04
0.2754E 16	0.1143E 16	0.4086E 02	-0.8077E-01	0.5015E 00	0.5663E 03	0.5908E 03	0.5600E 03	0.1303E 04	0.1030E 04
0.2369E 16	0.1098E 16	0.3515E 02	-0.8186E-01	0.5133E 00	0.5661E 03	0.5872E 03	0.5600E 03	0.1200E 04	0.9647E 03
0.2034E 16	0.1047E 16	0.3018E 02	-0.8263E-01	0.5228E 00	0.5658E 03	0.5839E 03	0.5600E 03	0.1110E 04	0.9080E 03
0.1740E 16	0.9914E 15	0.2582E 02	-0.8315E-01	0.5306E 00	0.5655E 03	0.5810E 03	0.5600E 03	0.1031E 04	0.8583E 03
0.1478E 16	0.9292E 15	0.2194E 02	-0.8345E-01	0.5370E 00	0.5651E 03	0.5783E 03	0.5600E 03	0.9604E 03	0.8138E 03
0.1240E 16	0.8591E 15	0.1840E 02	-0.8357E-01	0.5422E 00	0.5646E 03	0.5756E 03	0.5600E 03	0.8961E 03	0.7732E 03
0.1017E 16	0.7784E 15	0.1509E 02	-0.8349E-01	0.5463E 00	0.5633E 03	0.5724E 03	0.5600E 03	0.8352E 03	0.7344E 03
0.8019E 15	0.6824E 15	0.1190E 02	-0.8319E-01	0.5495E 00	0.5607E 03	0.5678E 03	0.5600E 03	0.7751E 03	0.6956E 03
0.5899E 15	0.5635E 15	0.8753E 01	-0.8280E-01	0.5518E 00	0.5619E 03	0.5672E 03	0.5600E 03	0.7197E 03	0.6612E 03
0.3870E 15	0.4182E 15	0.5743E 01	-0.8220E-01	0.5533E 00	0.5613E 03	0.5647E 03	0.5600E 03	0.6648E 03	0.6264E 03

HOURS 0.0 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.10000E 03 INT 13

AVERAGE VOID FRACTION 0.2882
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 10
FIRST BULK BOILING NODE 15

POWER/CM OF CHANNEL IN CORE REGIONS
0.2496E 03 0.1606E 03

RESTART AFTER 100.00000HOURS

ITERN	SPCR	REP
1	0.1000E 03	0.5236E 03
2	0.1150E 03	0.3869E 03
3	0.1574E 03	0.6818E 02
4	0.1665E 03	0.8043E 02
5	0.1069E 03	0.5215E 03
6	0.1774E 03	0.4453E 02
7	0.1840E 03	0.4243E 02
8	0.3000E 03	-0.4630E 03
9	0.1937E 03	-0.2241E 03
10	0.9408E 02	0.3937E 03
11	0.1576E 03	0.6909E 02
12	0.1711E 03	0.7705E 02
13	0.4026E 02	0.8236E 03
14	0.1846E 03	-0.7323E 02
15	0.1728E 03	0.7046E 02
16	0.1786E 03	0.5463E 02
17	0.1985E 03	-0.5618E 02
18	0.1884E 03	0.2519E 02
19	0.1916E 03	0.3421E 02
20	0.1797E 03	0.1121E 03
21	0.1968E 03	0.1279E 02
22	0.1990E 03	0.5444E 01
23	0.2006E 03	-0.2369E 01
24	0.2001E 03	0.2247E 01
25	0.2004E 03	0.1629E 01
26	0.2010E 03	-0.2117E 01
27	0.2006E 03	0.5911E 00
28	0.2007E 03	0.5860E 00
29	0.2097E 03	-0.5403E 02
30	0.2008E 03	-0.2917E 01
31	0.2003E 03	0.1539E 01
32	0.2005E 03	0.6633E 00
33	0.2006E 03	-0.2365E-01

IT 0 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.20060E 03 INT 34 REP 0.46300E 00

HOURS 0.0 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.20060E 03 INT 34

AVERAGE VOID FRACTION 0.2310
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 10
FIRST BULK BOILING NODE 17

POWER/CM OF CHANNEL IN CORE REGIONS
0.1918E 03 0.2185E 03

HOURS 0.0 IT 0 INT 34 POWER = 0.80000E 09 REP = 0.46300E 00

P1 P2

2	0.22146D 12	0.16814D 13
3	0.23138D 13	0.10951D 14
4	0.20203D 14	0.11679D 14
5	0.32037D 14	0.17940D 14
6	0.42635D 14	0.23856D 14
7	0.51833D 14	0.29006D 14
8	0.59492D 14	0.33297D 14
9	0.65532D 14	0.36680D 14
10	0.69915D 14	0.39136D 14
11	0.72631D 14	0.40657D 14
12	0.73682D 14	0.41245D 14
13	0.73076D 14	0.40913D 14
14	0.71118D 14	0.39831D 14
15	0.68391D 14	0.38318D 14
16	0.65400D 14	0.36655D 14
17	0.62571D 14	0.35082D 14
18	0.60265D 14	0.33800D 14
19	0.58795D 14	0.32987D 14
20	0.58463D 14	0.32817D 14
21	0.59725D 14	0.33550D 14
22	0.63318D 14	0.35605D 14
23	0.70216D 14	0.39656D 14
24	0.81330D 14	0.48741D 14
25	0.87303D 14	0.52711D 14
26	0.87971D 14	0.53182D 14
27	0.84507D 14	0.51128D 14
28	0.78026D 14	0.47233D 14
29	0.69400D 14	0.42027D 14
30	0.59240D 14	0.35883D 14
31	0.47939D 14	0.29040D 14
32	0.35730D 14	0.21674D 14
33	0.22673D 14	0.14358D 14
34	0.26078D 13	0.17451D 14
35	0.25066D 12	0.31442D 13
AVERAGES	0.61781D 14	0.35623D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.1885E 11	0.1284E 13	0.1495E 02	-0.3307E-02	0.0	0.5478E 03	0.5568E 03	0.5445E 03	0.8173E 03	0.7174E 03
0.2947E 11	0.1936E 13	0.2304E 02	-0.5140E-02	0.0	0.5503E 03	0.5641E 03	0.5452E 03	0.9656E 03	0.8116E 03
0.4041E 11	0.2584E 13	0.3065E 02	-0.6788E-02	0.0	0.5529E 03	0.5713E 03	0.5461E 03	0.1105E 04	0.9004E 03
0.5157E 11	0.3230E 13	0.3726E 02	-0.8174E-02	0.0	0.5555E 03	0.5778E 03	0.5472E 03	0.1227E 04	0.9780E 03
0.6334E 11	0.3903E 13	0.4277E 02	-0.9300E-02	0.0	0.5579E 03	0.5836E 03	0.5484E 03	0.1329E 04	0.1043E 04
0.7625E 11	0.4632E 13	0.4712E 02	-0.1017E-01	0.0	0.5603E 03	0.5885E 03	0.5498E 03	0.1409E 04	0.1095E 04
0.9095E 11	0.5455E 13	0.5027E 02	-0.1081E-01	0.0	0.5624E 03	0.5926E 03	0.5513E 03	0.1468E 04	0.1132E 04
0.1083E 12	0.6420E 13	0.5222E 02	-0.1120E-01	0.0	0.5644E 03	0.5957E 03	0.5528E 03	0.1505E 04	0.1157E 04
0.1294E 12	0.7588E 13	0.5297E 02	-0.1137E-01	0.0	0.5661E 03	0.5979E 03	0.5543E 03	0.1521E 04	0.1167E 04
0.1562E 12	0.9070E 13	0.5254E 02	-0.1317E-01	0.3808E-01	0.5667E 03	0.5983E 03	0.5543E 03	0.1514E 04	0.1163E 04
0.2001E 12	0.1148E 14	0.5115E 02	-0.1664E-01	0.7219E-01	0.5667E 03	0.5974E 03	0.5552E 03	0.1488E 04	0.1147E 04
0.2197E 12	0.1257E 14	0.4920E 02	-0.1982E-01	0.1026E 00	0.5666E 03	0.5962E 03	0.5560E 03	0.1453E 04	0.1125E 04
0.2241E 12	0.1282E 14	0.4706E 02	-0.2273E-01	0.1296E 00	0.5665E 03	0.5948E 03	0.5568E 03	0.1415E 04	0.1100E 04
0.2171E 12	0.1244E 14	0.4504E 02	-0.2543E-01	0.1538E 00	0.5665E 03	0.5935E 03	0.5576E 03	0.1378E 04	0.1077E 04
0.2017E 12	0.1161E 14	0.4338E 02	-0.2800E-01	0.1757E 00	0.5664E 03	0.5925E 03	0.5583E 03	0.1348E 04	0.1058E 04
0.1816E 12	0.1052E 14	0.4234E 02	-0.3053E-01	0.1959E 00	0.5664E 03	0.5918E 03	0.5591E 03	0.1329E 04	0.1046E 04
0.1601E 12	0.9352E 13	0.4211E 02	-0.3419E-01	0.2304E 00	0.5664E 03	0.5916E 03	0.5600E 03	0.1325E 04	0.1044E 04
0.1395E 12	0.8223E 13	0.4304E 02	-0.3962E-01	0.2695E 00	0.5664E 03	0.5922E 03	0.5600E 03	0.1342E 04	0.1054E 04
0.1208E 12	0.7189E 13	0.4567E 02	-0.4590E-01	0.3064E 00	0.5665E 03	0.5939E 03	0.5600E 03	0.1390E 04	0.1084E 04
0.1042E 12	0.6269E 13	0.5085E 02	-0.5283E-01	0.3426E 00	0.5667E 03	0.5972E 03	0.5600E 03	0.1483E 04	0.1143E 04
0.8971E 11	0.5461E 13	0.6212E 02	-0.6157E-01	0.3813E 00	0.5670E 03	0.6043E 03	0.5600E 03	0.1687E 04	0.1271E 04

0.7717E 11	0.4755E 13	0.6714E 02	-0.6923E-01	0.4176E 00	0.5672E 03	0.6075E 03	0.5600E 03	0.1777E 04	0.1328E 04
0.6626E 11	0.4136E 13	0.6773E 02	-0.7558E-01	0.4494E 00	0.5672E 03	0.6078E 03	0.5600E 03	0.1788E 04	0.1335E 04
0.5669E 11	0.3586E 13	0.6511E 02	-0.8054E-01	0.4763E 00	0.5671E 03	0.6062E 03	0.5600E 03	0.1741E 04	0.1305E 04
0.4816E 11	0.3090E 13	0.6015E 02	-0.8415E-01	0.4984E 00	0.5670E 03	0.6031E 03	0.5600E 03	0.1651E 04	0.1249E 04
0.4038E 11	0.2632E 13	0.5352E 02	-0.8652E-01	0.5163E 00	0.5668E 03	0.5989E 03	0.5600E 03	0.1531E 04	0.1174E 04
0.3312E 11	0.2195E 13	0.4570E 02	-0.8777E-01	0.5303E 00	0.5665E 03	0.5939E 03	0.5600E 03	0.1390E 04	0.1085E 04
0.2612E 11	0.1766E 13	0.3698E 02	-0.8800E-01	0.5409E 00	0.5662E 03	0.5884E 03	0.5600E 03	0.1233E 04	0.9855E 03
0.1922E 11	0.1330E 13	0.2760E 02	-0.8728E-01	0.5485E 00	0.5656E 03	0.5822E 03	0.5600E 03	0.1063E 04	0.8786E 03
0.1261E 11	0.8969E 12	0.1821E 02	-0.8581E-01	0.5533E 00	0.5645E 03	0.5755E 03	0.5600E 03	0.8927E 03	0.7710E 03

IT 1 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.20046E 03 INT 11 REP-0.24212E-01

IT 2 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.19966E 03 INT 10 REP 0.24964E 00

HOURS 1.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.19966E 03 INT 10

AVERAGE VOID FRACTION 0.2280
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 10
FIRST BULK BOILING NODE 18

POWER/CM OF CHANNEL IN CORE REGIONS
0.1848E 03 0.2254E 03

IT 3 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.19970E 03 INT 50 REP-0.17219E 02

IT 4 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.19736E 03 INT 31 REP-0.14246E 01

HOURS 2.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.19736E 03 INT 31

AVERAGE VOID FRACTION 0.2227
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 11
FIRST BULK BOILING NODE 17

POWER/CM OF CHANNEL IN CORE REGIONS
0.1842E 03 0.2260E 03

HOURS 2.00 IT 4 INT 31 POWER = 0.80000E 09 REP =-0.14246E 01

	P1	P2
2	0.19984D 12	0.15155D 13
3	0.20880D 13	0.98732D 13
4	0.18231D 14	0.10528D 14
5	0.28938D 14	0.16182D 14
6	0.38584D 14	0.21551D 14
7	0.47053D 14	0.26277D 14
8	0.54253D 14	0.30294D 14

16	0.67377D 14	0.37536D 14
17	0.67005D 14	0.37351D 14
18	0.66981D 14	0.37359D 14
19	0.67765D 14	0.37818D 14
20	0.69850D 14	0.39001D 14
21	0.73805D 14	0.41248D 14
22	0.80651D 14	0.45260D 14
23	0.91657D 14	0.54391D 14
24	0.97236D 14	0.58289D 14
25	0.97012D 14	0.58235D 14
26	0.92622D 14	0.55654D 14
27	0.85494D 14	0.51417D 14
28	0.76653D 14	0.46139D 14
29	0.66752D 14	0.40211D 14
30	0.56150D 14	0.33851D 14
31	0.45006D 14	0.27155D 14
32	0.33358D 14	0.20171D 14
33	0.21113D 14	0.13340D 14
34	0.24283D 13	0.16252D 14
35	0.23341D 12	0.29286D 13
AVERAGES	0.61867D 14	0.35617D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TEMAX	AVTE
0.3064E 15	0.7646E 14	0.1160E 02	-0.2522E-02	0.0	0.5470E 03	0.5540E 03	0.5444E 03	0.7561E 03	0.6786E 03
0.4726E 15	0.1116E 15	0.1791E 02	-0.3990E-02	0.0	0.5489E 03	0.5597E 03	0.5449E 03	0.8716E 03	0.7520E 03
0.6294E 15	0.1413E 15	0.2390E 02	-0.5335E-02	0.0	0.5510E 03	0.5653E 03	0.5456E 03	0.9816E 03	0.8219E 03
0.7672E 15	0.1648E 15	0.2925E 02	-0.6500E-02	0.0	0.5530E 03	0.5706E 03	0.5465E 03	0.1080E 04	0.8846E 03
0.8842E 15	0.1831E 15	0.3391E 02	-0.7492E-02	0.0	0.5550E 03	0.5754E 03	0.5475E 03	0.1166E 04	0.9395E 03
0.9796E 15	0.1967E 15	0.3788E 02	-0.8323E-02	0.0	0.5570E 03	0.5797E 03	0.5486E 03	0.1240E 04	0.9865E 03
0.1053E 16	0.2065E 15	0.4118E 02	-0.9007E-02	0.0	0.5589E 03	0.5837E 03	0.5498E 03	0.1301E 04	0.1026E 04
0.1105E 16	0.2127E 15	0.4383E 02	-0.9553E-02	0.0	0.5608E 03	0.5871E 03	0.5511E 03	0.1351E 04	0.1058E 04
0.1136E 16	0.2158E 15	0.4585E 02	-0.9973E-02	0.0	0.5626E 03	0.5901E 03	0.5524E 03	0.1389E 04	0.1083E 04
0.1145E 16	0.2159E 15	0.4728E 02	-0.1027E-01	0.0	0.5643E 03	0.5927E 03	0.5538E 03	0.1416E 04	0.1100E 04
0.1135E 16	0.2142E 15	0.4812E 02	-0.1046E-01	0.0	0.5659E 03	0.5948E 03	0.5552E 03	0.1433E 04	0.1111E 04
0.1112E 16	0.2105E 15	0.4837E 02	-0.1223E-01	0.3518E-01	0.5666E 03	0.5956E 03	0.5552E 03	0.1438E 04	0.1115E 04
0.1082E 16	0.2060E 15	0.4821E 02	-0.1568E-01	0.6761E-01	0.5666E 03	0.5955E 03	0.5560E 03	0.1435E 04	0.1113E 04
0.1054E 16	0.2014E 15	0.4798E 02	-0.1904E-01	0.9757E-01	0.5666E 03	0.5954E 03	0.5568E 03	0.1431E 04	0.1111E 04
0.1033E 16	0.1977E 15	0.4798E 02	-0.2238E-01	0.1255E 00	0.5666E 03	0.5954E 03	0.5575E 03	0.1431E 04	0.1111E 04
0.1025E 16	0.1956E 15	0.4857E 02	-0.2578E-01	0.1518E 00	0.5666E 03	0.5958E 03	0.5583E 03	0.1442E 04	0.1117E 04
0.1036E 16	0.1961E 15	0.5009E 02	-0.2936E-01	0.1771E 00	0.5666E 03	0.5967E 03	0.5591E 03	0.1469E 04	0.1135E 04
0.1075E 16	0.2004E 15	0.5297E 02	-0.3526E-01	0.2312E 00	0.5667E 03	0.5985E 03	0.5600E 03	0.1521E 04	0.1167E 04
0.1156E 16	0.2100E 15	0.5810E 02	-0.4391E-01	0.2828E 00	0.5669E 03	0.6018E 03	0.5600E 03	0.1614E 04	0.1226E 04
0.1320E 16	0.2270E 15	0.6943E 02	-0.5432E-01	0.3350E 00	0.5672E 03	0.6089E 03	0.5600E 03	0.1818E 04	0.1354E 04
0.1540E 16	0.2577E 15	0.7433E 02	-0.6358E-01	0.3819E 00	0.5673E 03	0.6120E 03	0.5600E 03	0.1907E 04	0.1410E 04
0.1610E 16	0.2707E 15	0.7425E 02	-0.7119E-01	0.4216E 00	0.5673E 03	0.6119E 03	0.5600E 03	0.1905E 04	0.1409E 04
0.1589E 16	0.2732E 15	0.7095E 02	-0.7714E-01	0.4543E 00	0.5673E 03	0.6098E 03	0.5600E 03	0.1846E 04	0.1372E 04
0.1503E 16	0.2674E 15	0.6554E 02	-0.8155E-01	0.4808E 00	0.5671E 03	0.6065E 03	0.5600E 03	0.1748E 04	0.1310E 04
0.1372E 16	0.2545E 15	0.5881E 02	-0.8463E-01	0.5020E 00	0.5669E 03	0.6022E 03	0.5600E 03	0.1627E 04	0.1234E 04
0.1211E 16	0.2353E 15	0.5125E 02	-0.8658E-01	0.5188E 00	0.5667E 03	0.5974E 03	0.5600E 03	0.1490E 04	0.1148E 04
0.1028E 16	0.2100E 15	0.4314E 02	-0.8754E-01	0.5319E 00	0.5664E 03	0.5923E 03	0.5600E 03	0.1344E 04	0.1056E 04
0.8285E 15	0.1786E 15	0.3460E 02	-0.8762E-01	0.5418E 00	0.5661E 03	0.5868E 03	0.5600E 03	0.1190E 04	0.9584E 03
0.6170E 15	0.1407E 15	0.2570E 02	-0.8687E-01	0.5488E 00	0.5655E 03	0.5809E 03	0.5600E 03	0.1029E 04	0.8568E 03
0.4067E 15	0.9811E 14	0.1692E 02	-0.8545E-01	0.5533E 00	0.5642E 03	0.5744E 03	0.5600E 03	0.8692E 03	0.7561E 03

IT 9 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.18865E 03 INT 4 REP 0.20470E 01

IT 10 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.18734E 03 INT 13 REP 0.13325E 02

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0.3483E 15  0.5362E 14  0.2691E 02 -0.8713E-01  0.5486E 00  0.5656E 03  0.5817E 03  0.5600E 03  0.1050E 04  0.8707E 03
0.2297E 15  0.3655E 14  0.1774E 02 -0.8568E-01  0.5533E 00  0.5644E 03  0.5751E 03  0.5600E 03  0.8841E 03  0.7656E 03

IT     5  POWER 0.80000E 09  VINLET 0.22458E 03  ROD INSERTION 0.19502E 03  INT     8  REP 0.24992E 00

IT     6  POWER 0.80000E 09  VINLET 0.22458E 03  ROD INSERTION 0.19355E 03  INT     9  REP 0.30644E 00


 HOURS   3.00  POWER 0.80000E 09  MASSFL 0.10000E 01  ROD INSERTION 0.19355E 03  INT     9

 AVERAGE VOID FRACTION 0.2205
 EXIT QUALITY     0.0824
 FIRST SUBCOOLED BOILING NODE     11
 FIRST BULK BOILING NODE     18

 POWER/CM OF CHANNEL IN CORE REGIONS
0.1759E 03  0.2343E 03

IT     7  POWER 0.80000E 09  VINLET 0.22458E 03  ROD INSERTION 0.19331E 03  INT    50  REP-0.15885E 02

IT     8  POWER 0.80000E 09  VINLET 0.22458E 03  ROD INSERTION 0.19112E 03  INT    12  REP-0.17175E 00


 HOURS   4.00  POWER 0.80000E 09  MASSFL 0.10000E 01  ROD INSERTION 0.19112E 03  INT    12

 AVERAGE VOID FRACTION 0.2146
 EXIT QUALITY     0.0824
 FIRST SUBCOOLED BOILING NODE     12
 FIRST BULK BOILING NODE     18

 POWER/CM OF CHANNEL IN CORE REGIONS
0.1720E 03  0.2383E 03


 HOURS    4.00    IT      8    INT      12    POWER = 0.80000E 09    REP =-0.17175E 00
```

	P1	P2
2	0.17235D 12	0.13068D 13
3	0.18007D 13	0.85137D 13
4	0.15723D 14	0.90674D 13
5	0.24986D 14	0.13946D 14
6	0.33395D 14	0.18610D 14
7	0.40886D 14	0.22774D 14
8	0.47415D 14	0.26401D 14
9	0.52978D 14	0.29491D 14
10	0.57598D 14	0.32057D 14
11	0.61310D 14	0.34120D 14
12	0.64147D 14	0.35698D 14
13	0.66139D 14	0.36808D 14
14	0.67300D 14	0.37458D 14
15	0.67635D 14	0.37658D 14

9	0.60147D 14	0.33582D 14
10	0.64731D 14	0.36138D 14
11	0.68022D 14	0.37973D 14
12	0.70044D 14	0.39100D 14
13	0.70816D 14	0.39531D 14
14	0.70348D 14	0.39280D 14
15	0.68907D 14	0.38495D 14
16	0.67006D 14	0.37454D 14
17	0.65095D 14	0.36407D 14
18	0.63571D 14	0.35577D 14
19	0.62794D 14	0.35165D 14
20	0.63111D 14	0.35371D 14
21	0.65033D 14	0.36485D 14
22	0.69416D 14	0.39020D 14
23	0.77344D 14	0.44332D 14
24	0.87178D 14	0.52387D 14
25	0.91041D 14	0.54872D 14
26	0.89888D 14	0.54228D 14
27	0.85056D 14	0.51351D 14
28	0.77665D 14	0.46918D 14
29	0.68527D 14	0.41419D 14
30	0.58171D 14	0.35173D 14
31	0.46903D 14	0.28370D 14
32	0.34884D 14	0.21135D 14
33	0.22113D 14	0.13991D 14
34	0.25434D 13	0.17012D 14
35	0.24447D 12	0.30642D 13
AVERAGES	0.61829D 14	0.35620D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.1798E 15	0.2939E 14	0.1346E 02	-0.2961E-02	0.0	0.5475E 03	0.5555E 03	0.5445E 03	0.7901E 03	0.7001E 03
0.2772E 15	0.4376E 14	0.2076E 02	-0.4634E-02	0.0	0.5497E 03	0.5622E 03	0.5451E 03	0.9239E 03	0.7851E 03
0.3689E 15	0.5642E 14	0.2765E 02	-0.6150E-02	0.0	0.5520E 03	0.5686E 03	0.5459E 03	0.1050E 04	0.8656E 03
0.4491E 15	0.6686E 14	0.3372E 02	-0.7442E-02	0.0	0.5544E 03	0.5746E 03	0.5469E 03	0.1162E 04	0.9367E 03
0.5163E 15	0.7522E 14	0.3886E 02	-0.8513E-02	0.0	0.5566E 03	0.5800E 03	0.5480E 03	0.1257E 04	0.9973E 03
0.5701E 15	0.8167E 14	0.4308E 02	-0.9375E-02	0.0	0.5588E 03	0.5847E 03	0.5493E 03	0.1335E 04	0.1047E 04
0.6101E 15	0.8640E 14	0.4635E 02	-0.1004E-01	0.0	0.5609E 03	0.5887E 03	0.5506E 03	0.1396E 04	0.1086E 04
0.6363E 15	0.8955E 14	0.4869E 02	-0.1052E-01	0.0	0.5629E 03	0.5921E 03	0.5520E 03	0.1440E 04	0.1115E 04
0.6486E 15	0.9125E 14	0.5013E 02	-0.1082E-01	0.0	0.5646E 03	0.5947E 03	0.5535E 03	0.1468E 04	0.1133E 04
0.6472E 15	0.9173E 14	0.5068E 02	-0.1095E-01	0.0	0.5662E 03	0.5967E 03	0.5550E 03	0.1480E 04	0.1141E 04
0.6342E 15	0.9149E 14	0.5035E 02	-0.1268E-01	0.3656E-01	0.5667E 03	0.5969E 03	0.5550E 03	0.1474E 04	0.1138E 04
0.6144E 15	0.8989E 14	0.4935E 02	-0.1608E-01	0.6963E-01	0.5666E 03	0.5962E 03	0.5558E 03	0.1456E 04	0.1126E 04
0.5919E 15	0.8760E 14	0.4803E 02	-0.1927E-01	0.9947E-01	0.5666E 03	0.5954E 03	0.5566E 03	0.1432E 04	0.1111E 04
0.5705E 15	0.8508E 14	0.4670E 02	-0.2229E-01	0.1265E 00	0.5665E 03	0.5946E 03	0.5574E 03	0.1408E 04	0.1096E 04
0.5535E 15	0.8277E 14	0.4567E 02	-0.2521E-01	0.1512E 00	0.5665E 03	0.5939E 03	0.5581E 03	0.1389E 04	0.1084E 04
0.5439E 15	0.8113E 14	0.4517E 02	-0.2812E-01	0.1742E 00	0.5665E 03	0.5936E 03	0.5589E 03	0.1380E 04	0.1079E 04
0.5447E 15	0.8061E 14	0.4547E 02	-0.3208E-01	0.2106E 00	0.5665E 03	0.5938E 03	0.5600E 03	0.1386E 04	0.1082E 04
0.5596E 15	0.8184E 14	0.4693E 02	-0.3803E-01	0.2555E 00	0.5665E 03	0.5947E 03	0.5600E 03	0.1412E 04	0.1099E 04
0.5951E 15	0.8548E 14	0.5020E 02	-0.4515E-01	0.2975E 00	0.5667E 03	0.5968E 03	0.5600E 03	0.1471E 04	0.1136E 04
0.6632E 15	0.9271E 14	0.5690E 02	-0.5315E-01	0.3389E 00	0.5669E 03	0.6010E 03	0.5600E 03	0.1592E 04	0.1212E 04
0.8086E 15	0.1077E 15	0.6690E 02	-0.6226E-01	0.3809E 00	0.5671E 03	0.6073E 03	0.5600E 03	0.1773E 04	0.1326E 04
0.8657E 15	0.1139E 15	0.7003E 02	-0.6993E-01	0.4187E 00	0.5672E 03	0.6093E 03	0.5600E 03	0.1829E 04	0.1361E 04
0.8681E 15	0.1146E 15	0.6917E 02	-0.7616E-01	0.4510E 00	0.5672E 03	0.6087E 03	0.5600E 03	0.1814E 04	0.1352E 04
0.8306E 15	0.1112E 15	0.6547E 02	-0.8093E-01	0.4778E 00	0.5671E 03	0.6064E 03	0.5600E 03	0.1747E 04	0.1310E 04
0.7644E 15	0.1045E 15	0.5980E 02	-0.8435E-01	0.4997E 00	0.5670E 03	0.6028E 03	0.5600E 03	0.1645E 04	0.1245E 04
0.6782E 15	0.9512E 14	0.5277E 02	-0.8656E-01	0.5172E 00	0.5667E 03	0.5984E 03	0.5600E 03	0.1518E 04	0.1165E 04
0.5779E 15	0.8342E 14	0.4480E 02	-0.8770E-01	0.5309E 00	0.5665E 03	0.5934E 03	0.5600E 03	0.1374E 04	0.1074E 04
0.4671E 15	0.6956E 14	0.3613E 02	-0.8787E-01	0.5413E 00	0.5661E 03	0.5878E 03	0.5600E 03	0.1217E 04	0.9758E 03

HOURS 5.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.18734E 03 INT 13

AVERAGE VOID FRACTION 0.2075
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 13
FIRST BULK BOILING NODE 18

POWER/CM OF CHANNEL IN CORE REGIONS
0.1625E 03 0.2478E 03

IT 11 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.18620E 03 INT 6 REP-0.27457E 00

IT 12 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.18389E 03 INT 8 REP 0.56139E 00

HOURS 6.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.18389E 03 INT 8

AVERAGE VOID FRACTION 0.2095
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 13
FIRST BULK BOILING NODE 18

POWER/CM OF CHANNEL IN CORE REGIONS
0.1594E 03 0.2508E 03

HOURS 6.00 IT 12 INT 8 POWER = 0.80000E 09 REP = 0.56139E 00

	P1	P2
2	0.14524D 12	0.11017D 13
3	0.15174D 13	0.71756D 13
4	0.13249D 14	0.76299D 13
5	0.21085D 14	0.11745D 14
6	0.28261D 14	0.15710D 14
7	0.34759D 14	0.19305D 14
8	0.40577D 14	0.22522D 14
9	0.45741D 14	0.25378D 14
10	0.50301D 14	0.27900D 14
11	0.54311D 14	0.30119D 14
12	0.57824D 14	0.32066D 14
13	0.60886D 14	0.33766D 14
14	0.63534D 14	0.35239D 14
15	0.65788D 14	0.36497D 14
16	0.67661D 14	0.37554D 14
17	0.69397D 14	0.38544D 14
18	0.71523D 14	0.39751D 14
19	0.74617D 14	0.41498D 14
20	0.79356D 14	0.44166D 14
21	0.86574D 14	0.48322D 14
22	0.97276D 14	0.56485D 14

23	0.10500D 15	0.62636D 14
24	0.10559D 15	0.63100D 14
25	0.10115D 15	0.60497D 14
26	0.93607D 14	0.56035D 14
27	0.84356D 14	0.50543D 14
28	0.74261D 14	0.44534D 14
29	0.63787D 14	0.38290D 14
30	0.53125D 14	0.31922D 14
31	0.42294D 14	0.25443D 14
32	0.31216D 14	0.18830D 14
33	0.19715D 14	0.12433D 14
34	0.22675D 13	0.15162D 14
35	0.21796D 12	0.27313D 13
AVERAGES	0.61894D 14	0.35615D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.3850E 15	0.1300E 15	0.9768E 01	-0.2085E-02	0.0	0.5465E 03	0.5524E 03	0.5444E 03	0.7226E 03	0.6573E 03
0.5940E 15	0.1872E 15	0.1509E 02	-0.3344E-02	0.0	0.5482E 03	0.5572E 03	0.5448E 03	0.8201E 03	0.7193E 03
0.7919E 15	0.2341E 15	0.2019E 02	-0.4512E-02	0.0	0.5499E 03	0.5620E 03	0.5454E 03	0.9137E 03	0.7788E 03
0.9672E 15	0.2705E 15	0.2481E 02	-0.5542E-02	0.0	0.5516E 03	0.5665E 03	0.5461E 03	0.9987E 03	0.8330E 03
0.1118E 16	0.2981E 15	0.2895E 02	-0.6445E-02	0.0	0.5534E 03	0.5708E 03	0.5470E 03	0.1075E 04	0.8816E 03
0.1244E 16	0.3185E 15	0.3262E 02	-0.7233E-02	0.0	0.5552E 03	0.5747E 03	0.5479E 03	0.1143E 04	0.9250E 03
0.1344E 16	0.3328E 15	0.3586E 02	-0.7920E-02	0.0	0.5569E 03	0.5785E 03	0.5490E 03	0.1203E 04	0.9636E 03
0.1421E 16	0.3417E 15	0.3871E 02	-0.8519E-02	0.0	0.5587E 03	0.5819E 03	0.5501E 03	0.1256E 04	0.9977E 03
0.1474E 16	0.3460E 15	0.4122E 02	-0.9041E-02	0.0	0.5605E 03	0.5852E 03	0.5513E 03	0.1303E 04	0.1028E 04
0.1503E 16	0.3460E 15	0.4340E 02	-0.9495E-02	0.0	0.5622E 03	0.5883E 03	0.5526E 03	0.1344E 04	0.1054E 04
0.1511E 16	0.3426E 15	0.4530E 02	-0.9889E-02	0.0	0.5639E 03	0.5911E 03	0.5539E 03	0.1380E 04	0.1078E 04
0.1502E 16	0.3368E 15	0.4691E 02	-0.1023E-01	0.0	0.5657E 03	0.5938E 03	0.5552E 03	0.1411E 04	0.1098E 04
0.1484E 16	0.3305E 15	0.4827E 02	-0.1221E-01	0.3510E-01	0.5666E 03	0.5956E 03	0.5552E 03	0.1436E 04	0.1114E 04
0.1466E 16	0.3244E 15	0.4954E 02	-0.1597E-01	0.6840E-01	0.5666E 03	0.5964E 03	0.5560E 03	0.1459E 04	0.1128E 04
0.1457E 16	0.3197E 15	0.5108E 02	-0.1984E-01	0.1002E 00	0.5667E 03	0.5973E 03	0.5568E 03	0.1487E 04	0.1146E 04
0.1467E 16	0.3174E 15	0.5332E 02	-0.2392E-01	0.1308E 00	0.5668E 03	0.5988E 03	0.5577E 03	0.1528E 04	0.1171E 04
0.1506E 16	0.3187E 15	0.5674E 02	-0.2834E-01	0.1610E 00	0.5669E 03	0.6009E 03	0.5586E 03	0.1589E 04	0.1210E 04
0.1586E 16	0.3259E 15	0.6206E 02	-0.3458E-01	0.2103E 00	0.5670E 03	0.6043E 03	0.5600E 03	0.1685E 04	0.1271E 04
0.1740E 16	0.3393E 15	0.7225E 02	-0.4482E-01	0.2771E 00	0.5673E 03	0.6107E 03	0.5600E 03	0.1869E 04	0.1387E 04
0.2009E 16	0.3656E 15	0.7989E 02	-0.5619E-01	0.3374E 00	0.5675E 03	0.6154E 03	0.5600E 03	0.2007E 04	0.1473E 04
0.2226E 16	0.4077E 15	0.8047E 02	-0.6554E-01	0.3875E 00	0.5675E 03	0.6158E 03	0.5600E 03	0.2018E 04	0.1480E 04
0.2265E 16	0.4273E 15	0.7714E 02	-0.7287E-01	0.4278E 00	0.5674E 03	0.6137E 03	0.5600E 03	0.1958E 04	0.1442E 04
0.2193E 16	0.4331E 15	0.7144E 02	-0.7835E-01	0.4599E 00	0.5673E 03	0.6101E 03	0.5600E 03	0.1855E 04	0.1377E 04
0.2047E 16	0.4271E 15	0.6443E 02	-0.8227E-01	0.4853E 00	0.5671E 03	0.6058E 03	0.5600E 03	0.1728E 04	0.1298E 04
0.1850E 16	0.4106E 15	0.5677E 02	-0.8492E-01	0.5054E 00	0.5669E 03	0.6009E 03	0.5600E 03	0.1590E 04	0.1211E 04
0.1620E 16	0.3840E 15	0.4880E 02	-0.8654E-01	0.5212E 00	0.5666E 03	0.5959E 03	0.5600E 03	0.1446E 04	0.1120E 04
0.1369E 16	0.3473E 15	0.4068E 02	-0.8729E-01	0.5334E 00	0.5663E 03	0.5907E 03	0.5600E 03	0.1299E 04	0.1028E 04
0.1100E 16	0.3000E 15	0.3242E 02	-0.8726E-01	0.5426E 00	0.5659E 03	0.5854E 03	0.5600E 03	0.1150E 04	0.9336E 03
0.8178E 15	0.2405E 15	0.2399E 02	-0.8649E-01	0.5491E 00	0.5653E 03	0.5797E 03	0.5600E 03	0.9976E 03	0.8373E 03
0.5387E 15	0.1708E 15	0.1577E 02	-0.8512E-01	0.5533E 00	0.5635E 03	0.5730E 03	0.5600E 03	0.8477E 03	0.7423E 03

IT 13 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.18239E 03 INT 11 REP 0.21870E 00

IT 14 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.18044E 03 INT 4 REP 0.29056E 01

HOURS 7.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.18044E 03 INT 4

AVERAGE VOID FRACTION 0.2095
EXIT QUALITY 0.0824

FIRST SUBCOOLED BOILING NODE 13
FIRST BULK BOILING NODE 19

POWER/CM OF CHANNEL IN CORE REGIONS
0.1521E 03 0.2582E 03

IT 15 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.17871E 03 INT 8 REP 0.12193E 01

IT 16 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.17831E 03 INT 50 REP-0.13821E 02

HOURS 8.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.17831E 03 INT 50

AVERAGE VOID FRACTION 0.2110
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 13
FIRST BULK BOILING NODE 19

POWER/CM OF CHANNEL IN CORE REGIONS
0.1488E 03 0.2615E 03

HOURS 8.00 IT 16 INT 50 POWER = 0.80000E 09 REP =-0.13821E 02

	P1	P2
2	0.12331D 12	0.93600D 12
3	0.12884D 13	0.60946D 13
4	0.11249D 14	0.64692D 13
5	0.17927D 14	0.99663D 13
6	0.24096D 14	0.13363D 14
7	0.29772D 14	0.16490D 14
8	0.34982D 14	0.19359D 14
9	0.39778D 14	0.22000D 14
10	0.44230D 14	0.24452D 14
11	0.48410D 14	0.26757D 14
12	0.52391D 14	0.28956D 14
13	0.56237D 14	0.31087D 14
14	0.59996D 14	0.33178D 14
15	0.63692D 14	0.35246D 14
16	0.67308D 14	0.37295D 14
17	0.71028D 14	0.39414D 14
18	0.75337D 14	0.41853D 14
19	0.80881D 14	0.44973D 14
20	0.88519D 14	0.49282D 14
21	0.99334D 14	0.56042D 14
22	0.11208D 15	0.66610D 14
23	0.11539D 15	0.68762D 14
24	0.11168D 15	0.66573D 14
25	0.10379D 15	0.61904D 14
26	0.93775D 14	0.55965D 14
27	0.82910D 14	0.49520D 14
28	0.71902D 14	0.42984D 14
29	0.61056D 14	0.36538D 14

30	0.50424D 14	0.30212D 14
31	0.39910D 14	0.23947D 14
32	0.29352D 14	0.17667D 14
33	0.18505D 14	0.11652D 14
34	0.21284D 13	0.14246D 14
35	0.20459D 12	0.25682D 13
AVERAGES	0.61865D 14	0.35617D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.4277E 15	0.1827E 15	0.8262E 01	-0.1721E-02	0.0	0.5462E 03	0.5511E 03	0.5443E 03	0.6951E 03	0.6398E 03
0.6601E 15	0.2606E 15	0.1277E 02	-0.2803E-02	0.0	0.5475E 03	0.5552E 03	0.5447E 03	0.7777E 03	0.6924E 03
0.8811E 15	0.3233E 15	0.1713E 02	-0.3819E-02	0.0	0.5490E 03	0.5593E 03	0.5452E 03	0.8577E 03	0.7432E 03
0.1078E 16	0.3713E 15	0.2114E 02	-0.4732E-02	0.0	0.5505E 03	0.5632E 03	0.5458E 03	0.9315E 03	0.7902E 03
0.1250E 16	0.4072E 15	0.2482E 02	-0.5552E-02	0.0	0.5521E 03	0.5669E 03	0.5465E 03	0.9993E 03	0.8335E 03
0.1397E 16	0.4335E 15	0.2820E 02	-0.6295E-02	0.0	0.5536E 03	0.5706E 03	0.5474E 03	0.1062E 04	0.8734E 03
0.1519E 16	0.4516E 15	0.3134E 02	-0.6974E-02	0.0	0.5552E 03	0.5741E 03	0.5483E 03	0.1120E 04	0.9107E 03
0.1617E 16	0.4628E 15	0.3430E 02	-0.7604E-02	0.0	0.5569E 03	0.5775E 03	0.5493E 03	0.1175E 04	0.9458E 03
0.1693E 16	0.4681E 15	0.3712E 02	-0.8200E-02	0.0	0.5586E 03	0.5809E 03	0.5503E 03	0.1227E 04	0.9795E 03
0.1747E 16	0.4679E 15	0.3985E 02	-0.8773E-02	0.0	0.5604E 03	0.5843E 03	0.5515E 03	0.1279E 04	0.1012E 04
0.1780E 16	0.4633E 15	0.4256E 02	-0.9333E-02	0.0	0.5622E 03	0.5878E 03	0.5528E 03	0.1329E 04	0.1045E 04
0.1798E 16	0.4556E 15	0.4528E 02	-0.9890E-02	0.0	0.5641E 03	0.5913E 03	0.5541E 03	0.1380E 04	0.1078E 04
0.1807E 16	0.4476E 15	0.4806E 02	-0.1216E-01	0.3496E-01	0.5666E 03	0.5954E 03	0.5541E 03	0.1433E 04	0.1112E 04
0.1815E 16	0.4400E 15	0.5094E 02	-0.1628E-01	0.6917E-01	0.5667E 03	0.5973E 03	0.5549E 03	0.1485E 04	0.1144E 04
0.1836E 16	0.4340E 15	0.5416E 02	-0.2063E-01	0.1027E 00	0.5668E 03	0.5993E 03	0.5557E 03	0.1543E 04	0.1181E 04
0.1883E 16	0.4308E 15	0.5821E 02	-0.2533E-01	0.1359E 00	0.5669E 03	0.6018E 03	0.5566E 03	0.1616E 04	0.1227E 04
0.1971E 16	0.4315E 15	0.6373E 02	-0.3055E-01	0.1692E 00	0.5671E 03	0.6053E 03	0.5575E 03	0.1715E 04	0.1290E 04
0.2122E 16	0.4371E 15	0.7222E 02	-0.3666E-01	0.2036E 00	0.5673E 03	0.6106E 03	0.5586E 03	0.1869E 04	0.1386E 04
0.2404E 16	0.4491E 15	0.8511E 02	-0.4676E-01	0.2764E 00	0.5676E 03	0.6187E 03	0.5600E 03	0.2101E 04	0.1533E 04
0.2690E 16	0.4917E 15	0.8766E 02	-0.5805E-01	0.3421E 00	0.5676E 03	0.6203E 03	0.5600E 03	0.2147E 04	0.1562E 04
0.2855E 16	0.5417E 15	0.8479E 02	-0.6738E-01	0.3938E 00	0.5676E 03	0.6185E 03	0.5600E 03	0.2096E 04	0.1529E 04
0.2829E 16	0.5683E 15	0.7880E 02	-0.7436E-01	0.4339E 00	0.5674E 03	0.6147E 03	0.5600E 03	0.1987E 04	0.1461E 04
0.2688E 16	0.5786E 15	0.7121E 02	-0.7937E-01	0.4651E 00	0.5673E 03	0.6100E 03	0.5600E 03	0.1851E 04	0.1375E 04
0.2472E 16	0.5744E 15	0.6300E 02	-0.8284E-01	0.4894E 00	0.5670E 03	0.6049E 03	0.5600E 03	0.1702E 04	0.1281E 04
0.2211E 16	0.5565E 15	0.5468E 02	-0.8513E-01	0.5084E 00	0.5668E 03	0.5996E 03	0.5600E 03	0.1552E 04	0.1187E 04
0.1922E 16	0.5250E 15	0.4647E 02	-0.8647E-01	0.5233E 00	0.5665E 03	0.5944E 03	0.5600E 03	0.1404E 04	0.1093E 04
0.1615E 16	0.4797E 15	0.3842E 02	-0.8704E-01	0.5347E 00	0.5662E 03	0.5893E 03	0.5600E 03	0.1259E 04	0.1002E 04
0.1293E 16	0.4191E 15	0.3045E 02	-0.8692E-01	0.5433E 00	0.5658E 03	0.5841E 03	0.5600E 03	0.1115E 04	0.9111E 03
0.9596E 15	0.3406E 15	0.2246E 02	-0.8615E-01	0.5494E 00	0.5652E 03	0.5786E 03	0.5600E 03	0.9699E 03	0.8198E 03
0.6316E 15	0.2455E 15	0.1475E 02	-0.8483E-01	0.5533E 00	0.5632E 03	0.5721E 03	0.5600E 03	0.8290E 03	0.7305E 03

IT 17 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.17588E 03 INT 8 REP-0.18092E 00

IT 18 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.17379E 03 INT 10 REP 0.26250E 00

HOURS 9.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.17379E 03 INT 10

AVERAGE VOID FRACTION 0.2084
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 14
FIRST BULK BOILING NODE 18

POWER/CM OF CHANNEL IN CORE REGIONS
0.1469E 03 0.2634E 03

IT 19 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.17216E 03 INT 12 REP 0.15763E 00
IT 20 POWER 0.80000E 09 VINLET 0.22458E 03 ROD INSERTION 0.17064E 03 INT 11 REP 0.23244E 00

HOURS 10.00 POWER 0.80000E 09 MASSFL 0.10000E 01 ROD INSERTION 0.17064E 03 INT 11

AVERAGE VOID FRACTION 0.2101
EXIT QUALITY 0.0824
FIRST SUBCOOLED BOILING NODE 14
FIRST BULK BOILING NODE 18

POWER/CM OF CHANNEL IN CORE REGIONS
0.1441E 03 0.2661E 03

HOURS 10.00 IT 20 INT 11 POWER = 0.80000E 09 REP = 0.23244E 00

	P1	P2
2	0.10857D 12	0.82338D 12
3	0.11343D 13	0.53623D 13
4	0.99042D 13	0.56873D 13
5	0.15810D 14	0.87728D 13
6	0.21320D 14	0.11796D 14
7	0.26473D 14	0.14627D 14
8	0.31322D 14	0.17288D 14
9	0.35937D 14	0.19821D 14
10	0.40402D 14	0.22274D 14
11	0.44808D 14	0.24696D 14
12	0.49243D 14	0.27139D 14
13	0.53796D 14	0.29652D 14
14	0.58553D 14	0.32282D 14
15	0.63600D 14	0.35077D 14
16	0.69026D 14	0.38084D 14
17	0.74932D 14	0.41371D 14
18	0.81738D 14	0.45170D 14
19	0.90333D 14	0.49976D 14
20	0.10189D 15	0.56613D 14
21	0.11744D 15	0.69183D 14
22	0.12335D 15	0.73223D 14
23	0.12041D 15	0.71546D 14
24	0.11210D 15	0.66630D 14
25	0.10118D 15	0.60163D 14
26	0.89366D 14	0.53170D 14
27	0.77630D 14	0.46221D 14
28	0.66404D 14	0.39573D 14
29	0.55794D 14	0.33286D 14
30	0.45714D 14	0.27310D 14
31	0.35980D 14	0.21531D 14
32	0.26365D 14	0.15832D 14
33	0.16590D 14	0.10426D 14
34	0.19081D 13	0.12757D 14
35	0.18341D 12	0.22987D 13

AVERAGES 0.61914D 14 0.35614D 14

CI	CX	HFL	DK	VF	TS	TIC	TL	TFMAX	AVTF
0.4468E 15	0.2305E 15	0.7283E 01	-0.1482E-02	0.0	0.5459E 03	0.5503E 03	0.5443E 03	0.6772E 03	0.6285E 03
0.6900E 15	0.3264E 15	0.1127E 02	-0.2449E-02	0.0	0.5471E 03	0.5539E 03	0.5446E 03	0.7503E 03	0.6750E 03
0.9222E 15	0.4027E 15	0.1516E 02	-0.3367E-02	0.0	0.5484E 03	0.5575E 03	0.5451E 03	0.8217E 03	0.7204E 03
0.1131E 16	0.4603E 15	0.1881E 02	-0.4207E-02	0.0	0.5498E 03	0.5611E 03	0.5456E 03	0.8887E 03	0.7630E 03
0.1316E 16	0.5032E 15	0.2223E 02	-0.4981E-02	0.0	0.5512E 03	0.5645E 03	0.5463E 03	0.9518E 03	0.8033E 03
0.1478E 16	0.5340E 15	0.2549E 02	-0.5706E-02	0.0	0.5527E 03	0.5680E 03	0.5470E 03	0.1012E 04	0.8417E 03
0.1617E 16	0.5551E 15	0.2865E 02	-0.6398E-02	0.0	0.5542E 03	0.5714E 03	0.5478E 03	0.1070E 04	0.8790E 03
0.1735E 16	0.5679E 15	0.3176E 02	-0.7070E-02	0.0	0.5558E 03	0.5749E 03	0.5488E 03	0.1128E 04	0.9160E 03
0.1834E 16	0.5735E 15	0.3491E 02	-0.7739E-02	0.0	0.5575E 03	0.5785E 03	0.5498E 03	0.1187E 04	0.9534E 03
0.1915E 16	0.5727E 15	0.3814E 02	-0.8417E-02	0.0	0.5594E 03	0.5823E 03	0.5509E 03	0.1247E 04	0.9918E 03
0.1980E 16	0.5667E 15	0.4152E 02	-0.9115E-02	0.0	0.5613E 03	0.5863E 03	0.5521E 03	0.1310E 04	0.1032E 04
0.2033E 16	0.5570E 15	0.4511E 02	-0.9846E-02	0.0	0.5635E 03	0.5905E 03	0.5534E 03	0.1376E 04	0.1075E 04
0.2080E 16	0.5461E 15	0.4898E 02	-0.1062E-01	0.0	0.5657E 03	0.5951E 03	0.5548E 03	0.1448E 04	0.1121E 04
0.2130E 16	0.5364E 15	0.5320E 02	-0.1332E-01	0.3854E-01	0.5668E 03	0.5987E 03	0.5548E 03	0.1525E 04	0.1170E 04
0.2195E 16	0.5289E 15	0.5808E 02	-0.1825E-01	0.7702E-01	0.5669E 03	0.6018E 03	0.5557E 03	0.1614E 04	0.1225E 04
0.2295E 16	0.5246E 15	0.6425E 02	-0.2376E-01	0.1158E 00	0.5671E 03	0.6056E 03	0.5567E 03	0.1725E 04	0.1296E 04
0.2450E 16	0.5239E 15	0.7275E 02	-0.3012E-01	0.1555E 00	0.5673E 03	0.6110E 03	0.5577E 03	0.1878E 04	0.1392E 04
0.2717E 16	0.5240E 15	0.8836E 02	-0.3937E-01	0.2125E 00	0.5677E 03	0.6207E 03	0.5600E 03	0.2160E 04	0.1570E 04
0.3068E 16	0.5539E 15	0.9345E 02	-0.5048E-01	0.2960E 00	0.5678E 03	0.6239E 03	0.5600E 03	0.2252E 04	0.1627E 04
0.3308E 16	0.6103E 15	0.9129E 02	-0.6187E-01	0.3602E 00	0.5677E 03	0.6225E 03	0.5600E 03	0.2213E 04	0.1603E 04
0.3388E 16	0.6663E 15	0.8502E 02	-0.7035E-01	0.4088E 00	0.5676E 03	0.6186E 03	0.5600E 03	0.2100E 04	0.1532E 04
0.3280E 16	0.6983E 15	0.7676E 02	-0.7641E-01	0.4458E 00	0.5674E 03	0.6135E 03	0.5600E 03	0.1951E 04	0.1438E 04
0.3063E 16	0.7122E 15	0.6784E 02	-0.8061E-01	0.4742E 00	0.5672E 03	0.6079E 03	0.5600E 03	0.1790E 04	0.1336E 04
0.2781E 16	0.7092E 15	0.5897E 02	-0.8344E-01	0.4961E 00	0.5669E 03	0.6023E 03	0.5600E 03	0.1630E 04	0.1236E 04
0.2463E 16	0.6898E 15	0.5048E 02	-0.8523E-01	0.5132E 00	0.5667E 03	0.5970E 03	0.5600E 03	0.1476E 04	0.1139E 04
0.2126E 16	0.6542E 15	0.4245E 02	-0.8624E-01	0.5264E 00	0.5664E 03	0.5919E 03	0.5600E 03	0.1331E 04	0.1048E 04
0.1777E 16	0.6016E 15	0.3483E 02	-0.8660E-01	0.5367E 00	0.5661E 03	0.5870E 03	0.5600E 03	0.1194E 04	0.9610E 03
0.1419E 16	0.5296E 15	0.2745E 02	-0.8639E-01	0.5444E 00	0.5656E 03	0.5821E 03	0.5600E 03	0.1060E 04	0.8769E 03
0.1051E 16	0.4346E 15	0.2018E 02	-0.8563E-01	0.5498E 00	0.5649E 03	0.5770E 03	0.5600E 03	0.9285E 03	0.7937E 03
0.6910E 15	0.3169E 15	0.1323E 02	-0.8440E-01	0.5533E 00	0.5627E 03	0.5706E 03	0.5600E 03	0.8011E 03	0.7127E 03

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Alfred Nobel

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