

NRC DISTRIBUTION FOR PART 50 DOCKET MATERIAL

FILE NUMBER

TO:  
Mr. George Lear

FROM:  
Niagara Mohawk Power Corp.  
Syracuse, New York  
Mr. Rudolph R. Schneider

DATE OF DOCUMENT  
8/3/76

DATE RECEIVED  
8/6/76

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DESCRIPTION

Ltr. w/attached...re their 5/19/76 ltr. and our 6/9/76 ltr....furnishing additional in information concerning Assembly Averaged Power-Void Relationship Tech Spec.

PLANT NAME: (5-P)  
Nine Mile Point #1

ENCLOSURE

ACKNOWLEDGED

DO NOT REMOVE

SAFETY FOR ACTION/INFORMATION ENVIRO 8/6/76 RJL

<input checked="" type="checkbox"/> ASSIGNED AD:		ASSIGNED AD:
<input checked="" type="checkbox"/> BRANCH CHIEF:	Lear (6)	BRANCH CHIEF:
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<input checked="" type="checkbox"/> LIC. ASST.:	Parrish	LIC. ASST.:

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<input checked="" type="checkbox"/> NRC PDR	HEINEMAN	TEDESCO	ENVIRO ANALYSIS
<input checked="" type="checkbox"/> I & E (2)	SCHROEDER	BENAROYA	DENTON & MULLER
<input checked="" type="checkbox"/> OELD		LAINAS	
<input checked="" type="checkbox"/> GOSSICK & STAFF	ENGINEERING	IPPOLITO	ENVIRO TECH.
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CASE	KNIGHT		BALLARD
HANAUER	SIHWEIL	OPERATING REACTORS	SPANGLER
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EXTERNAL DISTRIBUTION

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NIAGARA MOHAWK POWER CORPORATION

NIAGARA  MOHAWK

300 ERIE BOULEVARD WEST  
SYRACUSE, N. Y. 13202

August 3, 1976



Director of Nuclear Reactor Regulation  
Attn: Mr. George Lear, Chief  
Operating Reactors Branch #3  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

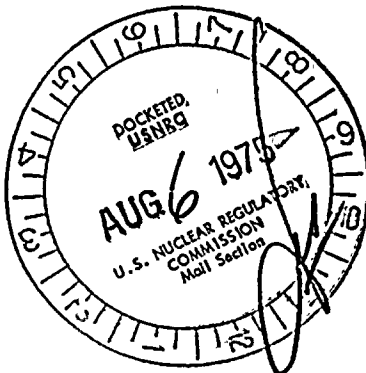
Re: Nine Mile Point Unit 1  
Docket No. 50-220  
DPR-63

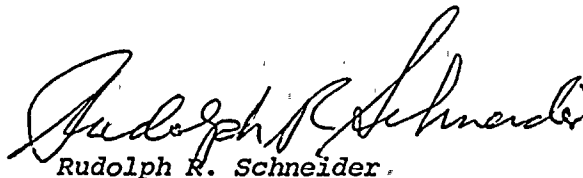
Dear Mr. Lear:

Our letter of May 19, 1976 transmitted proposed changes to the Assembly Averaged Power-Void Relationship Technical Specification for Nine Mile Point Unit 1. Your letter of June 9, 1976 requested additional information regarding that proposed change. The attached responses address the questions contained in your letter.

Sincerely,

NIAGARA MOHAWK POWER CORPORATION



  
Rudolph K. Schneider,

Vice President - Electric Operations

Attachment

Regulatory Docket File

7918



THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

5300 S. DICKINSON DRIVE

CHICAGO, ILL. 60637

RESPONSES TO JUNE 9, 1976 NRC QUESTIONS  
NINE MILE POINT UNIT 1  
Docket No. 50-220  
DPR-63

Request

Provide a quantitative explanation of how exposure dependent "B" values are calculated. Include examples which show how different values of "B" were calculated for two different exposures of the same fuel. The examples should show (1) the relationships (equations) assumed, and (2) the source and numerical values of all terms in the relationship for:

1. Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) and Average Heat Generation Rate ( $\dot{q}$ ) (i.e., assumed peaking factors).
2. Dryout Time. (i.e.,  $h_g$ ,  $h_{in}$ , flow, average density,  $\dot{q}$ ).
3. "B" values (i.e., void fraction, peaking factor, power).

Response

The duration of nucleate boiling for non-jet pump plant ECCS analyses has been determined using the correlation (Equation 1, below) described in "General Electric Compliance with 10CFR50 Appendix K-Acceptance Criteria I.C.4." That correlation shows the time to boiling transition (dryout time) is a function exclusively of liquid volume fraction and power input to the bundle. Converged MAPLHGR limits and conservative axial power distributions were assumed for the dryout time determinations. Both MAPLHGR limits and dryout times are exposure dependent. The following development shows how "B" values are calculated.

$$\Delta t = \frac{(0.31) (\rho_f) (h_{fg})}{Q'''}$$

Equation 1

$\Delta t$  = time to transition boiling, hr.

$\rho_f$  = saturated liquid density, lbm/ft<sup>3</sup>

$h_{fg}$  = enthalpy of vaporization, BTU/lbm

$$Q''' = \frac{\dot{q}}{V (1 - \alpha_i)}$$



$\dot{q}$  = Power generation in bundle, BTU/hr = (PF) (FCP) (ABTU)

PF = bundle radial power factor

FCP = fractional core power relative to 1850 MW

ABTU = average bundle output at 1850 MW, BTU/hr

V = active coolant volume, ft<sup>3</sup>

$\alpha_i$  = void fraction

Therefore . . .

$$\Delta t = \frac{(0.31) (\rho_f) (h_{fg}) (V) (1 - \alpha_i)}{(ABTU) (PF) (FCP)} \quad \text{Equation 2}$$

$$\text{"B" Factor} \equiv \frac{(1 - \alpha_i)}{(PF) (FCP)} \quad \text{Equation 3}$$

Limiting this "B" factor relationship will assure that local power void values will not result in dryout times shorter than those used in the ECCS Analysis.

Using Equation 2:

$$\text{"B" Factor} = \frac{(ABTU) (\Delta t)}{(0.31) (\rho_f) (h_{fg}) (V)} \quad \text{Equation 4}$$

Assumed nominal values are:

$$ABTU = 1.1869 \times 10^7 \text{ BTU/hr}$$

$$\rho_f = 45.977 \text{ lbm/ft}^3$$

$$h_{fg} = 641.36 \text{ BTU/lbm}$$

$$V = 1.2696 \text{ ft}^3, \text{ Initial Core}$$

$$V = 1.2948 \text{ ft}^3, \text{ Reloads 1, 2, 3}$$





$$V = 1.2936 \text{ ft}^3, \text{ Reloads 4, 5}$$

Substituting the above values in Equation 4 yields the "B" factor relationships for the different reloads:

"B" Factor = (1022.688) ( $\Delta t$ )	Initial Core	Equation 5
"B" Factor = (1002.784) ( $\Delta t$ )	Reloads 1, 2, 3	Equation 6
"B" Factor = (1003.714) ( $\Delta t$ )	Reloads 4, 5	Equation 7

The following examples show how different values of "B" were calculated for two different exposures of the same fuel (Reload 3):

<u>Exposure</u>	<u>ECCS Analysis Dryout Times</u>	<u>MAPLHGR</u>
5000 MWD/T	1.48 sec	10.68
25000 MWD/T	1.59 sec	9.92

Substituting the above dryout times in Equation 6 yields:

For 5000 MWD/T:

$$\text{"B" Factor} = (1002.784) (\Delta t)$$

$$\text{"B" Factor} = \frac{(1002.784/\text{hr}) (1.48 \text{ sec})}{3600 \text{ sec/hr}}$$

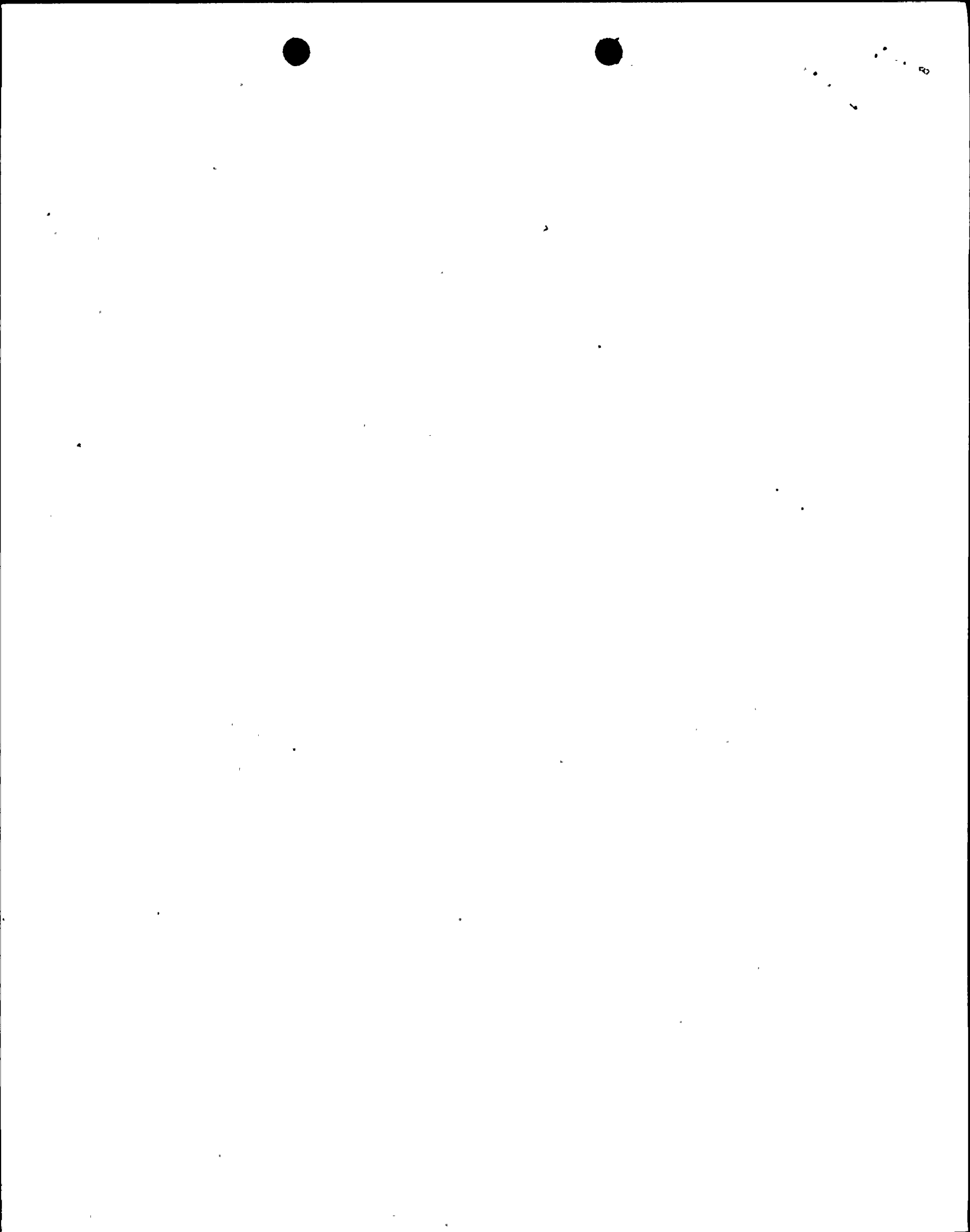
$$\text{"B" Factor} = 0.412$$

For 25000 MWD/T:

$$\text{"B" Factor} = (1002.784) (\Delta t)$$

$$\text{"B" Factor} = \frac{(1002.784/\text{hr}) (1.59 \text{ sec})}{3600 \text{ sec/hr}}$$

$$\text{"B" Factor} = 0.443$$



Request

Demonstrate how "B" values are calculated to assure conservatism when using the dryout times assumed in the ECCS analysis.

Response

As indicated in the above response, nominal values were used to calculate the "B" factors. Converged MAPLHGR limits and conservative axial power distributions were assumed for the dryout time determinations. In addition, a conservative correlation (G.E. compliance with 10CFR50, Appendix K criteria I.C.4.) was used which was previously approved by the Commission.

A "B" Factor Limiting Condition for Operation is not necessary to assure that actual dryout times are conservative. Dryout time is only one of many conservative inputs used to determine MAPLHGR limits, the ultimate restriction of interest. Sensitivity analyses performed by our fuel supplier have determined that the parameters used to calculate dryout time (void fraction, axial power distributions) are conservative when compared to normal plant operation.

