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 AUTH. NAME: AUTHOR AFFILIATION:
 DOLAN, J. E. Indiana & Michigan Electric Co.
 RECIP. NAME: RECIPIENT AFFILIATION:
 DENION, H. R. Office of Nuclear Reactor Regulation

SUBJECT: Forwards response to concerns re small break LOCA operator guidelines contained in NRC 791227 ltr. Normal fuel power subcooling value is being replaced w/45 F margin. Non-LOCA transients & emergency operating instructions under review.

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BOWLING GREEN STATION
NEW YORK, N. Y. 10004

January 30, 1980
AEP:NRC:00346

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
Subject: Modification of Small Break LOCA Operator Guidelines

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Denton:

This letter and its attachment are our response to the concerns on small break LOCA operator guidelines expressed in the letter of December 27, 1979 which Mr. D. F. Ross addressed to the Chairman of the Westinghouse Owners' Group, Mr. C. Reed.

As a result of our analysis of subcooling criteria for the termination of safety injection, we are replacing our original value of 50°F, which is the nominal full power subcooling for both Cook Units, with a criteria of 45°F margin if loop RTD's are used for temperature measurement or of 33°F margin if core exit thermocouples are used for temperature measurements. The basis for this revised limit is discussed in Attachment A to this letter. Also, the non-LOCA transients and their associated Emergency Operating Instructions (EOI's) are being reviewed for the purpose of incorporating a subcooling criteria in the HPI termination criteria. These reviews will be completed and the results transmitted to the NRC by the Westinghouse Owners' Group Chairman within the 21-day requirement stated in Mr. Ross' letter.

Very truly yours,

John E. Dolan
John E. Dolan
Vice President

JED:em

cc: R. C. Callen
G. Charnoff
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ATTACHMENT A
TO
AEP:NRC:00346

Calculation of Subcooling Margin After Consideration of Instrument Uncertainties (PRODAC)

I. Pressure Instrumentation

1) RCS Wide Range - Barton Model No. 763 Transmitter

A. Normal Operation

Channel statistical analysis $\pm 2.41\%$ of span (1)

PRODAC error $\pm 0.005\%$ of span (3)

$$\text{Maximum normal error} = \sqrt{(2.41)^2 + (0.005)^2} = 2.41\% \text{ of span}$$

B. Post Accident

Environmental allowance $\pm 10.00\%$ of span (4)

$$\text{C. } \underline{\text{Maximum Total Error}} = 2.41 + 10.00 = 12.41\% \text{ of span}$$

$$\text{Span} = 3000 \text{ psia}$$

$$\begin{aligned} \text{Maximum total pressure error} &= 0.1241 \times 3000 \\ &= 372.3 \text{ psi} \end{aligned}$$

II. Temperature Instrumentation

1) Core Thermocouples

A. Normal Operation

Reference accuracy $\pm 0.12\%$ of span (5)

Calibration accuracy $\pm 0.18\%$ of span (6)

PRODAC error $\pm 0.005\%$ of span (3)

$$\begin{aligned} \text{Maximum normal error} &= \sqrt{(0.12)^2 + (0.18)^2 + (0.005)^2} \\ &= 0.22\% \text{ of span} \end{aligned}$$

B. Post Accident

Environmental allowance $\pm 0.01\%$ of span (7)

$$\text{C. } \underline{\text{Maximum total error}} = 0.22 + 0.01 = 0.23\% \text{ of span}$$

$$\begin{aligned} \text{Maximum total temperature error} &= 0.0023 \times 2500 \\ &= 5.8^\circ\text{F} \end{aligned}$$

2) RTD's Rosemount Inc., Model No. 176 KS

A. Normal Operation

Channel statistical allowance $\pm 2.72\%$ of span (1)

PRODAC error $\pm 0.005\%$ of span (3)

$$\text{Maximum normal error} = \sqrt{(2.72)^2 + (0.005)^2} = 2.72\% \text{ of span}$$

B. Post Accident

Environmental allowance $\pm 0.01\%$ of span (7)

C. Maximum Total Error = $2.72 + 0.01 = 2.73\%$ of span

Span = 700°F

$$\begin{aligned}\text{Maximum total temperature error} &= 0.0273 \times 700 \\ &= 19.1^{\circ}\text{F}\end{aligned}$$

III. Calculation of Margin

Assume indicated pressure is 2250 psia. $T_{\text{SAT}} (2250) = 652.7^{\circ}\text{F}$

Minimum pressure = $2250 - 372.3 = 1877.7$ psia

$T_{\text{SAT}} (1877.7) = 629.9^{\circ}\text{F}$

Indicated temperature to insure subcooling = $T_{\text{SAT}} (1877.7) - \text{maximum temperature error}$

$$= 626.9 - 5.8 \text{ (thermocouples)}$$

$$19.1 \text{ (RTD's)}$$

$$= 621.1^{\circ}\text{F} \text{ (thermocouples)}$$

$$607.8^{\circ}\text{F} \text{ (RTD's)}$$

Indicated subcooling = $T_{\text{SAT}} (2250) - \text{indicated temperature to insure subcooling}$

$$= 652.7 - 621.1 \text{ (thermocouples)}$$

$$607.8 \text{ (RTD's)}$$

$$= 31.6^{\circ}\text{F} \text{ (thermocouples)}$$

$$44.9^{\circ}\text{F} \text{ (RTD's)}$$

Therefore, required subcooling margin = 32°F (thermocouples)
 $= 45^{\circ}\text{F}$ (RTD's)

Calculation of Subcooling Margin After Consideration of
Instrument Uncertainties (Subcooling Meter)

I. Pressure Instrumentation

1) RCS Wide Range - Barton Model No. 763 Transmitter

A. Normal Operation

Channel statistical allowance $\pm 2.41\%$ of span (1)

Rack error allowance $\pm 0.25\%$ of span (2)

Indicator reading error $\pm 0.10\%$ of span (3)

$$\text{Maximum normal error} = (2.41)^2 + (0.25)^2 + (0.10)^2 = 2.42\% \text{ of span}$$

B. Post Accident

Environmental allowance $\pm 10\%$ of span (4)

C. Maximum Total Error = $2.42 + 10.00 = 12.42\%$ of span

Span = 3000 psia

$$\begin{aligned}\text{Maximum total pressure error} &= 0.1242 \times 3000 \\ &= 372.6 \text{ psi}\end{aligned}$$

II. Temperature Instrumentation

1) Core Thermocouples

A. Normal Operation

Reference accuracy $\pm 0.2\%$ of span (5)

Calibration accuracy $\pm 0.3\%$ of span (6)

Rack error allowance $\pm 0.25\%$ of span (2)

Indicator reading error $\pm 0.10\%$ of span (3)

$$\begin{aligned}\text{Maximum normal error} &= \sqrt{(0.2)^2 + (0.3)^2 + (0.25)^2 + (0.10)^2} \\ &= 0.45\% \text{ of span}\end{aligned}$$

B. Post Accident

Environmental allowance $\pm 0.01\%$ of span (7)

C. Maximum Total Error = $0.45 + 0.01 = 0.46\%$ of span

Span = 1500°F

Maximum total temperature error = 0.0046×1500
= 6.9°F

2) RTD's - Rosemount Inc., Model No. 176 KS

A. Normal Operation

Channel statistical allowance $\pm 2.72\%$ of span (1)

Rack error allowance $\pm 0.25\%$ of span (2)

Indicator reading error $\pm 0.10\%$ of span (2)

Maximum normal error = $\sqrt{(2.72)^2 + (0.25)^2 + (0.10)^2}$
= 2.73% of span

B. Post Accident

Environmental allowance $\pm 0.01\%$ of span (7)

C. Maximum Total Error = $2.73 + 0.01 = 2.74\%$ of span

Span = 700°F

Maximum total temperature error = 0.0274×700
= 19.2°F

III. Calculation of Margin

Assume indicated pressure is 2250 psia. $T_{\text{SAT}}(2250) = 652.7^{\circ}\text{F}$.

Minimum pressure = $2250 - 372.6 = 1877.4$ psia .

$T_{\text{SAT}}(1877.4) = 626.9^{\circ}\text{F}$

Indicated temperature to insure subcooling = T_{SAT} (1877.4) - maximum
temperature error

$$\begin{aligned} &= 629.9 - 6.9 \text{ (thermocouples)} \\ &\quad 19.2 \text{ (RTD's)} \\ &= 620.0^{\circ}\text{F} \text{ (thermocouples)} \\ &\quad 607.7^{\circ}\text{F} \text{ (RTD's)} \end{aligned}$$

Indicated subcooling = T_{SAT} (2250) - indicated temperature to
insure subcooling

$$\begin{aligned} &= 652.7 - 620.0 \text{ (thermocouples)} \\ &\quad 607.7 \text{ (RTD's)} \\ &= 32.7^{\circ}\text{F} \text{ (thermocouples)} \\ &\quad 45.0^{\circ}\text{F} \text{ (RTD's)} \end{aligned}$$

Therefore, required indicated subcooling margin = 33°F (thermocouples)
= 45°F (RTD's)

REFERENCES

1. Attachment to AEP:NRC:00040 entitled, "Westinghouse Reactor Protection System/Engineered Safety Features Actuation System Setpoint Methodology, " Table 3-4.
2. Moore Industries Data Sheets 164-710-01A and 142-710-01B (November 1977)
3. Conservative estimate
4. Attachment to AEP:NRC:00095; Westinghouse Letter NS-TMA-1950 and enclosed report entitled, "Qualification Testing of Barton Transmitters."
5. Based on $\pm 3^{\circ}\text{F}$
6. Based on 0.75% of reading @ 600°F
7. TMI-OG-132

