B 06/07/78

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)
DISTRIBUTION FOR INCOMING MATERIAL 50-346

REC: STOLZ J F
NRC

ORG: ROE L E
TOLEDO EDISON

DOCDATE: 06/02/78
DATE RCVD: 06/06/78

DOCTYPE: LETTER NOTARIZED: NO

COPIES RECEIVED
LTR 1 ENCL 3

SUBJECT:
FORWARDING REVISED PAGE 1, 5, 10, 13, 14 AND 15 TO ATTACHMENT 1 OF APPLICANT"S LTR DTD 05/26/78 PERTAINING TO THE DETERMINATION OF TOTAL RC FLOWRATE AND ITS ACCURACY FOR UNIT 1 AT 100% PWR LEVEL.

PLANT NAME: DAVIS BESSE - UNIT 1

REVIEWER INITIAL: XJM
DISTRIBUTOR INITIAL: MM

***************** DISTRIBUTION OF THIS MATERIAL IS AS FOLLOWS *****************

NOTES:
1. SEND ALL AMENDMENTS TO J. ROE

PSAR/FSAR AMDTS AND RELATED CORESPONDENCE
(DISTRIBUTION CODE B001)

FOR ACTION:
- ASST DIR VASSALLO**LTR ONLY
- PROJ MGR ENGLE**W/ENCL
- BR CHIEF LWR#1 BC**LTR ONLY
- LIC ASST HYLTON**LTR ONLY

INTERNAL:
- REG FILE**W/ENCL
- I & E**W/2 ENCL
- OPERATOR LIC BR**W/ENCL
- QAB**W/ENCL
- MIPC**LTR ONLY
- MECH ENG BR**W/ENCL
- MATERIAL ENG BR**W/2 ENCL
- REACTOR SYSTEMS BR**W/ENCL
- CORE PERFORMANCE BR**W/ENCL
- AUXILIARY SYS BR**W/ENCL
- I & C SYSTEMS BR**W/ENCL
- AD FOR SITE TECH**W/4 ENCL
- ACCIDENT ANALYSIS**W/ENCL
- RAD ASSESSMENT BR**W/ENCL
- NRC PDR**W/ENCL
- OELD**LTR ONLY
- EMERGENCY PLAN BR**W/ENCL
- CASE**LTR ONLY
- AD FOR ENG**LTR ONLY
- STRUCTURAL ENG BR**W/ENCL
- AD FOR REAC SFTY**LTR ONLY
- ANALYSIS BR**W/ENCL
- AD FOR PLANT SYSTEMS**LTR ONLY
- CONTAINMENT SYSTEMS**W/ENCL
- POWER SYS BR**W/ENCL
- AD FOR SITE ANLYS**LTR ONLY
- EFFLUENT TREAT SYS**W/ENCL
- KIRKWOOD**W/ENCL
- HANAUER W/ENCL
- STELLO W/ENCL
- ENGINEERING BR W/ENCL
- REACTOR SAFETY BR W/ENCL
- PLANT SYS BR W/ENCL
- EEB W/ENCL

EXTERNAL:
- LPDR'S
  - PT. CLINTON, OH**W/ENCL
- TIC**W/ENCL
- NSIC**W/ENCL
- ACRS CAT B**W/16 ENCL

DISTRIBUTION: LTR ~~55~~ 62 ENCL ~~46~~ 52
SIZE: 1P+6P

CONTROL NBR: ~~781580007~~ MA

********************************* THE END *********************************

8001230646

TOLEDO EDISON

LOWELL E. ROE
Vice President
Facilities Development
(419) 259-5242

Docket No. 50-346

License No. NPF-3

June 2, 1978

Serial No. 440

Director of Nuclear Reactor Regulation
Attention: Mr. John F. Stolz, Chief
Light Water Reactors Branch No. 1
Division of Project Management
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Stolz:

We are supplying revised Pages 1, 5, 10, 13, 14, and 15 for attachment 1 of our letter to you dated May 26, 1978 (Serial No. 436). The revisions produce a small increase in the reactor coolant flow rate that is calculated from the heat balance, but have no significant effect on the flow rate uncertainty calculation.

Yours very truly,

Lowell E. Roe

Enclosures

db d/2

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B001
1/3

App Hanauer Stello Shao Baer Butler EEB

DETERMINATION OF TOTAL RC FLOWRATE AND

ITS ACCURACY FOR DAVIS-BESSE 1 AT 100%

POWER LEVEL

INTRODUCTION

In a B&W nuclear power plant, Gentile flowmeters are used to measure Loop 1 and 2 reactor coolant flowrates. These primary loop flowmeters are not calibrated prior to installation. Loop 1 and 2 feedwater flowrates are measured with calibrated flow meters and B&W utilizes a plant heat balance to set the calibration of the primary loop flowmeters.

An error analysis on the equations used to determine the total reactor core flowrate (Loop 1 plus Loop 2) has revealed that the errors in reactor coolant temperatures and feedwater flowmeter differential pressure are the most significant terms in calculating accurate values of total reactor core flowrate

SUMMARY

The calculated RC flowrate for Davis-Besse 1 at 100% power is 113.5% times the design flowrate of 352,000 gpm. The accuracy is ±2.2%. This was determined with RC temperature instrument string errors equal to ±0.79F and feedwater flowmeter ΔP errors equal to ±1.25% and steam temperature errors equal to ±4.2F.

Reactor coolant system temperatures are measured with ± 1/4% accurate pre-calibrated RTD's over a range of 520 to 620F. Similarly, the Bailey Meter Company differential pressure transmitters are calibrated to ± 1/2% at time of installation. The two feedwater flowmeters are calibrated to ± 1/2% prior to installation.

For normal everyday conditions in the instrumentation area of the plant, B&W has determined the accuracy of all input measurements used in this error analysis. (Refer to page 4 .)

COMPARISON OF HOT LEG TEMPERATURES (T_H)

FOR DAVIS-BESSE 1 AT 100% POWER ON

APRIL 5, 1978

TIME	LOOP 1 T719 (°F)	LOOP 1 T720 (°F)
14:39	605.6	605.8
14:44	606.0	606.1
14:50	606.0	606.2
14:54	605.9	606.1
14:59	605.6	606.1
15:04	605.8	606.1
15:09	605.9	605.9
15:14	605.9	606.1
Midpoint	605.8	606.0
Span	±0.2	±0.2

Average T_H = 605.9°F during 35 minutes

TIME	LOOP 2 T729 (°F)	LOOP 2 T728 (°F)
14:39	604.9	604.3
14:44	605.3	604.8
14:50	605.4	604.9
14:54	605.1	604.4
14:59	605.1	604.6
15:04	605.1	604.4
15:09	605.0	604.6
15:14	605.2	604.7
Midpoint	605.15	604.6
Span	±0.25	±0.3

Average T_H = 604.88°F during 35 minutes

 Revised 6/1/78

PRIMARY SIDE ENTHALPY CALCULATION:

NOMENCLATURE

H_H = Reactor Coolant hot leg enthalpy

H_C = Reactor Coolant cold leg enthalpy

H_S = Enthalpy of steam at steam generator outlet

H_F = Enthalpy of feedwater to the steam generator

ΔH = Change in enthalpy, an added subscript: 'pri' or 'sec' implies the primary and secondary loops respectively.

LOOP 1:

H_H @ 605.9°F and 2159 psia = 622.26 Btu/lb

H_C @ 558.7°F and 2220 psia = 558.14 Btu/lb

ΔH_{pri} = 64.12 Btu/lb

LOOP 2:

H_H @ 604.9°F and 2159 psia = 620.79 Btu/lb

H_C @ 558.9°F and 2220 psia = 558.39 Btu/lb

ΔH pri = 62.40 Btu/lb

SECONDARY SIDE ENTHALPY CALCULATION:

LOOP 1:

H_S @ 595.5°F and 920 psia = 1254.63 Btu/lb

H_F @ 460°F and 958 psia = 441.73 Btu/lb

ΔH_{sec} = 812.90 Btu/lb

LOOP 2:

H_S @ 596.5°F and 897 psia = 1258.03 Btu/lb

H_F @ 460°F and 972 psia = 441.74 Btu/lb

ΔH_{sec} = 816.29 Btu/lb

or $W_{RC1}(\Delta H_1)_{PRIMARY} = (W_F \Delta H_{sec})_{LOOP1} - \frac{74.76 \times 10^6}{2} \frac{Btu}{hr}$

and $W_{RC2}(\Delta H_2)_{PRIMARY} = (W_F \Delta H_{sec})_{LOOP2} - \frac{74.76 \times 10^6}{2} \frac{Btu}{hr}$

Solving for W_{RC1} and W_{RC2}:

$$W_{RC1} = \frac{(W_F \Delta H_{sec})_{LOOP1} - 37.38 \times 10^6 \text{ Btu/hr}}{(\Delta H_1)_{PRIMARY}}$$

and

$$W_{RC2} = \frac{(W_F \Delta H_{sec})_{LOOP2} - 37.38 \times 10^6 \text{ Btu/hr}}{(\Delta H_2)_{PRIMARY}}$$

From page 10

$(\Delta H_1)_{PRI} = 64.12$ Btu/lb

$(\Delta H_2)_{PRI} = 62.40$ Btu/lb

$(\Delta H_{sec})_{LOOP\ 1} = 812.90$ Btu/lb

$(\Delta H_{sec})_{LOOP\ 2} = 816.29$ Btu/lb

Substituting the above values and noting that

$W_{F\,LOOP1} = 5.812 \times 10^6$ lb/hr

$W_{F\,LOOP2} = 5.785 \times 10^6$ lb/hr

$$W_{RC1} = \frac{(5.812\times10^6)(812.90) - 37.38\times10^6 \text{ Btu/hr}}{(64.12)}$$

$$= 73.10\times10^6 \text{ lb/hr}$$

$$W_{RC2} = \frac{(5.785\times10^6)(816.29) - 37.38\times10^6 \text{ Btu/hr}}{(62.40)}$$

$$= 75.08\times10^6 \text{ lb/hr}$$

Total RC flow rate $= W_{RCT} = W_{RC1} + W_{RC2}$

$$= 148.18\times10^6 \text{ lb/hr}$$

The total RC flowrate in gpm may be calculated as

$$W_{RCT}(\text{gpm}) = \frac{W_{RCT}(\text{lb/hr})}{\frac{60}{7.4805}\times \rho_{\text{cold leg}}}$$

$\rho_{\text{cold leg}} = 46.26 \text{ lb/ft}^3$ at 558.8°F and 2220 psia

$$W_{RCT}(\text{gpm}) = 3.994\times10^5 \text{ gpm}$$

The design flowrate for RC system $= 4\times88000$ gpm/pump

$= 352,000$ gpm

Therefore the ratio to design flowrate is: $\frac{3.994\times10^5}{3.52\times10^5}$

$= 113.5\%$

ERROR ANALYSIS OF CALCULATED RC FLOWRATE

The basic equation for Loop 1 or 2 RC flowrate is:

$$W_{RC} = \frac{W_F\left[\Delta H_{sec}\right] - \frac{C}{2}}{\left[\Delta H_{PRI}\right]}$$

where $C = Q_{pumps} - Q_{rad.\ losses} = 74.76 \times 10^6$ Btu/hr

If one assumes an extreme case of a 10% error in C, then C would be equal to 8.2236×10^7 Btu/hr rather than 74.76×10^6 Btu/hr.

Then total RC Flowrate would become:

$$W_{RC1} = \frac{5.812\times10^6 \times 812.90 - 41.12\times10^6 \text{ Btu/hr}}{64.12} = 73.04\times10^6 \text{ lb/hr}$$

$$W_{RC2} = \frac{5.785\times10^6 \times 816.29 - 41.12\times10^6 \text{ Btu/hr}}{62.40} = 75.02\times10^6 \text{ lb/hr}$$

Total RC flow rate $= 148.06\times10^6$ lb/hr and the

Change in total RC flowrate is 0.08%.

For this small change we shall assume C is a constant and is 74.76×10^6 Btu/hr. If it is in error, its influence on the final value is insignificant.

The small corrections to the H_H values (as given on revised p.10) were not made in the error analysis on subsequent pages, because the corrections have a negligible effect on the error calculations.

Revised 6/1/78