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50-275/323

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PACIFIC GAS & ELEC

DOCDATE: 02/10/78
DATE RCVD: 02/21/78

DOCTYPE: LETTER NOTARIZED: NO
SUBJECT:
HEAT TRANSFER ANALYSIS SUMMARIES FOR THE SUBJECT FACILITIES CFC MOTOR HEAT EXCHANGERS.

COPIES RECEIVED
LTR 1 ENCL 40

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PACIFIC GAS AND ELECTRIC COMPANY

PG&E — 77 BEALE STREET, 31ST FLOOR • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211

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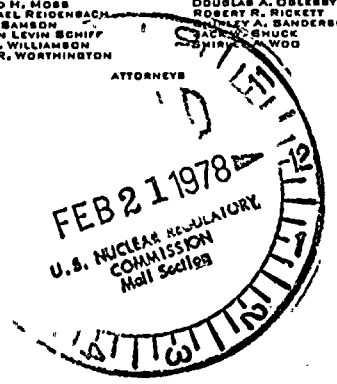
February 10, 1978



Mr. John F. Stolz, Chief
Light Water Reactors Branch No. 1
Division of Project Management
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: Dockets 50-275-OL - 50-323-OL
Diablo Canyon Units 1 and 2

Dear Mr. Stolz:

In a discussion on January 25, 1978 Mr. John Knox of the Regulatory Staff requested additional information for his review of the environmental qualification of the containment fan cooler (CFC) motors. He specifically asked for a heat-transfer analysis like the one Florida Power and Light provided in meetings on the St. Lucie Unit 1 license application.

The attached heat transfer analysis summaries for the Diablo Canyon CFC motor heat exchangers are the same type as those provided for St. Lucie. The analysis summaries document the capability of the Diablo Canyon CFC motor heat exchangers to provide cooling air to the motor inlet at the temperatures stated in our letter of January 19, 1978, for post-design basis accident and post-main steam line break containment conditions. We trust that this information is sufficient to complete the Staff review.

Kindly acknowledge receipt of the above material on the enclosed copy of this letter and return it to me in the enclosed addressed envelope.

A letter dated January 20, 1978 from C. Eicheldinger of Westinghouse to Dennis Allison transmitted forty copies of WCAP-9241 entitled "Evaluation of Reactor Coolant System for Postulated Loss of Coolant Accident for the Diablo Canyon Nuclear Power Plant" (proprietary) and twenty copies of WCAP-9242, the non-proprietary version of the same report. Also enclosed were:

1. One copy of Application for Withholding, AW-77-27 (non-proprietary).

A001/SE
1/40

2. One copy of Affidavit (non-proprietary).

The above report provides information for the Staff's review of the Diablo Canyon reactor vessel supports analysis.

Very truly yours,

Philip A. Crane, Jr.

Attachments (40)
CC w/attachment: Service List

14:53:33 DECEMBER 30, 1977

HEAT EXCHANGER DESIGN PROGRAM
T. J. FAGAN 501-2Y29 EXT 7306
OPTIMIZING ENTIRE EXCHANGER
STURTEVANT WATER CIRCUITING
1.00 VELOCITY WATER CIRCUITING

ORIGINAL POST ACCIDENT CONDITIONS
271°F, 61.7 psia
LOCA

PACIFIC GAS AND ELECTRIC

MOTOR COOLING SYSTEM PARAMETERS
MOTOR DIAMETER 33.25INCHES LENGTH 54.00INCHES A 32.00 INCHES
B 52.00 INCHES C 54.00 INCHES D 37.00 INCHES E 24.00 INCHES

LOSSES 8.50 KILOWATTS
CONTAINMENT
TEMPERATURE 271.00 DEG F PRESSURE 61.696 PSIA
PARTIAL PRESSURES AIR 19.146 PSIA WATER VAPOR 42.550 PSIA
DENSITIES AIR 0.07072 LBM/CU FT WATER VAPOR 0.10068 LBM/CU FT
MOTOR CASE
TEMPERATURE 263.40DEG F SURFACE AREA 36.54 SQ FT
PARTIAL PRESSURES AIR 24.175PSIA WATER VAPOR 37.521PSIA
DENSITIES AIR 0.09024 LBM/CU FT WATER VAPOR 0.08951 LBM/CU FT
CONVECTIONCOEFFICIENT 1.0771 BTU/HR-SQ FT-DEGF QCONV 298.98TU/HR
MASS TRANSPORT COEFFICIENT 24.3822 FT/HR QMASS 26668.3 BTU/HR
CONDENSATION RATE 28.47 LBM/HR
INSIDE CONVECTION COEFFICIENT 6.0000 BTU/HR-SQ FT-DEG F
BASE ENCLOSURE
TEMPERATURE 268.96 DEG F SURFACE AREA 44.43 SQ FT
PARTIAL PRESSURES AIR 23.550 PSIA WATERVAPOR 41.146 PSIA
DENSITIES AIR 0.07613 LBM/CU FT WATER VAPOR 0.09757 LBM/CU FT
CONVECTION COEFFICIENT 0.7065 BTU/HR-SQ FT-DEG F QCONV 64.2 BTU/HR
MASS TRANSPORT COEFFICIENT 15.9125 FT/HR QMASS 6377.3BTU/HR
CONDENSATION RATE 5.84 LBM/HR
INSIDE CONVECTIONCOEFFICIENT 1.0429 BTU/HR-SQ FT-DEG F

EXIT TEMPERATURE 130.94 DEG F ← AIR ENTERING MOTOR
COIL DESIGN PARAMETERS
F= 8.50 FINS/INCH TF= 0.0080 INCHES DB= 0.5250 INCHES DTO= 0.6437 INCHES
DTI= 0.5491 INCHES TT= 0.0490 INCHES PT= 1.5000 INCHES PL= 1.2990 INCHES
W= 30.00 INCHES H= 24.00 INCHES 8 ROWS VCF= 150.00 FPM VW= 4.303 FPS

AIR AND WATER INLET AND EXIT CONDITIONS
AIR IN → TAI= 149.85 DEG F PAIR= 61.696 PSI WAIR= 1.2291,+04 LB/HR (2731.33 SCFM)
WATER IN → TWI= 125.00 DEG F WWATER= 2.511C,+04 LB/HR (50.82 GPM)
AIR OUT → TAE= 128.76 DEG F TWE= 127.49 DEG F QAIR= 6.2214,+04 BTU/HR
QWATER= 6.2411.+04 BTU/HR QHTF= 6.2416,+04 BTU/HR RHOA= 0.27798 LB/CU FT

} HEAT EXCHANGER CONDITIONS

water out

AIR SIDE PRESSURE DROP
ARF= 0.932 ART= 0.560 PDA= 0.228 INCHES OF WATER PDR=10.000 INCHES OF WATER

WATER SIDE PRESSURE DROP
WATER TEMPERATURE 126 DEG F
NRE= 3.383,+04 PDW= 3.886,+00 PSI

HEAT TRANSFER PARAMETERS
ATI= 46.00 SQ FT ATO= 53.93 SQ FT ACOL= 51.51 SQ FT
AFIN= 729.02 SQ FT AAIR= 780.54 SQ FT
HI= 1195.10 BTU/HR-SQ FT-DEG F FI= 0.00050 HR-SQ FT-DEG F/BTU

KT= 215.00 BTU/HR-FT-DEG F HC= 2500.00 BTU/HR-SQ FT-DEG F
KF= 215.00 BTU/HR-FT-DEG F HA= 10.889 BTU/HR-SQ FT-DEG F
U= 7.66 BTU/HR-SQ FT-DEG F
K= 149.47 BTU/HR-SQ. FT FACE-DEG MED-ROW

HA AUGMENTED BY 0.00 PERCENT ETAF= 0.896

THERMAL IMPEDANCES BASED ON TOTAL AIR SIDE AREA
Q=(AAIR/RIOT).*LMTD

TUBE SIDE CONVECTION	0.31420	HR-SQ FT-DEG F/BTU	10.88 PERCENT
TUBE SIDE FOULING	0.00848	HR-SQ FT-DEG F/BTU	6.50 PERCENT
TUBE METAL CONDUCTION	0.00329	HR-SQ FT-DEG F/BTU	0.22 PERCENT
CONTACT IMPEDANCE	0.00579	HR-SQ FT-DEG F/BTU	4.43 PERCENT
COLLAR CONDUCTION	0.00004	HR-SQ FT-DEG F/BTU	0.03 PERCENT
AIR SIDE CONVECTION AND FIN EFFICIENCY	0.10174	HR-SQ FT-DEG F/BTU	77.94 PERCENT
TOTAL	0.13055	HR-SQ FT-DEG F/BTU	

SPOILER HEIGHT 0.0000 INCHES
CORRUGATIONS PER PITCH 3
HA AUGMENTED BY 0.00 PERCENT
PDA AUGMENTED BY 0.00 PERCENT
GRATZ NUMBER 0.00

HEAT EXCHANGER DESIGN PROGRAM
T. J. FAGAN 501-2729 EXT 7306

OPTIMIZING ENTIRE EXCHANGER

STURTEVANT WATER CIRCUITING

1.00 VELOCITY WATER CIRCUITING

NEW POST ACCIDENT CONDITIONS
Assumed 326°F, 110 psia
(Steam Line Break)

PACIFIC GAS AND ELECTRIC

MOTOR COOLING SYSTEM PARAMETERS
MOTOR DIAMETER 33.25INCHES LENGTH 54.00INCHES A 32.00 INCHES
B 52.00 INCHES C 54.00 INCHES D 37.00 INCHES E 24.00 INCHES

LOSSES 8.50 KILOWATTS
CONTAINMENT
TEMPERATURE 326.00 DEG F PRESSURE 110.000 PSIA
PARTIAL PRESSURES AIR 12.479 PSIA WATER VAPOR 97.521 PSIA

DENSITIES AIR 0.04287 LBM/CU FT WATER VAPOR 0.22033 LBM/CU FT
MOTOR CASE
TEMPERATURE 321.77DEG F SURFACE AREA 36.54 SQ FT
PARTIAL PRESSURES AIR 18.074PSIA WATER VAPOR 91.926PSIA
DENSITIES AIR 0.06243 LBM/CU FT WATER VAPOR 0.20836 LBM/CU FT
CONVECTIONCOEFFICIENT 1.0409 BTU/HR-SQ FT-DEGF QCONV 160.8BTU/HR
MASS TRANSPORT COEFFICIENT 13.6285 FT/HR QMASS 38815.1 BTU/HR
CONDENSATION RATE 43.42 LBM/HR

INSIDE CONVECTION COEFFICIENT 6.0000 BTU/HR-SQ FT-DEG F
BASE ENCLOSURE
TEMPERATURE 324.91 DEG F SURFACE AREA 44.43 SQ FT
PARTIAL PRESSURES AIR 13.944 PSIA WATERVAPOR 96.056 PSIA
DENSITIES AIR 0.04797 LBM/CU FT WATER VAPOR 0.21720 LBM/CU FT
CONVECTION COEFFICIENT 0.6564 BTU/HR-SQ FT-DEG F QCONV 31.7 BTU/HR
MASS TRANSPORT COEFFICIENT 8.6506 FT/HR QMASS 8943.1BTU/HR
CONDENSATION RATE 10.03 LBM/HR
INSIDE CONVECTIONCOEFFICIENT 1.0433 BTU/HR-SQ FT-DEG F

EXIT TEMPERATURE 132.67 DEG F ← AIR ENTERING MOTOR
COIL DESIGN PARAMETERS
F= 8.50 FINS/INCH TF= 0.0080 INCHES DB= 0.6250 INCHES DTO= 0.6437 INCHES
DTI= 0.5491 INCHES TT= 0.0490 INCHES PT= 1.5000 INCHES PL= 1.2990 INCHES
W= 30.00 INCHES H= 24.00 INCHES 8 ROWS VCF= 88.27 FPM VW= 4.303 FPS

AIR IN
WATER IN
AIR TEMPERATURE AND WATER INLET AND EXIT CONDITIONS.
TAI= 155.60 DEG F PAIR=110.000 PSI WAIR= 1.2291.+04 LB/HR (2731.33 SCFM)
TWI= 125.00 DEG F WWATER= 2.5110.+04 LB/HR (50.82 GPM).
TAE= 129.63 DEG F TWE= 128.06 DEG F QAIR= 7.6590.+04 BTU/HR
QWATER= 7.6833.+04 BTU/HR QHTF= 7.6839.+04 BTU/HR RHOA= 0.48174 LB/CU FT
} HEAT EXCHANGER CONDITIONS
AIR OUT
WATER OUT
AIR SIDE PRESSURE DROP

ARF= 0.932 ART= 0.560 PDA= 0.151 INCHES OF WATER PDR=10.000 INCHES OF WATER

WATER SIDE PRESSURE DROP

WATER TEMPERATURE 127 DEG F

NRE= 3.383.+04 POW= 3.886.+00 PSI

HEAT TRANSFER PARAMETERS

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AFIN= 729.02 SQ FT AAIR= 780.54 SQ FT
HI= 1195.10 BTU/HR-SQ FT-DEG F FI= 0.00050 HR-SQ FT-DEG F/BTU

KT= 215.00 BTU/HR-FT-DEG F HC= 2500.00 BTU/HR-SQ FT-DEG F
KF= 215.00 BTU/HR-FT-DEG F HA= 10.889 BTU/HR-SQ FT-DEG F
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SPOILER HEIGHT 0.0000 INCHES
CORRUGATIONS PER PITCH 3
HA AUGMENTED BY 0.00 PERCENT
PDA AUGMENTED BY 0.00 PERCENT
GRATZ NUMBER 0.00