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SUBJECT: Documents conclusion that 2,200 gpm sufficient to remove decay heat & maintain RCS temp less than 140 F while in Mode 6.

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April 16, 1986

Director, Office of Nuclear Reactor Regulation
Attention: Mr. George W. Knighton, Director
PWR Project Directorate No. 7
Division of PWR Licensing - B
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

Southern California Edison's letter dated April 11, 1986 responded to several questions raised by the NRC staff relating to the review of Proposed Change NPF-10/15-3 (PCN-3). PCN-3 would reduce Mode 6 shutdown cooling system (SDCS) flow requirements from 4000 gpm to 2200 gpm. In meetings with the NRC staff, SCE provided additional information in support of SCE's conclusion presented in response to Question 2 that 2200 gpm is sufficient to remove decay heat and maintain reactor coolant system (RCS) temperature less than 140°F while in Mode 6. This letter documents this information.

The heat removal capacity of the SDCS Heat Exchanger was calculated for a dedicated SDCS flow of 2200 gpm assuming a hot side inlet temperature of 140°F (the Mode 6 upper limit) and a component cooling water (CCW) shell side inlet temperature of 95°F. The heat exchanger was modeled as a counter flow heat exchanger with one shell pass and two tube passes. The heat exchanger capacity was calculated using the methods described in Chapter 7 of "Basic Heat Transfer," Kreith and Black, 1980, a standard heat transfer textbook. Under the stated conditions the capacity of the heat exchanger was calculated to be approximately 4.7 E+7 BTU per hour.

At 360 hours after shutdown the heat load consists of decay heat, LPSI pump heat and RCS metal mass with decay heat being the largest contributor. The decay heat was calculated using the proposed 1971 ANS decay heat standard which is consistent with the original design calculations for sizing the SDCS heat exchanger. The resultant heat load calculated at 360 hours after shutdown is approximately 2.8 E+7 BTU per hour. Thus the heat removal capacity for a 2200 gpm SDCS flow far exceeds the heat load.

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Similar calculations were done for different SDCS flows at various times after shutdown for both Mode 5 and 6. In the Mode 5 calculations, a hot side SDCS heat exchanger inlet temperature of 200°F was used. The results of these calculations are included in the attached table.

Additionally, as stated in SCE's April 11, 1986 response to Question 1, the SDCS can be operated at 3000 gpm with the RCS at mid-loop without vortexing. This provides additional conservatism relative to the proposed 2200 gpm flow requirement. During the current refueling outage RCS temperature was maintained at 110°F at approximately 10 days after shutdown using a 3000 gpm SDCS flow. PCN-3 was proposed to facilitate RCP seal replacement and steam generator nozzle dam removal in Mode 6 concurrent with reactor vessel head replacement following the completion of core alteration. Based on past experience, more than 360 hours would elapse from shutdown before Mode 6 mid-loop activities would be carried out.

If you have any questions regarding this information, please call me.

Very truly yours,

M. O. Medford

Enclosure

cc: Harry Rood, NRC (to be opened by addressee only)
F. R. Huey, USNRC Senior Resident Inspector, Units 1, 2 and 3

ENCLOSURE

SDCS FLOW REQUIREMENTS
FOLLOWING REACTOR SHUTDOWN

TIME AFTER SHUTDOWN	MODE 6 FLOW	MODE 5 FLOW
≥ 5 Hours	-----	≥ 5564 gpm
≥ 10 Hours	-----	≥ 3363 gpm
≥ 25 Hours	-----	≥ 2185 gpm
≥ 50 Hours	-----	≥ 1650 gpm
≥ 150 Hours	≥ 4005 gpm	≥ 1049 gpm
≥ 200 Hours	≥ 3500 gpm	-----
≥ 360 Hours	≥ 2030 gpm	-----

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