Attachment 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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MEMORANDUM TO: Conrad E. McCracken, Chief
Plant Systems Branch
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

FROM: for Edward J. Butcher, Chief
Probabilistic Safety Assessment Branch
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

SUBJECT: RISK IMPACT OF DAMPERS AND FANS--RESULTS OF A SMALL SAMPLE SURVEY

This memorandum responds to your request that the Probabilistic Safety Assessment Branch (SPSB) perform a first level assessment of the risk impact of dampers and fans. This subject was raised following a recent DET which found problems with tornado dampers at the South Texas Plant (STP). SPSB held discussions with appropriate staff members at four plants. Information exchanges were held with PRA and engineering personnel at the South Texas, TMI-1, and Grand Gulf plants, and with the Diablo Canyon PRA staff at Pacific Gas and Electric's San Francisco headquarters offices.

Damper and fan risk impact calculations, in terms of the core damage frequency reduction importance measure (internal events), were performed and provided by the South Texas, Grand Gulf, and Diablo Canyon PRA personnel. The risk reduction importance measure was used to assess the change in plant core damage frequency as a result of setting the probability of an individual failure event to zero. The pertinent results are presented below. Additionally, some qualitative damper/fan risk impact discussions are presented for the TMI-1, McGuire and Palo Verde plants.

Quantitative Plant PRA Risk Reduction Determinations

South Texas Units 1 or 2

A summary of the overall STP core damage frequency (CDF) fractional risk reduction importance determinations for fans and dampers, categorized by initiating event, is provided in Table 1.

CONTACT: M. L. Wohl, NRR/DSSA
504-1181

Table 1: Fractional Fan and Damper CDF Contributions (STP)

Initiating Event	Fractional Fan CDF Contribution	Fractional Damper CDF Contribution
Loss of CCW	4.0E-5	0.0
Loss of ECW	7.9E-5	3.5E-3
Loss of Control Room HVAC	2.25E-2	1.1E-4
Loss of EAB*HVAC	1.17E-1	4.5E-3
Total	1.39E-1	8.1E-3

*Electrical Auxiliary Building

As can be seen from Table 1, the chief risk contributors are fans supporting the Electrical Auxiliary Building HVAC (11.7%) and fans supporting the Control Room HVAC. The total fan contribution to the CDF is about 14%. The greatest damper contribution to the CDF comes from dampers supporting the EAB HVAC, but is less than half of one percent. The total damper contribution to the CDF is about 0.8%, quite small.

Grand Gulf

A summary of the most prominent Grand Gulf core damage frequency fractional risk reduction importance determinations for fans and dampers, categorized by component event, is shown in Table 2.

Component Event	Fractional CDF Contribution
Common Cause Failure of DG Rm. Dampers	9.39E-02
Motor-Op. Damper 1Y47F001A-A Fails to Open on Demand*	6.48E-02
Motor-Op. Damper 1Y47F002A-A Fails to Open on Demand*	6.48E-02
Common Cause Failure of SSW Pump House Dampers	5.70E-02
Outside Air Fan 1Y47C001A-A Unav.-Maint. (SSW Pump A)	4.20E-02
Motor-Op. Damper Unav. F0022A-Maintenance	1.70E-02
Motor-Op Damper 1Y47F001A-A Unav.-Maintenance	1.70E-02

*In standby service water (SSW) pump house

As can be seen from Table 2, two of the chief risk contributors are common cause failure of the diesel generator room dampers, about 9%, and common cause failure of the service water pump house dampers (5.7%). Also noteworthy are the risk contributions of the motor-operated dampers in the standby service water pump house failing to open on demand (6.5%).

Diablo Canyon Unit 1 or 2

A summary of the Diablo Canyon core damage frequency fractional risk reduction importance determinations for fans and dampers is provided in Table 3, categorized by initiating event.

Table 3: Combined Fan and Damper CDF Contributions (Diablo Canyon)

Initiating Event	Fractional CDF Contribution
Loss of Switchgear Ventilation	2E-02
Loss of Control Room Ventilation	5E-03
Loss of Auxiliary Saltwater	3E-03 *

*Contribution from fans only

As can be seen from Table 3, the chief risk-contributing initiating event in which dampers and fans are involved is Loss of Switchgear Ventilation, but the core damage frequency impact of this event is only 2%. In the switchgear area, the inverters constitute the largest heat load to be cooled.

Qualitative Damper/Fan Risk Impacts

Three Mile Island - 1 (TMI-1)

In the original TMI-1 PRA, Loss of Control Building Ventilation (the chief initiator in which dampers and fans are risk contributors) contributed 43% to the overall CDF from internal events. This was based on the assumption that the electrical power system would fail catastrophically (NUREG CR-5457) when the control building temperature exceeded 104° F. Subsequent licensee analyses indicated that Loss of Control Building Ventilation would not lead to failure of the electrical power system. The PRA review team confirmed this. Therefore, the CDF re-estimation used a value of zero for sequences with control building ventilation failure.

McGuire - Unit 2

According to NRC Inspection Report No. 94-12, the Unit 2B 500KV main step-up transformer oil cooling fan motors have failed on numerous occasions, requiring control room operations personnel to respond to avoid a plant transient. Sixty of these motors have been replaced on the Unit 2

transformer since 1987. Although the fan motors met the original design specification, the inspection report stated that revisions to the motor capacity resulted in an inability to handle heat loads encountered on the 2B main step-up transformer.

The limited maintenance performed on the transformer cooling coils was a contributing factor as well. The licensee plans to replace these existing motors with higher capacity motors and to evaluate the other site transformers. Additionally, the licensee plans to place increased emphasis on main transformer preventive maintenance. The inspectors concluded that the motor replacements and increased emphasis on preventive maintenance should increase the reliability of the main transformers.

Palo Verde Units 1, 2, and 3

The licensee had postulated that a mechanism by which failure of the 125 VDC Bus A could occur would be loss of HVAC to the DC battery chargers, resulting in subsequent battery draindown, as well as loss of two channels of vital AC in the same room. Failure of the two channels of AC would result in a plant trip. This would be a long term event; the 125 VDC batteries A would need to be depleted before the bus failed (about 2 hrs.). The licensee had been having problems with fire damper drops during testing of the fire suppression system which isolates HVAC from the DC battery chargers. The licensee believes the problem has been corrected. Additionally, temperature detectors have been installed in the DC equipment rooms, in addition to an alarm in the control room.

Results and Discussion

The results of the Level-1 PRA (core damage frequency) analyses for the South Texas (Table 1), Grand Gulf (Table 2), and Diablo Canyon (Table 3) plants do not indicate high CDF contributions from dampers and fans. For South Texas, the total fan contribution is about 1%. For Grand Gulf, common cause failure of the diesel generator room dampers represents about 9% of the total core damage frequency, whereas the contributions of motor-operated dampers in the standby servie water pump house failing to open on demand is about 6.5% for each of two dampers. These results are not unexpected, since the station blackout scenario and the standby service water system are highly important to risk at Grand Gulf. The chief risk-contributing initiating event in which dampers and fans are involved at Diablo Canyon is loss of switchgear ventilation, but the fractional CDF contribution is only about 2%.

The qualitative discussions of damper/fan risk contributing situations at the TMI-1, McGuire, Unit 2 and Palo Verde plants indicate that these situations have received proper attention and have been largely remedied.

Based on this small sample examination of (Level-1) risk contributions for dampers and fans, it does not appear that a generic concern regarding the risk impact of dampers and fans is justified. It must be stated that, in the PRA

analyses, not all dampers and fans were modeled (some fire dampers, electrical cabinet fans were not). It is possible that risk outlier situations involving dampers and fans exist at other plants, but, again, a generic concern does not seem warranted.

cc: G. Hubbard
W. Lefave
A. Dummer
K. Dempsey