



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 24, 1990

MEMORANDUM FOR: Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

FROM: Ashok C. Thadani, Director
Division of Systems Technology
Office of Nuclear Reactor Regulation

SUBJECT: PLANT-SPECIFIC BACKFIT ANALYSES FOR FIVE MARK I PLANTS
REGARDING THE INSTALLATION OF A HARDENED VENT CAPABILITY

Reference: Letter from Stephen D. Floyd (BWROG) to F. J. Miraglia, Jr.
(NRC) dated March 8, 1990, "Hardened Vent General Design
Criteria for Mark I Containment"

Background

In SECY-89-017 dated January 23, 1989, the staff presented to the Commission its recommendation concerning the Mark I Containment Performance Improvement (CPI) Program. One of the improvements that the staff recommended was the installation of a hardened vent capability. After reviewing the staff's recommendation, the Commission directed the staff on July 11, 1989, to begin imposing the requirement for a hardened vent capability for each BWR with a Mark I containment where a plant-specific backfit analysis supports such a backfit. For those licensees that on their own initiative elect to incorporate this plant improvement, the staff was directed to allow installation of a hardened vent under the provisions of 10 CFR 50.59. For the other licensees that do not intend to install a hardened vent voluntarily, the staff was directed to perform a plant-specific backfit analysis for each of these Mark I plants to evaluate the efficacy of requiring the installation of hardened vents.

The staff issued Generic Letter (GL) 89-16 dated September 1, 1989, to each of the BWR licensees with a Mark I containment to inform them of the direction given by the Commission regarding the hardened vent issue. For those plants not electing to voluntarily install hardened vents, the staff requested in GL 89-16 that the licensee provide a cost estimate for installation of the hardened vent. In response to GL 89-16, all Mark I licensees except four (involving five plants) have indicated that they intend to install the hardened vent voluntarily under the provisions of 10 CFR 50.59. Therefore, the staff performed a plant-specific backfit analysis for each of these five plants, namely, Dresden Units 2 and 3, Millstone Unit 1, Oyster Creek, and Fitzpatrick. The analyses were performed by Office of Nuclear Regulatory Research (RES) and the Office of Nuclear Reactor Regulation (NRR) jointly, in accordance with NRR Office Letter No. 901, "Procedures for Managing Plant-Specific Backfits." For plants volunteering to install the hardened vent system, the staff has concluded that the criteria developed by the BWROG (Reference) are appropriate and could also be used for these five plants.

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B/47

Discussion

We have followed backfit procedures and concluded that this improvement provides a substantial safety benefit and that the cost is justified for the following reasons:

1. Safety Benefit

- a. A core melt, combined with a reactor vessel and containment failure, would release a significant amount of fission products to the environment. The survivability of the containment, which acts as the last barrier for an uncontrolled release of radiation, is increased with venting. Although venting of the containment is currently included in BWR emergency operating procedures, it generally uses ductwork with a low design pressure. Venting under high-pressure severe accident conditions could fail this ductwork, release the containment atmosphere into the reactor building, and damage equipment needed for accident recovery. Venting through this ductwork is likely to hamper or complicate post-accident recovery activities and is therefore viewed by the staff as reducing the safety benefit. The installation of a reliable hardened wetwell vent allows for controlled venting through a path that would significantly reduce the fission product release.
- b. The addition of hardened vents prevents the majority of loss of decay heat removal capability sequences (TW) from resulting in core melt. These hardened vents greatly reduce the likelihood of a core melt from TW sequences to a frequency ranging from $1.4E-5$ to $4.5E-5$ per reactor year and therefore, reduce the risks to the public to amounts ranging from 35 to 65.5 man-rem per reactor year. For other sequences where core melt is predicted, venting could be effective in delaying containment failure and in mitigating the release of fission products.

2. Cost Effective

The following list summarizes the estimated value impact ratios for the five plants. These estimates contain the additional benefit resulting from the 20-year life extension and the averted costs (cleanup and repair of onsite damage, and replacement power).

a. Dresden 2	Value Impact Ratio (man-rem per million dollars)
Remaining Life	1005
With 20-year Life Extension	2010
With Averted Cost	1266
With Averted Costs and Life Extension	2624

	Value Impact Ratio (man-rem per million dollars)
b. Dresden 3	
Remaining Life	1055
With 20-year Life Extension	2060
With Adverted Cost	1333
With Averted Costs and Life Extension	2688
c. Millstone 1	
Remaining Life	671
With 20-year Life Extension	1310
With Adverted Cost	819
With Averted Costs and Life Extension	1644
d. Oyster Creek	
Remaining Life	702
With 20-year Life Extension	1440
With Adverted Cost	796
With Averted Costs and Life Extension	1667
e. FitzPatrick	
Remaining Life	2408
With 20-year Life Extension	4335
With Adverted Cost	-15366*
With Averted Costs and Life Extension	-17609*

*Because the value-impact ratio is defined as the ratio of the averted population dose and the cost differential between the installation of hardened vent and the averted cost, the negative numbers indicate that the averted costs exceed the installation costs. Thus, at FitzPatrick the installation is cost-effective even when considering the economic benefit alone, without considering the safety benefit.

If the value impact ratio based only on 1000 man-rem per million dollars were used, the results would be indeterminant for Millstone 1 and Oyster Creek. However, several other considerations summarized herein lead us to conclude that the installation of the hardened vent should be required for these plants.

The staff performed a generic environmental assessment (EA) of the installation of the hardened vent at Mark I plants. In the draft EA, the staff concluded that the installation of a hardened vent capability will have no significant radiological and non-radiological effects on the environment. The staff has concluded that the generic EA is applicable to all plants with Mark I

containments and that any plant-specific design features will have little bearing on the conclusion with respect to the environmental effects. This draft generic EA will be issued by the end of May 1990 for public comment. The final EA will incorporate any relevant public comments, but is expected to be very similar to the draft EA.

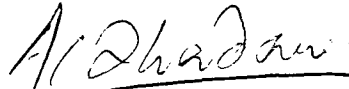
Conclusion

The staff concludes that a substantial increase in the public safety can be derived from the installation of hardened vent capability and that the results of the cost-benefit analysis support it. This conclusion is valid for all five plants in question.

Recommendation

Based on the plant-specific analyses, we propose to send a copy of our plant-specific analysis to each of the five plants as stated in the attached letters and to allow the licensees to inform the staff of their intent within 30 days of receipt of the letter. If any licensee chooses not to commit to install a hardened vent, the staff will pursue an order requiring the backfit under the provision of 10 CFR 50.109. Since the Committee for Review of Generic Requirements (CRGR) had previously reviewed the generic study in SECY-89-017, we believe additional review by CRGR on these plant-specific analyses is not necessary.

Enclosed are five plant-specific analyses and associated letters. Your approval for sending these letters and analyses to the licensees is requested.



Ashok C. Thadani, Director
Division of Systems Technology
Office of Nuclear Reactor Regulation

Approved: _____

T. Murley

Enclosures:

1. Letter to Commonwealth Edison
and Dresden 2 - Backfit Analysis
2. Letter to Commonwealth Edison
and Dresden 3 - Backfit Analysis
3. Letter to GPU Nuclear Corporation
and Oyster Creek - Backfit Analysis
4. Letter to Northeast Utilities
and Millstone 1 - Backfit Analysis
5. Letter to New York Power Authority
and FitzPatrick - Backfit Analysis

cc: F. Miraglia
W. Russell
G. Holahan
M. Thadani

Table I - Backfit Analysis for Proposed Hardened Vent Capability

Plant Group	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	
No. Plant Name	Date of Commercial Operation	Years of Operation Remaining	Population (0-50 miles) (1970)2	TM CMF 3	"Strip" Factor (SST1)4	Gross Dose (PB2*D)3	Man-Rem per RY (C+E)	Man-Rem Saved (A+F)	Install Costs (\$M)5&6	Value-Impact (G/H)	* Vop 7	Vph 7	Voha 7	Repl Pwr (\$ per Year)	* Vop & Repl Pwr (G/[H-N])	
4 Dresden 2	1970	20	6,305,000	1.40E-05	0.8346304	3.59E+06	50.2	1004.9	1.00	1005	\$76,520	\$1,004,895	\$5,880	\$169,317,660	\$206,082	1266
4 Dresden 2	1970	40	6,305,000	1.40E-05	0.8346304	3.59E+06	50.2	2009.8	1.00	2010	\$86,876	\$2,009,790	\$11,760	\$169,317,660	\$233,972	2624
4 Dresden 3	1971	21	6,305,000	1.40E-05	0.8346304	3.59E+06	50.2	1055.1	1.00	1055	\$77,660	\$1,055,140	\$6,174	\$168,367,200	\$208,414	1333
4 Dresden 3	1971	41	6,305,000	1.40E-05	0.8346304	3.59E+06	50.2	2060.0	1.00	2060	\$87,030	\$2,060,035	\$12,054	\$168,367,200	\$233,561	2688
2 Fitzpatrick	1975	25	843,700	4.50E-05	0.3385214	1.46E+06	65.5	1637.6	0.68	2408	\$261,105	\$1,637,597	\$23,625	\$201,248,590	\$786,575	-15366
2 Fitzpatrick	1975	45	843,700	4.50E-05	0.3385214	1.46E+06	65.5	2947.7	0.68	4335	\$281,294	\$2,947,675	\$42,525	\$201,248,590	\$847,395	-17609
4 Millstone 1	1971	21	2,591,600	1.40E-05	0.5836576	2.51E+06	35.1	737.9	1.10	671	\$77,660	\$737,860	\$6,174	\$156,961,680	\$199,556	819
4 Millstone 1	1971	41	2,591,600	1.40E-05	0.5836576	2.51E+06	35.1	1440.6	1.10	1310	\$87,030	\$1,440,584	\$12,054	\$156,961,680	\$223,634	1644
4 Oyster Creek	1969	19	3,290,000	1.40E-05	0.9202335	3.96E+06	55.4	1052.6	1.50	702	\$75,261	\$1,052,563	\$5,586	\$135,598,960	\$177,313	796
4 Oyster Creek	1969	39	3,290,000	1.40E-05	0.9202335	3.96E+06	55.4	2160.5	1.50	1440	\$86,706	\$2,160,524	\$11,466	\$135,598,960	\$204,277	1667

* Discount rate: 10 %

Analysis Date -> 16-Apr-90 Time -> 14:03

- 1) Source: USNRC NUREG-1350, dated March 1989
- 2) Source: USNRC NUREG-0348
- 3) Source: Memorandum from B.W. Sheron, dated October 19, 1989, to A.C. Thadani, "Reduction in Risk from the Addition of Hardened Vents in BWR Mark I Reactors"
- 4) Source: USNRC NUREG/CR-2723, dated September 1982 (except: Hope Creek = (Saleml/PBAPS)*(MMth-hc/MMth-s1))
- 5) Source: Generic Letter 89-16, dated September 1, 1989, "Installation of Hard Wetwell Vent"
- 6) Source: Installation costs from memorandum from J.G. Partlow to T.E. Murley, dated November 9, 1989, "Licensees' Responses to Generic Letter 89-16 Related to Installation of Hardened Wetwell Vent"
- 7) Source: USNRC NUREG/CR-3568, dated December 1983, pages 3.11-3.12, 3.29-3.31, 3.16-3.18
- 8) The numbers in the column titles refer to source of information number above.
- 9) The letter in brackets, (A), are the column identifiers and the letters in brackets, (C+E), are the equations using the column identifiers for references. The "Strip" Factor is the scaled man-rem SST1 number from the Strip Report divided by the similar number for Peach Bottom Unit 2 to account for the site differences.
- 10) Negative numbers in Column (D) indicate that the onsite costs exceed the installation costs. Therefore the proposed modification exceeds the \$1000/man-rem criteria and may be imposed.
- 11) Vop = value of avoided onsite property damage (\$)
 Vph = value of public health risk avoided for net-benefit method (\$)
 Voha = value of occupational health risk due to accident avoided (\$)

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ORIGINAL SIGNED BY A. C. THADANI

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 CLi
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 SVarga
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cc: F. Miraglia
W. Russell
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M. Thadani

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no legal objection

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