August 6, 1997 SECY-97-180

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: RESPONSE TO STAFF REQUIREMENTS MEMORANDUM OF MAY 28, 1997, CONCERNING BRIEFING ON IPE INSIGHT REPORT

PURPOSE:

To inform the Commission of the planned followup activities that are based on IPE results and on the industry's average cost per person-rem averted in satisfying Station Blackout requirements.

SUMMARY:

Based on IPE results, the staff is planning followup activities, which will be detailed in a plan that will be final in December 1997. Further, in response to this SRM, the staff has performed a gross scoping analysis of the costs and benefits associated with the Station Blackout rule. The staff's analysis concludes that, on average, the industry's response to the Station Blackout rule results in costs of slightly less than $5000 per person-rem averted. Given that the value or benefit of averting a person-rem is in excess of $5000 (averted health effects plus averted offsite and onsite property effects), the staff's analysis suggests that, on average, the Station Blackout costs and benefits were essentially the same. Furthermore, the overall average cost per person-rem averted is heavily skewed by a relatively few plants that spent $5 to $10 million per reactor. Most reactors were estimated to have incurred costs of less than $1 million, and thus, their corresponding cost to avert a person-rem was considerably less. For example, the staff's analysis concludes that more than 70 percent of the reactors incurred costs of less than $1000 per person-rem averted. In addition, a number of plants have received, or are in the process of receiving, credit for Station Blackout modifications in

terms of extensions in allowed outage times for diesel generators. These credits represent an economic benefit to the licensee because they reduce the need to shut down the plant to perform maintenance on the diesels and they promote a maintenance process that is more cost effective. These benefits have only partially been factored into our cost benefit analysis, and thus, the staff's estimate tends to overestimate the true cost of averting a person-rem.

BACKGROUND:

In the staff requirements memorandum (SRM) of May 28, 1997, concerning briefing on IPE insight report, the Commission directed the staff to "...provide the scope and schedule of activities related to using IPE results to assess regulatory effectiveness in resolving major safety issues. The Commission specifically requested that the staff provide an estimate of the average cost to respond to the Station Blackout rule per person-rem averted in achieving an average reduction in core damage frequency of 2E-5/RY."

DISCUSSION:

Follow-Up Activities Based Upon IPE Results

As reported in the PRA Implementation Plan, the staff is planning followup activities based on IPE results (item 1.7 of the plan). These followup activities will include assessing the effectiveness of the resolution of major safety issues (e.g., reactor coolant pump seal integrity, Station Blackout rule, ATWS) to see whether additional generic action is warranted, assessing whether any new generic safety issues warrant investigation or research, and assessing the need for plant-specific actions based on IPE results. Criteria are being developed to guide the identification of those plant-specific items to be included in the followup activities. The criteria would include factors such as whether any event sequences exceed the criteria for cost benefit analyses contained in the Regulatory Analysis Guidelines, how close the plants are to the Safety Goal Quantitative Health Objectives and why, and whether licensee actions discussed in the IPE submittal were in fact completed. NRR and RES are also working on defining their respective roles in implementing the IPE followup activities. The scope and schedule of these activities will be detailed in a plan that will be final in December 1997.

Station Blackout Rule

Average Cost

An NRR Station Blackout tracking system was used to identify the plant-specific requirements and modifications performed by industry to satisfy the Station Blackout rule. This data base includes results for 74 nuclear power plants representing 108 active power reactors. For this analysis, the requirements and modifications were judged to include one or more of seven cost elements, for which generic or average cost estimates were developed. Attachment 1 identifies the cost elements, corresponding dollar estimates, and the basis for each of the cost estimates. Appendix 1 provides more detailed plant-specific data. Based on this analysis, the staff estimates an average cost of about $2.2 million per reactor. The staff assumes that, in general, Station Blackout requirements were completed in 1993. This translates to an average remaining useful life per reactor of 24 years. If one assumed that the $2.2 million average reactor cost were evenly distributed over the reactor's remaining life, the 24-year levelized annual cost per reactor, based on a 7 percent real discount rate, would be equivalent to about $190,000 per reactor year. For sensitivity analysis purposes, if one assumed that half the reactor population opted for an additional 20-year license renewal term, the average remaining reactor life would be approximately 34-years, and the levelized annual cost would be about $170,000 per reactor year.

Benefit - Averted Person-Rem

In NUREG-1109, "Regulatory/Backfit Analysis for the Resolution of Unresolved Safety Issue A-44, Station Blackout," the average population dose associated with a severe accident caused by a Station Blackout event is estimated at about 2 million person-rem per reactor (within a 50-mile radius of the site).

Based on the Commission's assumption that the Station Blackout rule achieved an "average reduction in core damage frequency of 2E-5/RY," the average benefit per reactor year would be approximately 40 person-rem averted (2 million person-rem x 2E-5/RY).

Dollars per Person-Rem Averted

The average cost per person-rem averted on an annual per reactor basis is $190,000/40 person-rem averted = $4,750 per person-rem averted.

This result, however, does not fully attribute other values or benefits to the Station Blackout requirements; actually, there are substantial economic benefits being realized by licensees. As a result of installing alternate power (e.g., additional diesel generators), licensees have been granted relaxations in their limiting condition of operation (LCO), which affects the allowed outage time on their diesels. With these relaxations, plants can remove their diesels from operation for an additional 4 to 11 days without having to shut down the plant. Since a typical diesel requires a major overhaul every 5 to 10 years on average, a licensee can avoid 1 to 2 days per year of incremental downtime. Given that the average replacement energy costs for a typical reactor are $500,000 per day, the economic savings per reactor-year are $0.5 to $1.0 million. To date, 4 plants have received such LCO extensions, and another 20 are currently under review.

The foregoing analysis is based on a number of simplifying assumptions and conditions; therefore, the relevance and perspective of these results need to be considered in the context of these limiting factors. The staff acknow-ledges that its cost estimates are only gross approximations. For example, no attempt was made to survey the industry. In certain instances, individual plants were contacted and single point estimates were assumed representative for all reactors that had committed to similar fixes, even though plant-specific conditions could result in significant cost variability. The cost estimates are also somewhat subjective because certain modifications probably satisfied joint objectives and requirements, and these modifications should not necessarily be totally ascribed to the Station Blackout rule. The staff attempted to partially address this concern in costing the emergency (safetygrade) diesel generators. As for benefits, average values were used for the population dose and the reduction in core damage frequency, even though the regulatory analysis suggests that the reactor-specific variability for each of these terms is a factor of ñ 4 from the average value. This suggests that a good deal of caution should be attached to the differences reported between reactors as depicted in Attachment 2.

CONCLUSION:

Staff analyses on the value of averting an accident suggest that the cumulative benefits are approximately $5500 per person-rem in terms of averted health effects and averted off-site and onsite property effects.

This estimate is based on the following three factors: First, in 1995, the Commission adopted a conversion factor of $2000 as the monetary value of the health consequences associated with radiological exposure (see NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," November 1995, p. 22). Second, the mean offsite property damage costs are estimated to be $3000 per person-rem averted (see NUREG/CR-6349, "Cost-Benefit Considerations in Regulatory Analysis," October 1995, Table 5-4, pp. 5-7). Lastly, based on estimates developed in the "Regulatory Analysis Technical Evaluation Handbook," onsite property costs are $500 per person-rem averted for a generic reactor with a remaining life of 24 years (see NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," January 1997, pp. 5.40-5.49).

By contrast, the Station Blackout rule is averting a person-rem at a cost of about $4,750. This result, however, does not give full credit for other sizable economic benefits and it is heavily influenced by a relatively few reactors whose cost to satisfy the Station Blackout requirements exceeded $10 million per reactor. Most reactors were estimated to have incurred costs of less than $1 million, and the corresponding cost to avert a person-rem was considerably less.

Attachment 2 shows the distribution of reactors by the average cost per reactor, the average cost per person-rem averted, and the cumulative percentage of reactors with costs equal or less than the corresponding reference cost estimate. This calculation suggests that about 70 percent of
the reactors incurred costs of less than $1000 per person-rem averted, and 75
percent incurred costs of less than $2000 per person-rem averted.

COORDINATION

The Office of the General Counsel has reviewed this paper and has no legal
objection. This paper has been coordinated with the Office of the Chief Financial Officer and the Chief Information Officer for information.

L. Joseph Callan

Executive Director

for Operations

Attachments:
1. Cost Elements for Station Blackout Requirements
2. Distribution of Reactors by Cost
3. SRM dtd. 5/28/97
4. Appendix 1 - Plant Specific Data

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ATTACHMENT 1 - COST ELEMENTS FOR STATION BLACKOUT REQUIREMENT

COST ELEMENT	COST ESTIMATE ($THOUSAND)
A. Assess plant's capability to cope with station blackout and develop procedures and training	$350 per reactor
B. Add Non-class-IE diesel generator	$10,000 per site
C. Add emergency diesel generator	$10,000 per site
D. New batteries	$650 per site1
E. Add Non-class-IE gas turbine	$7,000 per site
F. Battery charger	$850 per site
G. Minor modifications (e.g. crosstie, valve modifications, circuit breakers)	$100 per site

ATTACHMENT 2- DISTRIBUTION OF REACTORS BY COST TO RESPOND TO STATION BLACKOUT RULE

Number of Reactors	CUMULATIVE PERCENTAGE	Average Cost Per Reactor	Average Cost Per Person-Rem Averted
38	35%	$350,000	

$760	16	50%	$400,000	
$870	23	71%	$450,000	
$980	2	73%	$675,000	
$1470	2	75%	$775,000	$1690
	1	76%	$1,000,000	
$2180	1	77%	$1,200,000	$2620
	3	80%	$5,015,000	$10,930
	4	83%	$5,350,000	$11,660
	4	87%	$5,400,000	$11,770
	10	96%	$10,350,000	$22,560
	4	100%	$10,400,000	$22,670
TOTAL	108			
WEIGHTED AVERAGE			$2,206,000	$4750

IN RESPONSE, PLEASE REFER TO: M970507

May 28, 1997

MEMORANDUM TO: L. Joseph Callan
Executive Director for Operations

FROM: John C. Hoyle, Secretary /s/

SUBJECT: STAFF REQUIREMENTS - BRIEFING ON IPE INSIGHT REPORT, 2:00 P.M., WEDNESDAY, MAY 7, 1997, COMMISSIONERS' CONFERENCE ROOM, ONE WHITE FLINT NORTH, ROCKVILLE, MARYLAND (OPEN TO PUBLIC ATTENDANCE)

The Commission was briefed by the NRC staff on the Individual Plant Examination (IPE) insight report. The Commission asked the staff to expedite activities in the following areas: (1) using IPE results to prioritize inspection activities; (2) improving regional capabilities for the use of PRA

and risk insights; and (3) providing related inspector training.
(EDO) (SECY Suspense:TBD)

The Commission asked the staff to provide the scope and schedule of activities related to using IPE results to assess regulatory effectiveness in resolving major safety issues. The Commission specifically requested that the staff provide an estimate of the average cost to respond to the Station Blackout rule per person-rem averted in achieving an average reduction in core damage frequency of 2E-5/RY. These activities should be coordinated with the regulatory effectiveness organization.
(EDO) (SECY Suspense:6/27/97)

After the IPE database has been placed on the Internet, the staff should consider allowing licensees to update their IPEs voluntarily to reflect changes in plant configuration.

cc: Chairman Jackso
Commissioner Rogers
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
OGC
CFO
CIO
OCA
OIG
Office Directors, Regions, ACRS, ACNW, ASLBP (via E-Mail)
PDR - Advance
DCS - P1-17

APPENDIX 1 - PLANT-SPECIFIC DATA

PLANTS:	COST ELEMENTS:1	COST ESTIMATE (PER REACTOR-$THOUSAND)
ARKANSAS 1, 2	A, B, G	5,400
BEAVER VALLEY 1, 2	A, G	400
BIG ROCK POINT	A	

350

BRAIDWOOD 1, 2 A

350

BROWNS FERRY 2 A

350

BROWNS FERRY 1, 3 A

350

BRUNSWICK 1, 2 A, G 400

BYRON 1, 2 A

350

CALLOWAY A

350

CALVERT CLIFFS 1, 2 A, B, C

10,350

CATAWBA 1, 2 A

350

CLINTON A

350

COMANCHE PEAK 1, 2 A

350

COOK 1, 2 A

350

COOPER A

350

CRYSTAL RIVER 3 A, G 450

DAVIS BESSE A, B

10,350

DIABLO CANYON 1, 2 A, C

5,350

DRESDEN 2,3 A, B(2)

10,350

DUANE ARNOLD A, G 450

FARLEY 1, 2 A, G 400

PLANTS: COST ELEMENTS:1 COST ESTIMATE

(PER REACTOR-$THOUSAND)

FERMI 2 A

350

FITZPATRICK A, G 450

FORT CALHOUN A

350

GINNA A
350

GRAND GULF A

350

HADDAM NECK A, G 450

HARRIS A, G
450

HATCH 1, 2 A, F

775

HOPE CREEK A, G 450

INDIAN POINT 2 A, G 450

INDIAN POINT 3 A

350

KEWAUNEE A, G 450

LASALLE 1, 2 A, D

675

LIMERICK 1, 2 A

350

MAINE YANKEE A

350

MCGUIRE 1, 2 A

350

MILLSTONE 1 A, G 450

MILLSTONE 2 A, G 450

MILLSTONE 3 A, B

10,350

MONTICELLO A, G 450

NINE MILE POINT 1 A, D

1,000

NINE MILE POINT 2 A

350

NORTH ANNA 1, 2 A, B, G 5,400

OCONEE 1, 2, 3 A

350

OYSTER CREEK A, G

450

PLANTS: COST ELEMENTS:1 COST ESTIMATE

(PER REACTOR-$THOUSAND)

PALISADES A, G 450

PALO VERDE 1, 2, 3 A, E(2)

5,015

PEACH BOTTOM 2, 3 A, G 400

PERRY A, G

450

PILGRIM A, G

450

POINT BEACH 1, 2 A, C(2), G 10,400

PRAIRIE ISLAND 1, 2 A, C(2)

10,350

QUAD CITY 1, 2 A, B(2)

10,350

RIVER BEND A, G 450

ROBINSON 2 A, G 450

SALEM 1, 2 A, G 400

SAN ONOFRE 2, 3 A

350

SEABROOK 1 A

350

SEQUOYAH 1, 2 A, G 400

SOUTH TEXAS 1, 2 A

350

ST. LUCIE 1 A, G
450

SUMMER A, F
1,200

SURRY 1, 2 A, B

5,350

SUSQUEHANNA 1, 2 A

		350
THREE MILE ISLAND 1	A, G	450
TURKEY POINT 3, 4	A, C(2), G	10,400
VERMONT YANKEE	A, G	450
VOGTLE 1, 2	A, G	400
WATERFORD 3	A, G	450

PLANTS:	COST ELEMENTS:1	COST ESTIMATE (PER REACTOR-$THOUSAND)
WATTS BAR 1	A	350
WNP-2	A, G	450
WOLF CREEK	A	350
ZION	A, G	450

NOTE 1

Cost Element A	Assess plant's capability to cope with station blackout and develop procedures and training
Cost Element B	Add Non-class-IE diesel generator
Cost Element C	Add emergency diesel generator
Cost Element D	Add New batteries
Cost Element E	Add Non-class-IE gas turbine

Cost Element F	Battery charger
Cost Element G	Minor modifications (e.g. crosstie, valve modifications, circuit breakers)

B(2), C(2), or E(2) indicates that two diesels or turbines were added at the site.