



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

NOV 01 1985

PDR

MEMORANDUM FOR: Chairman Palladino
Commissioner Roberts
Commissioner Asselstine
Commissioner Bernthal
Commissioner Zech

FROM: William J. Dircks
Executive Director for Operations

SUBJECT: USI A-44, STATION BLACKOUT

The staff has received questions on USI A-44, Station Blackout, from Commissioners Asselstine, Bernthal, Roberts and Zech. The enclosure to this memo provides the staff's response to these questions.

(Signed) William J. Dircks

William J. Dircks
Executive Director for Operations

Enclosure:
As Stated Above

cc w/encl:
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QUESTION 1. BOTH THE ACRS AND THE CRGR RECOMMEND THAT GREATER EMPHASIS BE PLACED ON COORDINATING THE RESOLUTION OF OTHER SAFETY ISSUES WITH THE STATION BLACKOUT ISSUE. IS IT NECESSARY AND AS COST EFFECTIVE TO APPROACH THE PROBLEM PIECEMEAL RATHER THAN AFTER THE OTHER ISSUES ARE RESOLVED?

ANSWER.

ON FEBRUARY 26, 1985, THE STAFF MET WITH AN ACRS SUBCOMMITTEE TO DISCUSS THE PROPOSED RESOLUTION OF USI A-44 AND TO ADDRESS PREVIOUS COMMENTS FROM ACRS. AFTER THIS MEETING, THE ACRS SENT A LETTER TO THE EDO DATED MARCH 12, 1985, STATING THAT THEY BELIEVE THE NRC STAFF HAS TAKEN APPROPRIATE ACCOUNT OF ACRS RECOMMENDATIONS INCLUDING A RECOMMENDATION TO COORDINATE RELATED ISSUES. THE COORDINATION BETWEEN USI A-44 AND RELATED GENERIC SAFETY ISSUES IS DISCUSSED ON PAGES 30 THROUGH 37 OF NUREG-1109. WE BELIEVE THAT THIS COORDINATION WILL BE EFFECTIVE IN ACCOMPLISHING THE FOLLOWING OBJECTIVES: (1) A TIMELY RESOLUTION OF IMPORTANT GENERIC SAFETY ISSUES, AND (2) AVOIDING INCONSISTENT AND/OR OVERLAPPING REQUIREMENTS AND THE EXPENDITURE OF UNNECESSARY RESOURCES BY BOTH NRC AND INDUSTRY.

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QUESTION 2. THE CRGR RECOMMENDS THAT A ZERO-HOUR DURATION CATEGORY BE INCLUDED, YET THE STAFF HAS ELECTED ONLY FOUR-HOUR AND EIGHT-HOUR CATEGORIES. WHY?

ANSWER.

THE DRAFT REGULATORY GUIDE PROVIDES RECOMMENDATIONS FOR MINIMUM STATION BLACKOUT COPING CAPABILITY OF FOUR OR EIGHT HOURS DEPENDING ON SPECIFIC PLANT CHARACTERISTICS. THE APPROACH WAS TAKEN SO THAT LICENSEES WOULD HAVE A RELATIVELY SIMPLE METHOD TO DETERMINE A STATION BLACKOUT COPING CAPABILITY TO COMPLY WITH THE PROPOSED RULE. USE OF THIS METHOD WOULD RESULT IN STATION BLACKOUT BEING A RELATIVELY SMALL CONTRIBUTOR TO TOTAL CORE MELT FREQUENCY. OTHER METHODS COULD BE USED BY LICENSEES TO DETERMINE AN ACCEPTABLE COPING CAPABILITY. IN FACT, THE GUIDE SPECIFICALLY STATES THAT TIMES OTHER THAN FOUR OR EIGHT HOURS COULD BE ACCEPTABLE.

THE REASONS FOR NOT INCLUDING A "ZERO-HOUR" CATEGORY ARE DISCUSSED BELOW.

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QUESTION 2. (CONTINUED)

- O A REVIEW OF THE TECHNICAL ANALYSIS AND ESTIMATES OF CORE MELT FREQUENCIES AND THE RESULTING SEVERE CONSEQUENCES FOR STATION BLACKOUT EVENTS, INCLUDING UNCERTAINTIES, LED TO THE STAFF'S RECOMMENDATION THAT, FOR ADDITIONAL DEFENSE-IN-DEPTH, ALL PLANTS SHOULD BE ABLE TO COPE WITH A STATION BLACKOUT FOR SOME MINIMUM DURATION AND THAT PROCEDURES AND TRAINING FOR STATION BLACKOUT EVENTS OF THAT DURATION BE IMPLEMENTED.
- O EVEN FOR PLANTS WITH UNUSUALLY HIGH REDUNDANCY OF ONSITE EMERGENCY AC POWER SYSTEMS WHICH MIGHT BE INCLINED TO JUSTIFY A ZERO-DURATION, COMMON MODE FAILURES CAN NOT BE IGNORED. SUCH FAILURES HAVE OCCURRED IN THE PAST, AND THEY CAN NOT BE ELIMINATED ENTIRELY IN THE FUTURE. THE PROPOSED RESOLUTION OF USI A-44 ORIGINALLY INCLUDED GUIDANCE TO REVIEW THE OFFSITE AND ONSITE AC POWER SYSTEMS FOR POTENTIAL SINGLE POINT VULNERABILITIES TO MINIMIZE COMMON MODE FAILURES. CRGR RECOMMENDED THAT THIS BE TAKEN OUT OF THE "REGULATORY POSITION" SECTION OF THE REGULATORY GUIDE BECAUSE LICENSEES HAVE ALREADY BEEN REQUIRED TO PROVIDE REDUNDANT AND INDEPENDENT ONSITE EMERGENCY AC POWER SYSTEMS. THE STAFF AGREED WITH THE RECOMMENDATION.

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QUESTION 2. (CONTINUED)

HOWEVER, IT IS IMPORTANT TO NOTE THAT EVEN IF COMMON MODE FAILURES FROM COMPONENT OR SYSTEM DESIGN ARE REDUCED TO THE EXTENT PRACTICAL, OTHER WAYS OF COMMON MODE FAILURE INCLUDING MAINTENANCE AND EXTERNAL EVENTS STILL REMAIN AS A THREAT. THE STAFF IS AWARE, THROUGH LERS AND OTHER REPORTS, THAT SINGLE POINT VULNERABILITIES HAVE BEEN IDENTIFIED, AND WHEN IDENTIFIED, THEY ARE CORRECTED. IF UNCORRECTED OR UNIDENTIFIED, SUCH FAILURES COULD LEAD TO LARGER ESTIMATES OF CORE MELT FREQUENCY AT SPECIFIC PLANTS THAN ASSUMED IN THE STAFF'S ESTIMATES IN NUREG-1032.

- O ALL PLANTS ALREADY HAVE THE ABILITY TO COPE WITH A STATION BLACKOUT FOR SOME PERIOD OF TIME, MEETING SOME MINIMUM "NON-ZERO" DURATION WOULD NOT BE DIFFICULT TO SHOW.

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QUESTION 3. THE STAFF HAS CONCLUDED, ACCORDING TO SLIDE 6, THAT THE RULE WOULD PROVIDE A SUBSTANTIAL INCREASE IN THE OVERALL PROTECTION OF THE PUBLIC HEALTH AND SAFETY. PAGE 1 OF THE STAFF'S REGULATORY ANALYSIS (ENCLOSURE 2 TO SECY-85-163) INDICATES THAT FOR SOME PLANTS STATION BLACKOUT CAN BE AN IMPORTANT CONTRIBUTOR TO A TOTAL RISK THAT IS ITSELF SMALL. PAGE 2 INDICATES THAT THIS RISK COULD BE AS HIGH AS 10^{-4} PER REACTOR YEAR FOR SOME PLANTS. PAGE 3 INDICATES THAT THE GENERAL OBJECTIVE OF THE PROPOSED RULE IS TO REDUCE THE TOTAL RISK BY MAKING STATION BLACKOUT A RELATIVELY SMALL CONTRIBUTOR. IF, AS I UNDERSTAND TO BE THE CASE, OTHER RELATIVELY IMPORTANT CONTRIBUTORS TO RISK WILL CONTINUE TO EXIST AFTER THIS ONE IS REDUCED, HOW DOES REDUCING THIS ONE ALONE PROVIDE A SUBSTANTIAL INCREASE IN OVERALL PROTECTION?

ANSWER.

THE PROPOSED RESOLUTION OF USI A-44 WOULD PROVIDE A SUBSTANTIAL INCREASE IN PROTECTION FROM STATION BLACKOUT EVENTS. SINCE STATION BLACKOUT CAN BE A DOMINANT CONTRIBUTOR TO CORE DAMAGE

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QUESTION 3. (CONTINUED)

FREQUENCY, AND CONTAINMENT HEAT REMOVAL SYSTEMS ARE UNAVAILABLE WITHOUT AC POWER, THERE WOULD BE AN OVERALL INCREASE IN PUBLIC HEALTH AND SAFETY. IT IS CORRECT THAT OTHER NON-STATION BLACKOUT RISK CONTRIBUTORS WOULD CONTINUE TO EXIST. FOR ADDITIONAL DISCUSSION ON THIS QUESTION, SEE THE RESPONSE TO QUESTION NUMBER 1.A FROM COMMISSIONER ZECH.

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QUESTION 4. IT APPEARS THAT THE STAFF IN MAKING ITS COST-BENEFIT ANALYSIS HAS ASSUMED THAT ALL PLANTS CAN PRESENTLY COPE WITH A STATION BLACKOUT FOR ONLY TWO HOURS. DOESN'T THAT ASSUMPTION BIAS THE COST-BENEFIT ANALYSIS AGAINST PLANTS ALREADY HAVING A LONGER COPING CAPABILITY?

ANSWER.

ALTHOUGH PLANTS MAY HAVE THE CAPABILITY TO COPE WITH A STATION BLACKOUT FOR A SPECIFIC DURATION (I.E., "HAVING THE CAPABILITY" MEANS NO HARDWARE MODIFICATIONS ARE NECESSARY TO COPE FOR THAT PERIOD OF TIME), CERTAIN OPERATOR ACTIONS WOULD BE NECESSARY TO ASSURE THE PLANT COULD SUCCESSFULLY COPE WITH, AND RECOVER FROM, A STATION BLACKOUT. WITHOUT ADEQUATE PROCEDURES AND TRAINING, THE LIKELIHOOD OF PROPER OPERATOR ACTIONS IS UNCERTAIN. THEREFORE, THE STAFF ASSUMED IN ITS COST-BENEFIT ANALYSIS THAT PROCEDURES AND TRAINING WOULD MINIMIZE OPERATOR ERRORS AND THEREBY WOULD SIGNIFICANTLY IMPROVE THE PROBABILITY OF SUCCESSFULLY COPING WITH A STATION BLACKOUT EVENT. THIS ASSUMPTION DOES NOT BIAS THE COST-BENEFIT ANALYSIS AGAINST PLANTS HAVING LONGER COPING CAPABILITY, UNLESS PROCEDURES ARE ALREADY IN PLACE FOR THE LONGER DURATION. IF SUCH PROCEDURES DO EXIST FOR THE STATION BLACKOUT DURATION, NOTHING MORE WOULD BE REQUIRED OF THOSE LICENSEES TO COMPLY WITH THE PROPOSED RULE.

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QUESTION 5.

THE STAFF PROPOSES ONLY TWO CHOICES FOR COPING DURATION, FOUR HOURS OR EIGHT HOURS, AND WOULD REQUIRE JUSTIFICATION, INCLUDING A COST-BENEFIT ANALYSIS, FOR COPING TIMES OF SHORTER DURATION. DOES THIS NOT STAND BACKFIT CONSIDERATIONS ON THEIR HEAD? THE BACKFIT RULE IS INTENDED TO ASSURE THAT EXCEPT FOR THOSE NECESSARY TO RESOLVE AN IMMEDIATE AND REAL THREAT TO PUBLIC HEALTH AND SAFETY, ONLY THOSE REGULATORY REQUIREMENTS DEMONSTRATED BY THE COMMISSION TO PROVIDE A SUBSTANTIAL INCREASE IN OVERALL PROTECTION AND TO BE COST-BENEFICIAL WILL BE IMPOSED. IT WAS NOT INTENDED TO REQUIRE THAT LICENSEES JUSTIFY THAT GREATER REQUIREMENTS ARE NEITHER NECESSARY NOR COST-BENEFICIAL.

ANSWER.

THE APPROACH TO THE STAFF'S PROPOSED RESOLUTION OF USI A-44, WHICH WOULD REDUCE THE RISK FROM STATION BLACKOUT EVENTS, IS TO REQUIRE PLANTS TO BE ABLE TO COPE WITH A STATION BLACKOUT OF SOME DURATION. THE PROPOSED RULE SPECIFIES THIS REQUIREMENT, BUT THE RULE IS NOT SPECIFIC AS TO A REQUIRED DURATION. THE DRAFT REGULATORY GUIDE PROVIDES A SIMPLE METHOD THAT LICENSEES

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QUESTION 5. (CONTINUED)

MAY USE TO DETERMINE THE DURATION. LICENSEES MAY CHOOSE TO USE ALTERNATE METHODS AND JUSTIFY OTHER DURATIONS AS WELL. THIS DOES NOT APPEAR TO CONFLICT WITH THE BACKFIT RULE. IN DEVELOPING THE FOUR AND EIGHT-HOUR CATEGORIES FOR COPING WITH STATION BLACKOUT EVENTS IN THE DRAFT REGULATORY GUIDE, THE STAFF UTILIZED THE BEST INFORMATION AVAILABLE TO ANALYZE SIGNIFICANT FACTORS AND TO ESTIMATE THE FREQUENCY OF LOSSES OF ALL AC POWER. THIS INCLUDED ACTUAL LOSS-OF-OFFSITE-POWER EXPERIENCE AND THE RELIABILITY OF ONSITE EMERGENCY AC POWER SYSTEMS. AC POWER RELIABILITY, AND THE ABILITY TO RESTORE AC POWER IF IT WERE LOST FROM PREFERRED SOURCES, ALSO DEPENDS IN PART ON THE AVAILABILITY OF OTHER NEARBY OR ONSITE NON-SAFETY-RELATED POWER SOURCES (E.G., PEAKING GAS TURBINES). FOR MOST PLANTS, NRC DOES NOT HAVE INFORMATION ON THE AVAILABILITY OF THESE ALTERNATE SOURCES OF AC POWER SINCE THEY ARE NOT SAFETY-RELATED AND ARE NOT PART OF THE NORMAL PLANT REVIEW BY NRC STAFF. THE STAFF BELIEVES A STATION BLACKOUT COPING CAPABILITY OF LESS THAN FOUR HOURS COULD BE ACCEPTABLE FOR SOME PLANTS BASED ON THE AVAILABILITY OF ALTERNATE SOURCES OF AC POWER AS WELL AS THE EXISTENCE OF PROCEDURES TO RESTORE POWER FROM THESE SOURCES. HOWEVER, BECAUSE OF SIGNIFICANT DIFFERENCES BETWEEN THE NUMBER

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QUESTION 5. (CONTINUED)

AND AVAILABILITY OF THESE SOURCES FROM PLANT TO PLANT, THE
STAFF BELIEVES DURATIONS OF LESS THAN FOUR HOURS SHOULD BE
DETERMINED BY LICENSEES ON A PLANT-BY-PLANT BASIS.

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1. THE REGULATORY ANALYSIS PROVIDED WITH THE SECY PAPER SEEMS TO HAVE CONFLICTING STATEMENTS.

ONE QUOTE INDICATES A SBO COULD BE AN IMPORTANT CONTRIBUTOR TO THE TOTAL RISK FROM NUCLEAR POWER PLANT ACCIDENTS. IT THEN INDICATES THE TOTAL RISK WAS FOUND TO BE SMALL, BUT THE RELATIVE IMPORTANCE OF THE SBO RISK WAS ESTABLISHED.

ANOTHER QUOTE INDICATES IF DURATION TIMES ARE ESTABLISHED, IT CAN SIGNIFICANTLY REDUCE CORE MELT FREQUENCY.

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QUESTION 1A. IF WE ARE DEALING WITH VERY SMALL RISKS OF CORE DAMAGE TO BEGIN WITH, HOW SHOULD THE COMMISSION INTERPRET THE USE OF TERMS LIKE "RELATIVE IMPORTANCE" AND "SIGNIFICANTLY REDUCE"?

ANSWER.

THE FIRST QUOTE ABOVE IS TAKEN FROM THE BACKGROUND INFORMATION PROVIDED IN THE REGULATORY ANALYSIS AND REFERS TO ONE OF THE CONCLUSIONS FROM THE "REACTOR SAFETY STUDY" (WASH - 1400, OCTOBER 1975). A MORE COMPLETE ANALYSIS OF RISKS FROM STATION BLACKOUT EVENTS IS PUBLISHED IN DRAFT NUREG-1032, "EVALUATION OF STATION BLACKOUT ACCIDENTS AT NUCLEAR POWER PLANTS, TECHNICAL FINDINGS RELATED TO USI A-44," MAY 1985. THE NUREG-1032 ANALYSIS INCLUDES SPECIFIC STATION BLACKOUT ACCIDENT SEQUENCES THAT WERE OMITTED IN WASH-1400 (E.G. TIME-DEPENDENT SEQUENCES SUCH AS NOT RESTORING AC POWER BEFORE DC POWER SUPPLIES ARE DEPLETED). THE RESULTS IN NUREG-1032 PRESENT THE STAFF'S CURRENT UNDERSTANDING OF IMPORTANT CONTRIBUTORS TO RISK FROM STATION BLACKOUT EVENTS. THIS ANALYSIS SHOWS THAT THE ESTIMATED FREQUENCY OF CORE DAMAGE ASSOCIATED WITH STATION BLACKOUT IS, FOR MANY PLANTS, A SIGNIFICANT CONTRIBUTOR TO TOTAL CORE DAMAGE FREQUENCY. FOR SOME PLANTS, THIS FREQUENCY COULD BE AS HIGH AS

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QUESTION 1A. (CONTINUED)

10^{-4} PER YEAR FROM STATION BLACKOUT ALONE, WHICH WOULD MAKE STATION BLACKOUT A MAJOR CONTRIBUTOR TO TOTAL RISK. FOR SUCH PLANTS, IMPLEMENTING THE STAFF'S PROPOSED RESOLUTION WOULD SIGNIFICANTLY REDUCE THE TOTAL RISK BY REDUCING THE ESTIMATED FREQUENCY OF CORE DAMAGE FROM STATION BLACKOUT BY APPROXIMATELY AN ORDER OF MAGNITUDE (I.E., TO ABOUT 10^{-5} PER YEAR).

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QUESTION 1B. WHY HAS THE STAFF DECIDED TO SUPPORT A GOAL OF ATTAINING 10 MINUS 5 IN THIS STUDY, INSTEAD OF 10 MINUS 4 WHICH IS THE NUMBER THAT HAS BEEN NORMALLY DISCUSSED FOR A SAFETY GOAL?

ANSWER.

AN ESTIMATED FREQUENCY OF CORE MELT OF LESS THAN 10^{-4} PER REACTOR-YEAR HAS BEEN DISCUSSED AS A PROPOSED PLANT PERFORMANCE DESIGN OBJECTIVE IN NUREG-0880, REV. 1, "SAFETY GOALS FOR NUCLEAR POWER PLANT OPERATION." THIS DESIGN OBJECTIVE ENCOMPASSES TOTAL CORE MELT FREQUENCY FROM ALL ACCIDENT SEQUENCES. THE STAFF AND ACRS BELIEVE THAT THE ACCIDENT SEQUENCES ASSOCIATED WITH STATION BLACKOUT SHOULD NOT BE A MAJOR FRACTION OF THIS TOTAL CORE MELT FREQUENCY. IN FACT, IN A LETTER DATED JULY 17, 1985, FROM ACRS TO CHAIRMAN PALLADINO ON THE SUBJECT "ACRS COMMENTS ON PROPOSED NRC SAFETY GOAL EVALUATION REPORT," THE ACRS STATED, "WE SUPPORT THE GENERAL PRINCIPLE THAT NO MORE THAN ABOUT 10 PERCENT OF ANY QUANTITATIVE DESIGN OBJECTIVE SHOULD BE ACCOUNTED FOR BY A SINGLE MAJOR ISSUE OR ACCIDENT." THE STAFF BELIEVES A TARGET OF ESTIMATED CORE MELT FOR STATION BLACKOUT EVENTS OF 10^{-5} PER REACTOR-YEAR WOULD BE CONSISTENT WITH THE SAFETY GOAL OBJECTIVES.

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QUESTION 1C. DOES THE STAFF, CRGR, ACRS, AND OPE FEEL THAT THE COMMISSION WILL BE ABLE TO DEMONSTRATE THAT THE PROPOSED RULE WILL RESULT IN A SUBSTANTIAL INCREASE IN OVERALL PROTECTION OF THE PUBLIC HEALTH AND SAFETY?

ANSWER.

THE STAFF BELIEVES THAT IMPLEMENTING THE PROPOSED RULE WOULD RESULT IN STATION BLACKOUT BEING A RELATIVELY SMALL CONTRIBUTOR TO TOTAL CORE DAMAGE FREQUENCY AND WOULD SUBSTANTIALLY INCREASE THE OVERALL PROTECTION OF THE PUBLIC HEALTH AND SAFETY. NUREG-1109, "REGULATORY ANALYSIS FOR THE RESOLUTION OF USI A-44," DOCUMENTS THE STAFF'S VALUE-IMPACT ANALYSIS THAT INCLUDES THE STAFF'S ESTIMATE OF PUBLIC RISK REDUCTION ASSOCIATED WITH THE PROPOSED RULE.

IN A LETTER TO THE EDO DATED MARCH 12, 1985, THE ACRS STATED, "WE BELIEVE THAT IF FOLLOWED, THEY [I.E., THE NRC STAFF'S PROPOSED RECOMMENDATIONS] WILL REDUCE RISK TO THE PUBLIC AND TO OPERATING PLANTS."

THE DIRECTOR, OPE, STATED IN A LETTER TO THE COMMISSIONERS ON SEPTEMBER 5, 1985, "OVERALL, WE FEEL THAT THE STAFF HAS MADE A

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QUESTION 1C. (CONTINUED)

REASONABLE ASSESSMENT OF THE POSSIBLE COST OF IMPLEMENTING THE RULE AND ASSESSING THE BENEFITS IN TERMS OF REDUCED RISK TO THE PUBLIC." IN CONCLUSION OPE STATED, "BASED ON OUR REVIEW, WE RECOMMEND THAT THE PROPOSED RULE BE PUBLISHED FOR COMMENT. WE BELIEVE, FIRST, THAT THERE IS ADEQUATE JUSTIFICATION TO SUPPORT RULEMAKING TO REDUCE THE RISK OF SEVERE ACCIDENTS POSED BY STATION BLACKOUT AND, SECOND, THAT THERE IS SUFFICIENT COORDINATION OF EFFORTS BETWEEN USI A-44 AND USI A-45 AND OTHER GENERIC ISSUES, SUCH THAT A DELAY IN PUBLISHING THE PROPOSED STATION BLACKOUT RULE IN ORDER TO BETTER INTEGRATE THESE EFFORTS IS NOT JUSTIFIED."

(NOTE: THE FOLLOWING PART OF THE RESPONSE TO THIS QUESTION WAS PROVIDED BY CRGR).

DURING SEVERAL MEETINGS, CRGR REVIEWED THE STAFF'S PROPOSED RESOLUTIONS OF USI A-44 AND THE ESTIMATED RISK REDUCTION BENEFITS IN THE PUBLIC HEALTH AND SAFETY. AS REFLECTED IN THE MINUTES OF CRGR MEETING No. 60 (MAY 8, 1984), THE CRGR DID RAISE SOME ISSUES WITH THE STRUCTURE OF, AND IMMEDIATE NEED FOR, THE RULE AND ITS OVERALL BENEFITS.

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QUESTION 1C. (CONTINUED)

CRGR AGREES THAT SOME INCREMENTAL REDUCTION IN THE PUBLIC RISK SHOULD ACCURE FROM THE STAFF'S PROPOSED RESOLUTION OF USI A-44, BUT IT IS DIFFICULT TO CONCLUDE THAT THIS SEPARATE INCREMENT WOULD REPRESENT A SUBSTANTIAL INCREASE IN THE OVERALL PROTECTION OF THE PUBIC HEALTH AND SAFETY FOR MANY OF THE

- EXISTING REACTORS WITHOUT CONSIDERING THE OUTCOME OF RELATED ACTIVITIES. THE STAFF'S REGULATORY ANALYSIS DID ON THE OTHER HAND INDICATE THAT THE PROPOSED RULE REQUIREMENTS SHOULD BE COMMENSURATE WITH THIS COST.

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2. THE REGULATORY ANALYSIS AND THE DRAFT REG GUIDE MAKE
REFERENCE TO THE ESTABLISHMENT OF A RELIABILITY PROGRAM.

QUESTION 2A. IS THIS A NEW REQUIREMENT, AN OLD REQUIRE-
MENT WITH NEW ASPECTS, OR JUST THE RECENTLY
REVISED AGENCY METHOD TO ENSURE EMERGENCY
DIESEL GENERATOR RELIABILITY VIA THE
SURVEILLANCE TESTING PROGRAM? IF NEW REQUIRE-
MENTS ARE BEING IMPOSED, WHAT ARE THE BASIS
FOR THE REQUIREMENTS?

ANSWER.

THE DRAFT REGULATORY GUIDE ON STATION BLACKOUT RECOMMENDS THAT
EMERGENCY DIESEL GENERATOR (EDG) RELIABILITY BE MAINTAINED ABOVE
CERTAIN MINIMUM LEVELS. THE BASIS FOR THIS RECOMMENDATION IS
THAT RELIABILITY LEVELS BELOW THESE MINIMUM VALUES WOULD RESULT
IN HIGHER ESTIMATED CORE DAMAGE FREQUENCY THAN ASSUMED IN THE
STAFF'S ANALYSIS OF STATION BLACKOUT EVENTS.

THE RELIABILITY PROGRAM IS NOT A NEW REQUIREMENT. IT IS A
REVISED METHOD TO ENSURE THAT MINIMUM EDG RELIABILITY LEVELS ARE

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QUESTION 2A. (CONTINUED)

BEING MAINTAINED. CURRENTLY, REG. GUIDE 1.108, "PERIODIC TESTING OF DIESEL GENERATOR UNITS USED AS ONSITE ELECTRICAL POWER SYSTEM AT NUCLEAR POWER PLANTS," ESTABLISHES A RELIABILITY GOAL OF 0.99 FOR EDG'S. IF EDG RELIABILITY FALLS BELOW THIS LEVEL, THE GUIDE CALLS FOR MORE FREQUENT EDG TESTING. CURRENTLY, LESS THAN HALF OF THE OPERATING NUCLEAR PLANTS IN THE U.S. (I.E., THOSE LICENSED SINCE 1977) HAVE STANDARD TECHNICAL SPECIFICATIONS THAT INCLUDE THE DIESEL GENERATOR RELIABILITY GOAL. PLANTS LICENSED BEFORE 1977 DO NOT HAVE ANY SUCH GOAL. THE STAFF HAS FOUND THAT A 0.99 RELIABILITY GOAL MAY BE DIFFICULT FOR LICENSEES TO ACHIEVE. THE INDUSTRY AVERAGE DIESEL GENERATOR RELIABILITY IS CLOSE TO 0.98, WITH A RANGE OF FROM SLIGHTLY LESS THAN 0.90 TO 1.0. WHILE SPECIFIC MINIMUM RELIABILITY LEVELS ARE PART OF THE PROPOSED RESOLUTION OF USI A-44, THE DEVELOPMENT OF AN ACCEPTABLE EDG RELIABILITY PROGRAM IS PART OF GENERIC ISSUE B-56. (THIS PROGRAM IS CLOSELY COORDINATED WITH USI A-44.) SUCH A PROGRAM WOULD PROVIDE ASSURANCE THAT MINIMUM EDG RELIABILITY LEVELS WERE BEING MAINTAINED; AND IF EDG RELIABILITY DROPPED BELOW THESE LEVELS, ACTIONS WOULD BE TAKEN TO IMPROVE THE RELIABILITY. IT SHOULD ALSO BE NOTED THAT THE NUGSBO PROPOSAL RECOMMENDS THAT INDUSTRY DEVELOP PROGRAMS TO IMPROVE ONSITE EMERGENCY AC POWER SYSTEMS RELIABILITY.

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3. THERE APPEARS TO BE VARYING OPINIONS AS TO THE COST ASSOCIATED WITH THE ANALYSIS AND ANY PROPOSED MODIFICATIONS THAT MAY BE NECESSARY TO COMPLY WITH THE PROPOSED RULE. THE STAFF CONSULTANT ESTIMATED AN AVERAGE OF \$600,000 PER PLANT AND A RECENT NUGSBO LETTER INDICATES THE NUMBER WOULD ACTUALLY BE IN THE MILLIONS.

QUESTION 3A. WHAT ARE THE RESULTS OF COST BENEFIT AND VALUE IMPACT ANALYSIS WHEN APPLIED OVER THE RANGE (HIGH TO LOW) OF COSTS AS DETERMINED BY THE STAFF AND BY THE INDUSTRY?

ANSWER.

THE STAFF HAS NOT RECEIVED SPECIFIC COMMENTS FROM NUGSBO REGARDING ESTIMATED COSTS FOR MODIFICATIONS TO COMPLY WITH THE PROPOSED RULE. THEREFORE, WE CAN NOT COMMENT ON THE NUGSBO COST ESTIMATES REFERRED TO ABOVE.

A SUMMARY OF THE STAFF'S ESTIMATES OF THE VALUE IMPACT RATIO FOR HIGH, LOW AND BEST ESTIMATE CASES IS PRESENTED IN TABLE 8, ON

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QUESTION 3A. (CONTINUED)

PAGE 25 OF NUREG 1109. FOR THE HIGH AND LOW ESTIMATES, THE RATIOS ARE 1,300 AND 3,600 PERSON-REM AVERTED PER MILLION DOLLARS; THE BEST ESTIMATE IS 2,100 PERSON-REM AVERTED PER MILLION DOLLARS.

THE RANGE OF VALUES FOR THIS RATIO IS BASED ON THE FOLLOWING SPECIFIC COST ESTIMATES PER PLANT (SEE TABLE 6 OF NUREG 1109):

- ° ASSESS ABILITY TO COPE WITH STATION BLACKOUT - \$100 TO 200 THOUSAND.
- ° DEVELOP PROCEDURES AND TRAINING - \$50 TO 100 THOUSAND.
- ° IMPROVE DIESEL GENERATOR RELIABILITY (IF NEEDED) - \$250 THOUSAND TO \$2.8 MILLION.
- ° INCREASE CAPABILITY TO COPE WITH A STATION BLACKOUT (IF NEEDED) - \$500 THOUSAND TO \$2 MILLION.

THERE ARE MANY PLANT-SPECIFIC DIFFERENCES THAT COULD RESULT IN SIGNIFICANT DIFFERENCES IN COSTS FROM PLANT TO PLANT TO COMPLY WITH THE PROPOSED RULE (E.G., DIFFERENCES IN DESIGN AND NEED TO MAKE MODIFICATIONS), BUT THE ABOVE COSTS ARE EXPECTED TO BE REASONABLE ESTIMATES FOR MOST PLANTS. AN INDEPENDENT REVIEW OF THE STAFF'S ESTIMATED COSTS WAS PERFORMED BY THE COST ANALYSIS GROUP IN THE DIVISION OF BUDGET ANALYSIS. IN A MEMO DATED

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QUESTION 3A. (CONTINUED)

APRIL 12, 1985, TO THE DIRECTOR, NRR, THE DIRECTOR, RM/B, STATED THAT "THE COST ANALYSIS GROUP'S REVIEW INDICATED THAT THE (STAFF'S) COST ESTIMATES ARE REASONABLE AND TEND TO BE CONSERVATIVELY HIGH IN MEASURING THE LIKELY COST IMPACT (FOR USI A-44)."

INDUSTRY COMMENTS ON SIGNIFICANTLY HIGHER COSTS COULD BE BASED ON THEIR ASSUMPTIONS, FOR EXAMPLE, REGARDING THE SCOPE AND DEPTH OF THE ANALYSIS TO ASSESS THE ABILITY TO COPE WITH STATION BLACKOUT. THE STAFF'S GUIDANCE ON THIS ANALYSIS, WHICH IS INCLUDED IN THE DRAFT REGULATORY GUIDE AND THE DRAFT ANS STANDARD, SPECIFIES THAT THIS SHOULD BE A REALISTIC ANALYSIS. IT IS HIGHLY UNLIKELY THAT DETAILED THERMAL-HYDRAULIC ANALYSES, SUCH AS REQUIRED FOR APPENDIX K TYPE LOCA CALCULATIONS, WOULD BE REQUIRED FOR A STATION BLACKOUT COPING STUDY.

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QUESTION 1. STAFF SUGGESTS THAT VALUE/IMPACT IS FAVORABLE TO GOING AHEAD WITH THE STATION BLACKOUT RULE. AT \$1,000/MAN-REM, THE BENEFIT/COST RATIO IS 2. IS THIS VIEWED BY THE STAFF AS SUFFICIENTLY FAVORABLE TO ALLOW THE STATEMENTS ON PAGE 6 OF THE SEPTEMBER 11, 1985, VIEWGRAPHS? WHAT ARE THE UNCERTAINTIES ASSOCIATED WITH THIS VALUE?

ANSWER.

ALTHOUGH THE STAFF'S BEST ESTIMATE OF THE OVERALL VALUE-IMPACT RATIO FOR THE PROPOSED RESOLUTION OF USI A-44 IS FAVORABLE (I.E., APPROXIMATELY \$500 PER PERSON-REM AVERTED), IT IS IMPORTANT TO NOTE THAT THIS WAS NOT THE ONLY BASIS FOR THE STAFF'S RECOMMENDATIONS. OTHER FACTORS WERE CONSIDERED, AND THESE CONSIDERATIONS SUPPORT THE STAFF'S CONCLUSION THAT THE ADDITIONAL DEFENSE-IN-DEPTH PROVIDED BY THE ABILITY OF A PLANT TO COPE WITH A STATION BLACKOUT WOULD REDUCE THE RISKS ASSOCIATED WITH STATION BLACKOUT. THESE CONSIDERATIONS INCLUDE (1) THE POTENTIALLY SEVERE CONSEQUENCES OF STATION BLACKOUT EVENTS BECAUSE MITIGATING FEATURES, SUCH AS CONTAINMENT HEAT REMOVAL SYSTEMS, ARE INOPERABLE WITHOUT AC POWER AVAILABLE, (2) UNCERTAINTIES IN THE ANALYSES RELATED TO USING POINT ESTIMATES

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QUESTION 1. (CONTINUED)

FOR CORE DAMAGE FREQUENCIES, AND (3) POTENTIAL COMMON CAUSE FAILURES OF AC POWER SYSTEMS. EACH OF THESE ITEMS IS DISCUSSED MORE THOROUGHLY IN NUREG-1109 (ENCLOSURE 2 OF SECY-85-163).

THE HIGH AND LOW VALUE-IMPACT RATIO ESTIMATES FROM TABLE 8 IN NUREG-1109 ARE 1,300 AND 3,600 PERSON-REM AVERTED PER MILLION DOLLARS RESPECTIVELY. SINCE "BEST ESTIMATES" WERE USED IN THIS EVALUATION, THERE IS ABOUT AN EQUAL PROBABILITY THAT THE VALUE-IMPACT RATIO WOULD BE EITHER HIGHER OR LOWER THAN THE BEST ESTIMATE OF 2,100 PERSON-REM AVERTED PER MILLION DOLLARS.

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QUESTION 2. SINCE \$1,000/MAN-REM IS A SURROGATE FOR MANY OFFSITE CONSEQUENCES, HOW WOULD THE BENEFIT/COST RATIO CHANGE IF OFFSITE PROPERTY DAMAGE WAS EXCLUDED, AND AN APPROPRIATELY ADJUSTED \$/MAN-REM RELATION USED? CAN STAFF ESTIMATE THE SIMILAR BENEFIT/COST RATIO IF AVERTED ON-SITE DAMAGE IS TAKEN INTO ACCOUNT?

ANSWER.

THE STAFF'S VALUE-IMPACT ANALYSIS IS BASED ON BEST ESTIMATES FOR 67 REACTORS OF THE TOTAL PUBLIC RISK REDUCTION OVER THE LIFE OF THESE PLANTS (80,000 PERSON-REM) AND THE TOTAL COST FOR THE SAME NUMBER OF PLANTS TO COMPLY WITH THE PROPOSED RULE (\$40 MILLION). THE VALUE-IMPACT RATIO, WHICH IS CALCULATED DIRECTLY BY DIVIDING THESE TWO NUMBERS, RESULTS IN ABOUT 2,000 PERSON-REM AVERTED PER MILLION DOLLARS. THE STAFF PRACTICE IS TO CLASSIFY AVERTED OFFSITE DAMAGE COSTS AS A BENEFIT (OR VALUE) BUT IN MOST CASES, INCLUDING THE USI A-44 ANALYSIS, THEY ARE NOT EXPLICITLY INCLUDED IN THE VALUE-IMPACT RATIO. THE RATIO IS USUALLY COMPARED TO THE PROPOSED BENEFIT-COST GUIDELINES IN NUREG-0880 OF \$1,000 PER PERSON-REM AVERTED (I.E., 1,000 PERSON-REM AVERTED PER MILLION DOLLARS). THIS PROPOSED BENEFIT-COST GUIDELINE (\$1,000 PER PERSON-REM) IMPLICITLY INCLUDES POTENTIAL OFFSITE

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QUESTION 2. (CONTINUED)

PROPERTY DAMAGE. IF OFFSITE PROPERTY DAMAGE WERE EXCLUDED FROM THE GUIDELINES, THE "YARDSTICK" WHICH IS USED TO COMPARE TO ESTIMATES OF BENEFIT-COST RATIOS FOR PROPOSED BACKFITS WOULD BE REDUCED SOMEWHAT (I.E., WOULD BE LESS THAN \$1000/PERSON-REM). POSTULATED RELEASES ASSOCIATED WITH STATION BLACKOUT ACCIDENTS ARE POTENTIALLY OF HIGH SEVERITY. FOR SUCH RELEASES, THE OFFSITE PROPERTY DAMAGE WOULD BE SMALL COMPARED TO THE \$1000/PERSON-REM GUIDELINE WHICH REPRESENTS BOTH HEALTH-EFFECTS RISK AND OFFSITE PROPERTY DAMAGE FOR RADIOACTIVE RELEASES. THEREFORE, THE \$1,000/PERSON-REM FIGURE USED AS A "YARDSTICK" WOULD NOT CHANGE SUBSTANTIALLY EVEN IF OFFSITE PROPERTY DAMAGE WERE EXCLUDED.

THE STAFF HAS INCLUDED ESTIMATES OF THE BENEFIT-COST RATIO IF AVERTED ONSITE DAMAGE IS TAKEN INTO ACCOUNT. THE OVERALL VALUE-IMPACT RATIO WOULD IMPROVE BY ABOUT A FACTOR OF FOUR TO 8,000 PERSON-REM AVERTED PER MILLION DOLLARS (SEE PAGES 23 AND 24 OF NUREG-1109).

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QUESTION 3. WHAT DESIGN CHARACTERISTICS ENABLE FRENCH PLANTS TO HAVE A 20-HOUR STATION BLACKOUT CAPABILITY?

ANSWER.

THE NEW FRENCH 1300 MWE NUCLEAR POWER PLANTS ARE DESIGNED WITH A GOAL OF COPING WITH A STATION BLOCKOUT FOR AT LEAST 20 HOURS. IN PRACTICE, THE DESIGN FEATURES THAT PROVIDE THIS CAPABILITY (LISTED BELOW) PERMIT THE PLANT TO WITHSTAND A STATION BLOCKOUT FOR THREE DAYS.

- O A STEAM-DRIVEN GENERATOR PROVIDES POWER FOR A SMALL POSITIVE DISPLACEMENT PUMP THAT SUPPLIES COOLING FOR REACTOR COOLANT PUMP (RCP) SEALS AND ALSO PROVIDES POWER FOR INSTRUMENTATION AND CONTROLS AND CONTROL ROOM LIGHTING NECESSARY TO WITHSTAND A STATION BLACKOUT. THIS DESIGN FEATURE, WHICH IS ALSO BEING BACKFIT ON ALL OPERATING 900 MWE NUCLEAR PLANTS IN FRANCE, ADDRESSES TWO FACTORS THAT IMPACT THE ABILITY TO COPE WITH A STATION BLACKOUT - RCP SEAL COOLING WITH AC POWER UNAVAILABLE AND BATTERY DEPLETION.
- O TWO TURBINE-DRIVEN AUXILIARY FEEDWATER (AFW) PUMPS ARE INCLUDED IN THE 1300 MWE FRENCH DESIGN IN ADDITION TO TWO MOTOR-DRIVEN AFW PUMPS. MOST U.S. PWRs HAVE ONE

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QUESTION 3. (CONTINUED)

TURBINE-DRIVEN AFW PUMP IN ADDITION TO TWO MOTOR-DRIVEN PUMPS. THEREFORE, THE FRENCH DESIGN PROVIDES ADDITIONAL REDUNDANCY IN THE AC-INDEPENDENT TRAINS OF THE AFW SYSTEM

- O GRAVITY FEED BACK-UP WATER SUPPLY FROM THE DEMINERALIZED WATER STORAGE TANK TO THE CONDENSATE STORAGE TANK PROVIDES ADDITIONAL WATER FOR DECAY HEAT REMOVAL VIA THE AFW SYSTEM FOR LONG-DURATION STATION BLACKOUT EVENTS (I.E., UP TO THREE DAYS).

THIS THREE-DAY STATION BLOCKOUT CAPABILITY WOULD PERMIT SUFFICIENT TIME TO CONNECT A MOBILE GAS TURBINE GENERATOR TO PROVIDE POWER IF AC POWER COULD NOT BE RESTORED FROM OTHER PREFERRED SOURCES. A MOBILE GAS TURBINE GENERATOR IS LOCATED AT, OR IN THE REGION OF, EVERY NUCLEAR POWER PLANT SITE IN FRANCE.

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QUESTION 4. WHAT UNIQUE COPING FEATURES ARE BUILT INTO THE
 SIZEWELL PWR?

ANSWER.

IN ADDITION TO FOUR DIESEL GENERATORS TO SUPPLY EMERGENCY
ON-SITE AC POWER (U.S. PLANTS TYPICALLY HAVE TWO DIESEL
GENERATORS PER REACTOR), THE SIZEWELL DESIGN INCLUDES TWO
STEAM-DRIVEN POSITIVE DISPLACEMENT CHARGING PUMPS TO PROVIDE
SEAL INJECTION FOR RCP SEAL COOLING IN THE EVENT OF A STATION
BLACKOUT.

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QUESTION 5. WHAT ARE THE RESULTS OF THE FRENCH TESTS OR ANY OTHER TESTS EXPLORING THE ISSUE OF REACTOR COOLANT PUMP SEAL INTEGRITY AND WHAT ARE THE IMPLICATIONS FOR THIS ISSUE?

ANSWER.

THERE HAVE BEEN SEVERAL TESTS IN THE U.S. AND FRANCE OF REACTOR COOLANT PUMP (RCP) SEAL INTEGRITY DURING A STATION BLACKOUT. THE MOST RECENT TEST WAS PERFORMED IN MAY 1985 IN FRANCE. WE ONLY HAVE PRELIMINARY RESULTS FROM THIS TEST OF THE FRENCH 7" HYDROSTATIC REACTOR COOLANT PUMP SEAL. UNTIL THE COMPLETE DETAILS OF THIS TEST, AS WELL AS THE SEAL DESIGN, ARE MADE AVAILABLE, WE CANNOT DETERMINE THE SIGNIFICANCE OF THE TESTS WITH RESPECT TO STATION BLACKOUT IN U.S. PLANTS. THERE ARE A NUMBER OF DIFFERENCES BETWEEN THE WESTINGHOUSE 8" HYDROSTATIC SEAL IN CURRENT USE IN U.S. PLANTS AND THE OLDER DESIGN 7" FRENCH SEAL. THESE DIFFERENCES APPARENTLY INCLUDE MATERIAL DIFFERENCES IN THE COMPOUNDING OF THE SECONDARY SEALS. THE FRENCH RCP SEAL DID SURVIVE THE SIMULATED STATION BLACKOUT TEST. THE LATEST FRENCH TEST DIFFERS FROM RESULTS FROM EARLIER FRENCH RCP SEAL TESTS OF SHORTER DURATION THAT INDICATED TO THE FRENCH THAT THE RCP SEALS WOULD FAIL DURING A STATION BLACKOUT.

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QUESTION 5. (CONTINUED)

OTHER RCP SEAL OR SEAL COMPONENT TESTS WHICH ARE RELATED TO STATION BLACKOUT ARE THE BYRON-JACKSON (BJ) 50-HOUR LOSS-OF-SEAL-COOLING TEST ON A SEAL CARTRIDGE ASSEMBLY FROM THE ST. LUCIE PLANT AND THE SAN ONOFRE 30-MINUTE LOSS-OF-COOLING TEST PERFORMED ON THE COMPLETE BJ PUMPS WHILE RUNNING. NEITHER OF THESE TESTS RESULTED IN SEAL FAILURES. THE BJ PUMP USES A HYDRODYNAMIC TYPE OF SEAL.

RESULTS OF THE ATOMIC ENERGY OF CANADA LIMITED (AECL) STUDY FOR NRC "REACTOR COOLANT PUMP SHAFT LEAK BEHAVIOR DURING STATION BLACKOUT" (NUREG/CR-4077) INDICATE A NUMBER OF POTENTIAL RCP SEAL PROBLEMS ASSOCIATED WITH STATION BLACKOUT. THE MOST SERIOUS CONCERNS UNDER STATION BLACKOUT CONDITIONS ARE THE POSSIBILITY OF THE SEAL FACES "POPPING OPEN" OR FAILURE OF THE ELASTOMER SECONDARY O-RING SEALS. "POPPING OPEN" IS POSSIBLE FOR CURRENT SEAL DESIGNS IF SUFFICIENT FLASHING OCCURS BETWEEN SEAL FACES. IF THIS OCCURS, LEAK RATES OF GREATER THAN 100 GALLONS PER MINUTE PER PUMP ARE LIKELY.

AS A RESULT OF THE AECL TEST PROGRAM, THE WESTINGHOUSE OWNERS GROUP HAS DECIDED TO CHANGE THE O-RING MATERIAL PRESENTLY USED IN WESTINGHOUSE RCP SEALS TO A MORE TEMPERATURE-RESISTANT

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QUESTION 5. (CONTINUED)

MATERIAL TO REDUCE THE LIKELIHOOD OF SEAL FAILURE DURING A STATION BLACKOUT.

THE STAFF IS CONTINUING ITS STUDY OF THE RCP STATION BLACKOUT SEAL FAILURE PROBLEM AS PART OF GENERIC ISSUE 23, REACTOR COOLANT PUMP SEAL FAILURES. ADDITIONAL TECHNICAL STUDIES ON RCP SEAL BEHAVIOR, AS WELL AS THE RESULTS OF THE RECENT FRENCH RCP SEAL TEST WILL BE REVIEWED BY THE STAFF BEFORE ANY ADDITIONAL CONCLUSIONS CAN BE REACHED REGARDING RCP SEAL FAILURES DURING STATION BLACKOUT. THESE RESULTS AND CONCLUSIONS WILL PROVIDE INFORMATION TO THE STAFF FOR THEIR REVIEW OF LICENSEES' RESPONSES TO THE PROPOSED STATION BLACKOUT RULE (I.E., ASSESSMENTS OF PLANT COPING CAPABILITY IN THE EVENT OF A STATION BLACKOUT).

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THE FOLLOWING QUESTIONS REFERENCE ENCLOSURE 1 TO THE SECY PAPER
(NOTICE OF PROPOSED RULEMAKING):

QUESTION 6. PAGE 2, 4TH LINE FROM BOTTOM: WHAT WERE THE
"ORIGINALLY ANTICIPATED" RELIABILITIES?

ANSWER.

WHEN GENERAL DESIGN CRITERION (GDC) 17, "ELECTRIC POWER SYSTEMS," WAS WRITTEN, THE REQUIREMENTS FOR INDEPENDENCE AND REDUNDANCY OF BOTH THE OFFSITE AND ONSITE AC ELECTRIC POWER SUPPLIES WERE FELT TO BE SUFFICIENT TO ASSURE THAT CORE COOLING AND CONTAINMENT INTEGRITY COULD BE MAINTAINED IN THE EVENT OF POSTULATED ACCIDENTS. NO SPECIFIC SYSTEM RELIABILITIES WERE ASSUMED IN DEVELOPING GDC 17. THE STAFF FELT, ON A DETERMINISTIC BASIS, THAT PROVIDING A REDUNDANT EMERGENCY DIESEL GENERATOR WOULD BE AN ACCEPTABLE DESIGN FROM A PUBLIC HEALTH AND SAFETY STANDPOINT. RESULTS OF PRAs WERE LIMITED AT THAT TIME, ESPECIALLY COMPARED TO THE STAFF'S PRESENT UNDERSTANDING OF RISK FACTORS ASSOCIATED WITH STATION BLACKOUT EVENTS. RESULTS OF PRAs HAVE SHOWN THAT EVEN THOUGH PLANTS MEET CURRENT NRC REGULATIONS FOR THE DESIGN OF OFFSITE AND ONSITE AC POWER SYSTEMS, STATION BLACKOUT CAN STILL BE A SIGNIFICANT CONTRIBUTOR TO OVERALL PLANT RISK. THE

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QUESTION 6. (CONTINUED)

RELIABILITIES OF THE AC POWER SYSTEMS HAVE BEEN STUDIED EXTENSIVELY, AND RESULTS OF THESE STUDIES HAVE BEEN FACTORED INTO THE PRAs.

BECAUSE OF CONCERN ABOUT RELIABILITY OF ONSITE AC POWER SYSTEMS, REVISION 1 OF REGULATORY GUIDE 1.108 WAS ISSUED IN 1977. THIS GUIDE ESTABLISHED A RELIABILITY GOAL FOR EMERGENCY DIESEL GENERATORS OF 0.99. AS STATED IN RESPONSE TO QUESTION 2.A FROM COMMISSIONER ZECH, LESS THAN HALF OF THE OPERATING PLANTS IN THE U.S. HAVE STANDARD TECHNICAL SPECIFICATIONS THAT INCLUDE THE REGULATORY GUIDE GOAL OF 0.99. THE STAFF BELIEVES THAT, IN LIGHT OF EXPERIENCE, THIS MAY NOT BE A REALISTIC GOAL.

THE CURRENT APPROACH IS TO HAVE EACH LICENSEE DEVELOP AN ACCEPTABLE EDG RELIABILITY PROGRAM (AS THE RESOLUTION OF GENERIC ISSUE B-56, "DIESEL GENERATOR RELIABILITY") AND SELECT A DIESEL GENERATOR RELIABILITY THAT THE LICENSEE WOULD COMMIT TO MAINTAIN IN MEETING THE COPING REQUIREMENTS OF THE STATION BLACKOUT RULE (0.95 OR 0.97 ARE THE SUGGESTED RELIABILITY VALUES IN THE PROPOSED REGULATORY GUIDE WHICH SUPPORTS THE RULE).

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QUESTION 7. PAGE 10, 4TH LINE FROM BOTTOM: WHAT PLANTS ARE
OUTSIDE THE SCOPE OF THIS RULE?

ANSWER.

THE PROPOSED RULE WAS LIMITED IN SCOPE SO THAT THE RULE WOULD
NOT APPLY TO A PLANT FOR WHICH STATION BLACKOUT ALREADY HAS BEEN
• LITIGATED DURING THE PROCEEDINGS TO LICENSE THE PLANT AND A
SPECIFIC STATION BLACKOUT COPING CAPABILITY HAS BEEN CONSIDERED AND
SPECIFIED AS A BASIS FOR LICENSING THE PLANT. AS FAR AS THE
STAFF IS AWARE, THIS EXEMPTION WOULD APPLY ONLY TO ONE PLANT, ST.
LUCIE. HOWEVER, THE LANGUAGE IN THE RULE WAS WRITTEN GENERALLY
TO ACCOUNT FOR THE POSSIBILITY THAT SIMILAR ACTIONS COULD TAKE
PLACE AT OTHER PLANTS PENDING PROMULGATION OF THE FINAL RULE.

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QUESTION 8. PAGE 11, LINES 7 AND 8: WHAT IS THE STAFF DEFINITION OF ADEQUATE "CORE COOLING" THAT MUST BE MAINTAINED? WHAT IS THE STAFF DEFINITION OF "CONTAINMENT INTEGRITY" THAT WILL HAVE TO BE MAINTAINED?

ANSWER.

THE ABILITY TO ADEQUATELY COOL THE CORE DURING A STATION BLACKOUT MEANS THAT REACTOR COOLANT INVENTORY (BOTH FLOW AND WATER LEVEL) SHALL BE SUFFICIENT TO REMOVE DECAY HEAT FROM THE REACTOR CORE TO A HEAT SINK (E.G., STEAM GENERATORS FOR PWRs AND SUPPRESSION POOL OR ISOLATION CONDENSER FOR BWRs) FOR THE DURATION OF THE STATION BLACKOUT AND DURING THE PERIOD OF TIME AFTER AC POWER IS RESTORED UNTIL NORMAL OR SAFE SHUTDOWN COOLING SYSTEMS ARE RESTORED.

MAINTAINING CONTAINMENT INTEGRITY MEANS A CONTAINMENT BOUNDARY SHALL BE AVAILABLE AND THE CONTAINMENT CAN BE ISOLATED, IF NEEDED, IN ORDER TO PREVENT OR LIMIT THE ESCAPE OF RADIOACTIVITY DURING A STATION BLACKOUT.

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QUESTION 1. WHAT COSTS AND WHAT BENEFITS WERE INCLUDED IN THE COST-BENEFIT ANALYSIS ASSOCIATED WITH THIS PROPOSED RULE? FOR KNOWN COSTS AND KNOWN BENEFITS NOT INCLUDED, WHAT WAS THE RATIONALE FOR EXCLUDING THEM? PLEASE INDICATE WHETHER THE MAGNITUDE OF EACH EXCLUDED FACTOR IS HIGHER OR LOWER THAN THOSE FACTORS THAT WERE INCLUDED.

ANSWER.

THE COSTS FOR INDUSTRY TO COMPLY WITH THE PROPOSED RULE INCLUDE THE COSTS REQUIRED TO (1) ASSESS THE PLANT CAPABILITY TO COPE WITH STATION BLACKOUT, (2) DEVELOP PROCEDURES FOR HANDLING STATION BLACKOUT AND PROVIDING TRAINING IN THOSE PROCEDURES, (3) IMPROVE EMERGENCY DIESEL GENERATOR (EDG) RELIABILITY THROUGH A RELIABILITY INVESTIGATION AND ANY NECESSARY HARDWARE CHANGES TO IMPROVE RELIABILITY AND (4) INCREASE CAPABILITY TO COPE WITH STATION BLACKOUT BY MAKING THE NECESSARY HARDWARE CHANGES TO STATION BATTERIES, CONDENSATE STORAGE, AND/OR INSTRUMENT AIR. THE INDUSTRY COSTS FOR OPERATION AND MAINTENANCE OF ANY ADDITIONAL EQUIPMENT WERE ALSO INCLUDED. THE COSTS FOR NRC REVIEW OF THE RULE IMPLEMENTATION WERE INCLUDED.

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QUESTION 1. (CONTINUED)

THE BENEFITS CONSIDERED WERE THE REDUCTION IN RISK TO THE PUBLIC AS WELL AS REDUCED OCCUPATIONAL EXPOSURE FOR POST ACCIDENT CLEANUP AND REPAIR WHICH WOULD RESULT FROM THE ESTIMATED REDUCED FREQUENCY OF STATION BLACKOUT ACCIDENTS IF THE PROPOSED RULE WERE IMPLEMENTED (SEE NUREG-1109, FOR COMMENT, SECTION 4)

IN A SUPPLEMENTARY CONSIDERATION, THE STAFF ALSO INCLUDED THE BENEFIT FROM AVERTED ONSITE PROPERTY DAMAGE TO ASSESS ITS EFFECT ON THE COST-BENEFIT ANALYSIS. IF THIS BENEFIT WERE INCLUDED, THE OVERALL VALUE-IMPACT RATIO WOULD BE ABOUT 8,000 PERSON-REM AVERTED PER MILLION DOLLARS (COMPARED TO ABOUT 2000 PERSON-REM AVERTED PER MILLION DOLLARS IF ONSITE PROPERTY DAMAGE WERE NOT INCLUDED).

THE STAFF DID NOT EXPLICITLY ESTIMATE THE MAGNITUDE OF OTHER BENEFITS OR COSTS BECAUSE WE BELIEVE THEIR EFFECT ON THE VALUE/IMPACT RATIO WOULD BE SMALL. EXAMPLES OF SUCH ADDITIONAL ITEMS THAT COULD BE CONSIDERED ARE THE BENEFIT THAT WOULD ACCRUE FROM IMPROVED AVAILABILITY OF THE PLANT (FEWER SHUTDOWNS DUE TO EDG UNAVAILABILITY) AND THE BENEFIT THAT WOULD RESULT FROM THE AVERTED COST OF OFFSITE INTERDICTION AND DECONTAMINATION FOLLOWING A STATION BLACKOUT ACCIDENT.

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QUESTION 2. WHAT STATION BLACKOUT PROBABILITY DOES THE CRGR BELIEVE SUPPORTS A ZERO-HOUR COPING CAPABILITY? WHAT WOULD CRGR REQUIRE TO ENSURE THAT THAT PROBABILITY IS MAINTAINED? WHAT UNCERTAINTIES IN PROBABILISTIC ANALYSES DID CRGR CONSIDER, WHAT DOES CRGR BELIEVE THEIR RELATIVE IMPORTANCE TO BE, AND HOW WOULD CRGR TREAT THEM TO ENSURE THEY ARE NOT IMPORTANT CONTRIBUTORS TO STATION BLACKOUT RISKS IF ITS RECOMMENDATION TO HAVE A ZERO-HOUR DURATION CATEGORY WERE ADOPTED?

ANSWER

(NOTE: THE RESPONSE TO THIS QUESTION WAS PROVIDED BY CRGR).

CRGR, AS PART OF ITS DELIBERATIONS ON THE PROPOSED STATION BLACKOUT RULE (USI A-44) PRESENTED FOR ITS REVIEW (IN MEETINGS NOS. 59, 60 AND 61), INQUIRED OF THE STAFF WHETHER A "ZERO-HOUR" COPING CAPABILITY COULD BE FOUND ACCEPTABLE. IN ESSENCE, CRGR WAS ASKING THE STAFF THIS SAME QUESTION: I.E., IF OR WHETHER THERE EXISTED ANY COMPLEMENT AND CONFIGURATION OF AC POWER SUPPLIES OF SUFFICIENT REDUNDANCY AND/OR RELIABILITY THAT THE STAFF COULD FIND ACCEPTABLE WITHOUT A LICENSEE HAVING TO JUSTIFY AN EXTENDED COPING CAPABILITY OF 4, 8, OR 16-HOUR DURATION. THE

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QUESTION 2. (CONTINUED)

STAFF ESTABLISHED AN AIMING POINT VALUE OF 10^{-5} /REACTOR-YEAR AS AN ACCEPTABLE FREQUENCY LEVEL FOR A CORE DAMAGE/CORE MELT ACCIDENT THAT COULD RESULT FROM SEQUENCES INITIATED BY A STATION BLACKOUT (LOSS OF ALL AC). THE ACRS HAD ALSO RECOMMENDED USE OF SUCH AN AIMING POINT (ALBEIT LOWER) FOR THE USI A-44 RESOLUTION. THIS PROBABILISTICALLY-BASED GOAL WAS QUITE COMPARABLE TO THAT PREVIOUSLY USED BY THE STAFF IN OTHER USI RESOLUTIONS (SUCH AS ATWS). CRGR TOOK NO ISSUE WITH THIS PROPOSAL, NOR DID IT SUGGEST ANY ALTERNATIVE PROBABILISTIC GOALS, UNCERTAINTY ANALYSES OR DIFFERENT FORMULATIONS FOR COMMON-MODE CONTRIBUTIONS. RATHER, CRGR DID RECOGNIZE THAT SOME LICENSEES COULD PROVIDE, OR MAY ACTUALLY HAVE IN PLACE, ALTERNATIVE WAYS THAT WOULD SIGNIFICANTLY ENHANCE THE OVERALL AC POWER RELIABILITY AND COULD REDUCE THE CHANCE OF COMMON-CAUSED FAILURES DISABLING ALL OF THE AC SUPPLIES (SUCH AS ADDITIONAL DIESEL OR GAS TURBINE DRIVEN GENERATORS, "BLACK-START" CAPABILITIES, OR PERHAPS CROSS-CONNECT OPTIONS AT TWO-UNIT SITES THAT COULD SERVE AS A ONE-OF-FOUR EMERGENCY DIESEL GENERATOR CONFIGURATION RATHER THAN ONE-OF-TWO). THESE ALTERNATIVE WAYS OF ENHANCING THE OVERALL AC POWER RELIABILITY MAY NOT HAVE BEEN PREVIOUSLY RECOGNIZED (NOR CREDITED) BY THE STAFF IN ITS REVIEW OF THE AC POWER SYSTEMS AVAILABLE AND ITS PROPOSED RESOLUTION FOR THE USI A-44 ISSUE.

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QUESTION 2. (CONTINUED)

IN ESPOUSING THIS OPTION FOR A "ZERO-HOUR" COPING CAPABILITY, CRGR NOTED ITS CONCERN THAT THE PROPOSED RULE STRUCTURE WAS INFLEXIBLE AND GAVE CONSIDERABLE EMPHASIS TO THE MITIGATION, RATHER THAN PREVENTION, OF THE SAFETY PROBLEM AT ISSUE. THE RULE APPEARED TO FORECLOSE ANY CREDIT FOR OR DISCOURAGE INCENTIVES BY LICENSEES TO TAKE ADDITIONAL PREVENTION STEPS THAT MIGHT BENEFIT THE OVERALL RELIABILITY OF AC POWER. THIS LOGIC SEEMED SOMEWHAT INCONSISTENT WITH THE USUAL PREFERENCE BY NRC TO EMPHASIZE A PREVENTIVE SAFETY PHILOSOPHY IN ADDRESSING A SAFETY ISSUE LIKE USI A-44. IF THE RULE STRUCTURE WOULD PERMIT THE STAFF TO ACCEPT ARGUMENTS ON THE "ZERO-HOUR" COPING CAPABILITY, THEN CRGR VIEWED IT AS REASONABLE TO EXPECT THAT COMMON CAUSE FAILURE CONCERNS MIGHT BE FURTHER REDUCED BY HAVING THE LICENSEE EXPLORE ALTERNATIVE AC POWER CONFIGURATIONS, REDUNDANCIES, DIVERSITIES AND RESTORATION OPTIONS. IT IS ALSO NOTED THAT APPLICATION OF THE STAFF'S PRA TECHNIQUES BY NUGSBO INDICATES THAT FOR THE MORE VULNERABLE PLANTS THE EXTENSION OF COPING CAPABILITY FROM ABOUT A 2-HOUR TO A 4-HOUR DURATION WOULD (IF SUCCESSFUL) WOULD ACHIEVE PERHAPS A FACTOR OF 2.5 REDUCTION IN PROBABILITY OF THOSE CORE MELT SEQUENCES INITIATED BY A STATION BLACKOUT. A LESSER REDUCTION FACTOR SHOULD BE EXPECTED FOR THE OVERALL CORE MELT FREQUENCY FOR MOST OF THE PLANTS. FURTHER, IT IS NOT

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QUESTION 2. (CONTINUED)

UNREASONABLE TO NOTE THAT THE NEW SOURCE TERM WORK ALREADY HAS INDICATED AN EQUIVALENT FACTOR OF REDUCTION IN PUBLIC RISK RELATIVE TO THAT PREDICTED BY THE PROPOSED STATION BLACKOUT RULE. THIS RELATIVELY SMALL INCREMENTAL REDUCTION IN THE FREQUENCY OF THE BLACKOUT INITIATED CORE MELT SEQUENCES AND IN THE PUBLIC RISK FROM THESE SEQUENCES WOULD ALSO APPEAR ACHIEVABLE FROM ENHANCING THE "FRONT-END" RELIABILITY OF THE AC POWER SOURCES.

IN SUM, CRGR DID NOT SET FORTH ANY ALTERNATIVE PROBABILISTIC GOALS, ALTERNATIVE DATA ASSESSMENTS OR ITS OWN ANALYSIS OF PRA UNCERTAINTIES. CRGR GENERALLY ACCEPTED THE STAFF'S PRA ASSESSMENTS AS BEING REASONABLE. IT ALSO ACCEPTED THE STAFF'S VIEW THAT MOST PLANTS WERE EXPECTED TO ALREADY HAVE ABOUT A 2-HOUR COPING CAPABILITY GIVEN THE STATION BLACKOUT EVENT. IT SHOULD BE NOTED THAT CURRENT NRC REQUIREMENTS SPECIFY THE AVAILABILITY OF A DIVERSE (INDEPENDENT OF BULK AC POWER) MEANS OF DECAY HEAT REMOVAL AND THE CRGR WAS NOT CHALLENGING THIS REQUIREMENT FOR DIVERSITY IN ITS ESPOUSAL OF THE "ZERO HOUR" COPING CAPABILITY. CRGR ALSO QUESTIONED THE IMMEDIATE NEED FOR THE RULE AND THE OVERALL BENEFITS AND COST EFFECTIVENESS OF "PIECEMEAL" RESOLUTION CONSIDERING THAT OTHER GENERIC ISSUES COULD BE VIEWED TO BE INTEGRALLY RELATED TO THE SEVERE ACCIDENT POLICY AND THE

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QUESTION 2. (CONTINUED)

RESOLUTION OF USI A-44. TO RESTATE: THE "ZERO HOUR" COPING
CAPABILITY WAS RELATED TO A CONCERN ABOUT THE FUNDAMENTAL RULE
STRUCTURE AND ITS LOGIC, NOT TO THE PRA DETAILS.

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QUESTION 3. IF THE PROPOSED RULE WERE IMPLEMENTED, WHAT WOULD STAFF BELIEVE THE MEAN PROBABILITY OF A STATION BLACKOUT EVENT TO BE AND WHAT WOULD BE THE RANGE OF PROBABILITIES ENCOMPASSING ALL PLANTS?

ANSWER.

THE STAFF ESTIMATES THAT THE PROBABILITY OF CORE MELT DUE TO STATION BLACKOUT FOR INDIVIDUAL PLANTS IS CURRENTLY IN THE RANGE FROM 10^{-4} TO NEAR 10^{-6} /REACTOR-YEAR. IMPLEMENTATION OF THE BLACKOUT RULE IS EXPECTED TO HAVE LITTLE IMPACT ON THOSE PLANTS ALREADY AT THE LOWER END OF THE SPECTRUM EXCEPT TO PROVIDE GREATER ASSURANCE THAT THE CAPABILITY TO COPE ALREADY DESIGNED INTO THOSE PLANTS WILL BE READILY AVAILABLE, BUT WOULD LOWER THE PROBABILITY TO APPROXIMATELY 10^{-5} /REACTOR-YEAR FOR PLANTS AT THE UPPER END. THE RESULTING MEAN PROBABILITY FOR THE TOTAL POPULATION OF PLANTS IS DIFFICULT TO ESTIMATE SINCE IT IS DEPENDENT UPON THE COPING CAPABILITY FOR EACH FACILITY, AND THE PLANT-SPECIFIC INFORMATION NECESSARY TO MAKE THIS EVALUATION IS NOT AVAILABLE TO THE STAFF. HOWEVER, IT SHOULD BE BETWEEN 10^{-5} AND 10^{-6} PER REACTOR-YEAR.

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QUESTION 4. THIS RULE APPEARS TO BE PREMISED ON MAKING
BLACKOUT AND ANY OTHER ACCIDENT SEQUENCE A 10^{-5}
EVENT PER YEAR. WHAT MORE WOULD HAVE TO BE
REQUIRED IF INDIVIDUAL ACCIDENT SEQUENCES WERE
TO HAVE A PROBABILITY OF NO MORE THAN 10^{-6} PER
YEAR CONSISTENT WITH THE DIRECTOR OF NRR
RECOMMENDATION ON THE SAFETY GOAL?

ANSWER.

A REDUCTION IN THE CORE MELT FREQUENCY FROM STATION BLACKOUT
CAN BE ACHIEVED BY INCREASING OFFSITE POWER RELIABILITY,
INCREASING ONSITE EMERGENCY AC POWER RELIABILITY, INCREASING
REDUNDANCY IN ONSITE EMERGENCY POWER SOURCES, OR INCREASING THE
COPING CAPABILITY FOR STATION BLACKOUT OR SOME COMBINATION OF
THESE. IMPROVEMENTS HAVE BEEN, AND ARE BEING, MADE IN SWITCHYARDS
PRONE TO SINGLE FAILURE TO REDUCE PLANT-CENTERED LOSSES OF
OFFSITE POWER. THERE HAVE BEEN MANY EFFORTS, PARTIALLY
SUCCESSFUL, TO IMPROVE THE RELIABILITY OF EDGs. THE ADDITION OF
AN ONSITE GAS-TURBINE GENERATOR THAT CAN PROVIDE POWER DIRECTLY
TO EMERGENCY BUSES WOULD BE AN EFFECTIVE, BUT COSTLY, ADDITION.
THE EXTENSION OF COPING TIME BEYOND THAT PRESENTLY CONSIDERED IN

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QUESTION 4. (CONTINUED)

THE REGULATORY GUIDE IS FEASIBLE AND WOULD BE EFFECTIVE IN REDUCING FURTHER THE ESTIMATED CORE MELT FREQUENCY FROM STATION BLACKOUT.

A SIMPLIFIED METHOD TO ESTIMATE STATION BLACKOUT CORE DAMAGE FREQUENCY IS PRESENTED IN APPENDIX C OF NUREG-1032, "EVALUATION OF STATION BLACKOUT ACCIDENTS AT NUCLEAR POWER PLANTS". TABLE C.4 PROVIDES ESTIMATES OF THE CORE DAMAGE FREQUENCY (PER REACTOR-YEAR) AS A FUNCTION OF DIESEL GENERATOR CONFIGURATION, DIESEL UNRELIABILITY, OFFSITE POWER CLUSTER AND COPING CAPABILITY (HOURS). THESE TABLES INDICATE THAT MOST PLANTS WOULD MEET THE VALUE OF 10^{-6} PER YEAR IF THEY HAD A DIESEL RELIABILITY OF 0.99 AND COPING CAPABILITY OF 16 HOURS.

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QUESTION 5. WHAT ARE THE ROOT CAUSES OF STATION BLACKOUT AND HOW WOULD THIS PROPOSED RULE CORRECT THE ROOT CAUSES?

ANSWER.

THE ROOT CAUSES OF STATION BLACKOUT ARE THE VARIOUS FACTORS THAT ADVERSELY AFFECT THE RELIABILITY OF BOTH THE OFFSITE AND ONSITE EMERGENCY AC POWER SYSTEMS. THE AVERAGE FREQUENCY FOR THE LOSS OF OFFSITE POWER IS 0.1 PER SITE-YEAR, AND THE AVERAGE DIESEL GENERATOR RELIABILITY IS 0.98 PER DEMAND, WITH A RANGE FROM 0.90 TO 1.0 PER DEMAND. THESE DATA ARE DERIVED FROM MANY YEARS OF OPERATING EXPERIENCE. ALTHOUGH THERE HAS BEEN SOME IMPROVEMENT IN RELIABILITY, BOTH FOR OFFSITE POWER AND ONSITE DIESEL GENERATORS, IT HAS NOT BEEN SUFFICIENT TO ELIMINATE THE CONCERN FOR STATION BLACKOUT.

THE PROPOSED RULE ITSELF DOES NOT ADDRESS THE ROOT CAUSES, BUT ENSURES THAT EACH PLANT WOULD HAVE THE CAPABILITY FOR COPING WITH A STATION BLACKOUT FOR A MINIMUM DURATION. THE DURATION OF THE COPING CAPABILITY DERIVES DIRECTLY FROM THE EXPERIENCE DATA BASE WHICH SHOWS THAT THE PROBABILITY OF RESTORING OFFSITE POWER (AND ONSITE POWER) INCREASES SIGNIFICANTLY OVER A MATTER OF HOURS. BY FORMALIZING A REQUIREMENT FOR AN A.C.-INDEPENDENT

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QUESTION 5. (CONTINUED)

DECAY HEAT REMOVAL SYSTEM ALREADY INCLUDED IN NUCLEAR POWER PLANTS, AND ADDING IMPROVEMENTS, AS NECESSARY, FOR BATTERY POWER, CONDENSATE STORAGE, COMPRESSED AIR STORAGE, EQUIPMENT COOLING, AND REACTOR COOLANT PUMP SEAL INTEGRITY, A SEPARATE AND DIVERSE RESOLUTION OF THE STATION BLACKOUT ISSUE IS ACHIEVED.

THE DRAFT REGULATORY GUIDE DOES PROVIDE GUIDANCE ON MINIMIZING, OR RECOVERING FROM, LOSSES OF AC POWER. MINIMUM RECOMMENDED DIESEL GENERATOR RELIABILITIES ARE SPECIFIED. AS DISCUSSED IN SECY-85-163, A PROGRAM TO IMPROVE DIESEL RELIABILITY IS BEING DEVELOPED UNDER GENERIC ISSUE B-56, "DIESEL GENERATOR RELIABILITY". THIS PROGRAM WILL ESTABLISH A BASIS FOR MAINTAINING AND DETERMINING THE RELIABILITY OF EMERGENCY DIESEL GENERATORS. WITH REGARD TO OFFSITE POWER, THE PROPOSED REGULATORY GUIDE STATES THAT PROCEDURES SHOULD INCLUDE ALL ACTIONS NECESSARY TO RESTORE OFFSITE POWER AND USE NEARBY POWER SOURCES WHEN OFFSITE POWER IS UNAVAILABLE.

AN ALTERNATIVE, BUT LESS COST-EFFECTIVE RESOLUTION, WOULD BE TO REQUIRE MORE SOURCES OF ONSITE EMERGENCY POWER (DIESEL GENERATORS OR GAS TURBINES) TO PROVIDE POWER TO THE SAFETY BUSES. SHOULD A LICENSEE DECIDE THAT SUCH ADDITIONAL POWER

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QUESTION 5. (CONTINUED)

SOURCES WERE COST EFFECTIVE BECAUSE OF OTHER BENEFITS (E.G.,
IMPROVED PLANT AVAILABILITY), THEN A SHORTER COPING DURATION
COULD BE JUSTIFIED UNDER THE PROPOSED RULE.

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QUESTION 6. WITH REGARD TO VIEWGRAPH 34, WHAT ARE THE UNCERTAINTY BOUNDS ON THE RISK REDUCTION FACTOR AND WHAT IS THE BASIS FOR SELECTING 80,000 MAN-REM FOR USE IN THE COST/BENEFIT ANALYSIS?

ANSWER.

THE 80,000 MAN-REM VALUE IS DETERMINED BY SUMMING THE ESTIMATED REDUCTION IN OFFSITE EXPOSURE FOR A STATION BLACKOUT EVENT FOR THE NUMBER OF OPERATING PLANTS TIMES THE AVERAGE REMAINING LIFE OF THE PLANT (SEE NUREG-1109, FOR COMMENT, SECTION 4). THE ESTIMATED OFFSITE EXPOSURE IS A FUNCTION OF PLANT SIZE AND POPULATION DENSITY, AND RANGED FROM ABOUT 0.5 TO 7×10^6 MAN-REM/PLANT; THE AVERAGE VALUE IS APPROXIMATELY 2×10^6 MAN-REM/PLANT. THE MEAN REDUCTION IN CORE MELT FREQUENCY FOR ALL PLANTS IS APPROXIMATELY 3×10^{-5} PER REACTOR-YEAR, AND A VALUE OF 25 YEARS WAS ASSUMED FOR THE AVERAGE REMAINING PLANT LIFE. A POPULATION OF 67 OPERATING PLANTS WAS USED AND THE PLANTS WERE GROUPED BY SIMILAR CHARACTERISTICS (E.G. EDG CONFIGURATION, LOSS OF OFFSITE POWER CATEGORY). THE ANALYSIS USED 67 PLANTS BECAUSE SIGNIFICANT OPERATING EXPERIENCE WAS AVAILABLE FOR THIS GROUP ALONG WITH INFORMATION REGARDING OFFSITE POWER AND ONSITE POWER DESIGN CONFIGURATION. THE

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QUESTION 6. (CONTINUED)

RESULTANT MAN-REM EXPOSURE REDUCTION WAS OBTAINED BY SUMMING THE CONTRIBUTION FOR EACH GROUP OF PLANTS RATHER THAN PERFORMING THE CALCULATION FOR EACH PLANT AND SUMMING THE RESULT.

THE 80,000 MAN-REM VALUE IS A BEST ESTIMATE CALCULATION AND COULD VARY EQUALLY ON EITHER THE HIGHER OR LOWER SIDE. BASED ON ESTIMATES AND SENSITIVITY ANALYSES IN NUREG-1032, THE ACTUAL CORE DAMAGE FREQUENCY COULD VARY BY ABOUT AN ORDER OF MAGNITUDE (HIGHER OR LOWER) FROM THE BEST ESTIMATE DEPENDING ON THE ACTUAL PLANT-SPECIFIC RELIABILITY PARAMETERS.

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QUESTION 7. PLEASE PROVIDE THE NUMERICAL SCALES FOR THE
GRAPHS ON VIEWGRAPHS 20 AND 26 AND AN EXPLANATION
OF HOW THE UPPER AND LOWER BOUNDS WERE DETERMINED.

RESPONSE.

THE INFORMATION PRESENTED ON VIEWGRAPHS 20 AND 26 WAS INTENDED
TO CONVEY GENERAL CONCLUSIONS AND WAS NOT INTENDED TO BE
QUANTITATIVE. ALTHOUGH THESE GRAPHS WERE QUALITATIVE IN NATURE,
THEY WERE BASED ON INFORMATION IN APPENDIX A OF NUREG-1032.
VIEWGRAPH 20 WAS INTENDED TO DISPLAY THE RANGE OF DATA ON FIGURE
A-14 WHICH SHOWS THE FREQUENCY OF LOSS OF OFFSITE POWER FOR
DIFFERENT PLANT DESIGN AND SITE CHARACTERISTICS. VIEWGRAPHS 26
IS A COMPOSITE OF THE DATA GIVEN ON FIGURES 8.1, 8.2, AND 8.3
SHOWING THE ESTIMATED CORE DAMAGE FREQUENCY AS A FUNCTION OF
STATION BLACKOUT COPING CAPABILITY AND THREE OTHER PARAMETERS,
OFFSITE POWER CHARACTERISTICS, DIESEL GENERATOR RELIABILITY, AND
DIESEL GENERATOR CONFIGURATION RESPECTIVELY. THE REFERENCED
FIGURES FROM NUREG-1032 ARE ATTACHED.

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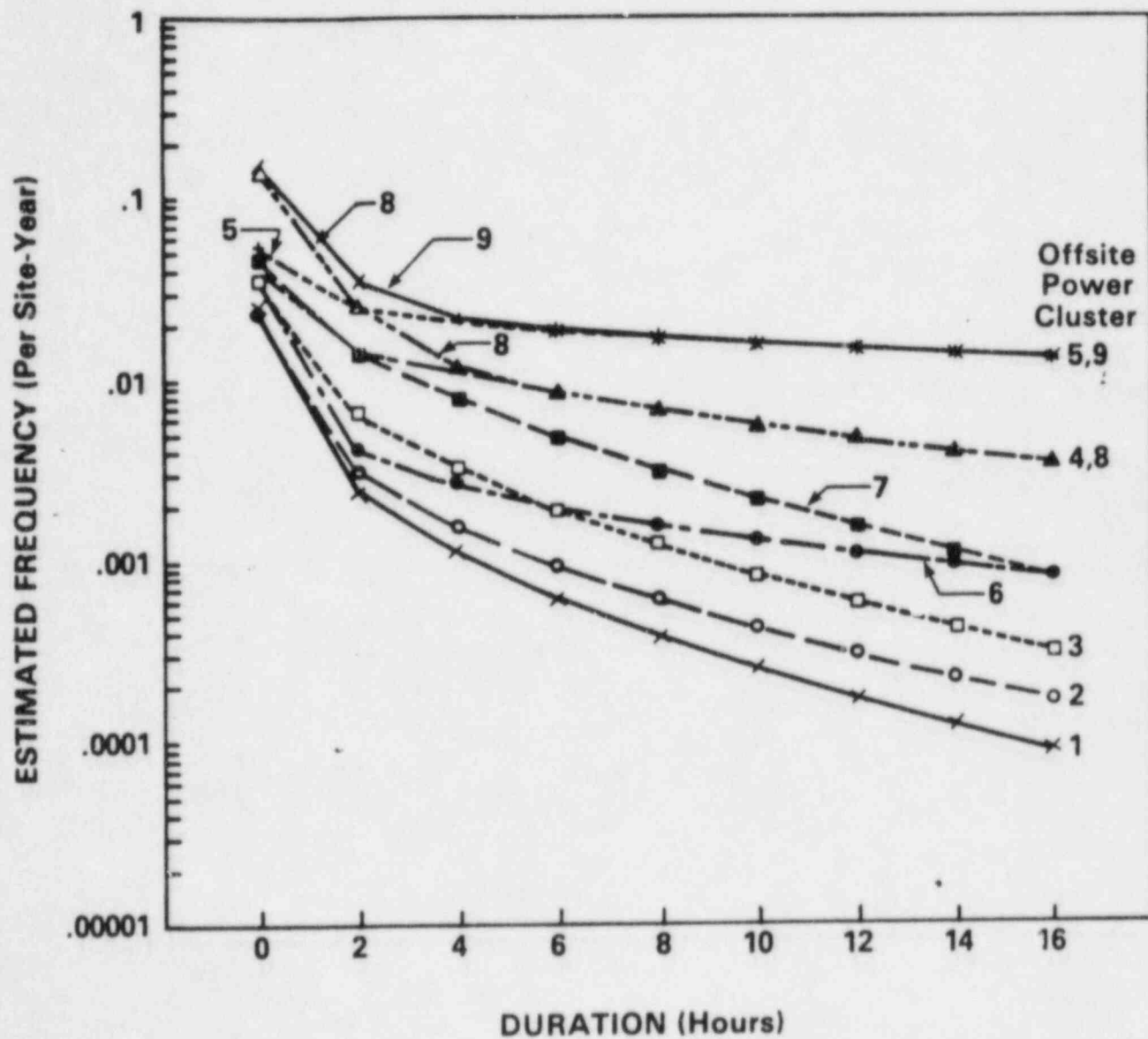


Figure A.14 Estimated frequency of occurrence of losses of offsite power exceeding specified durations for nine offsite power clusters

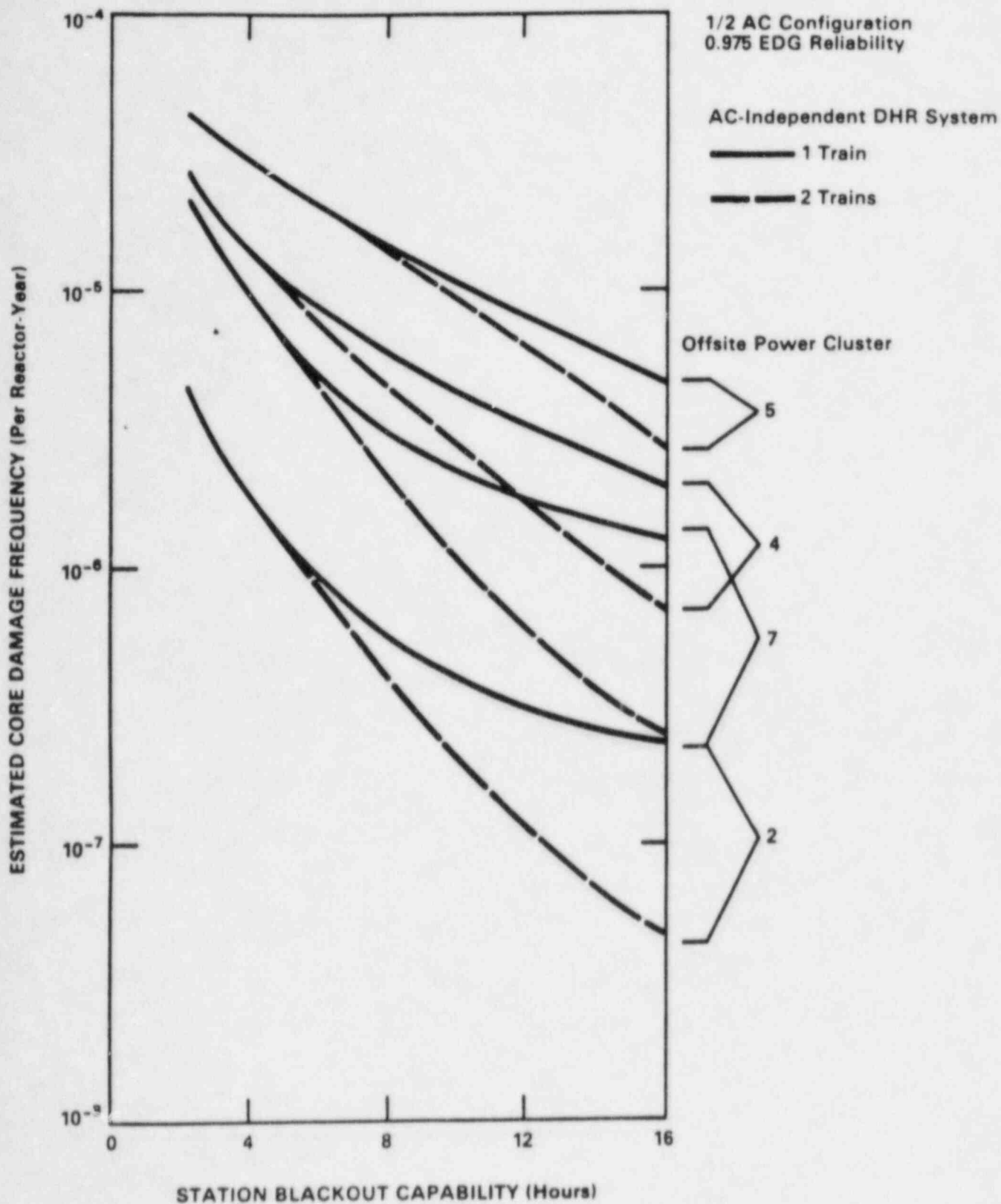


Figure 8.1 Sensitivity of estimated station blackout-core damage frequency to offsite power cluster, AC-independent decay heat removal reliability, and station blackout coping capability

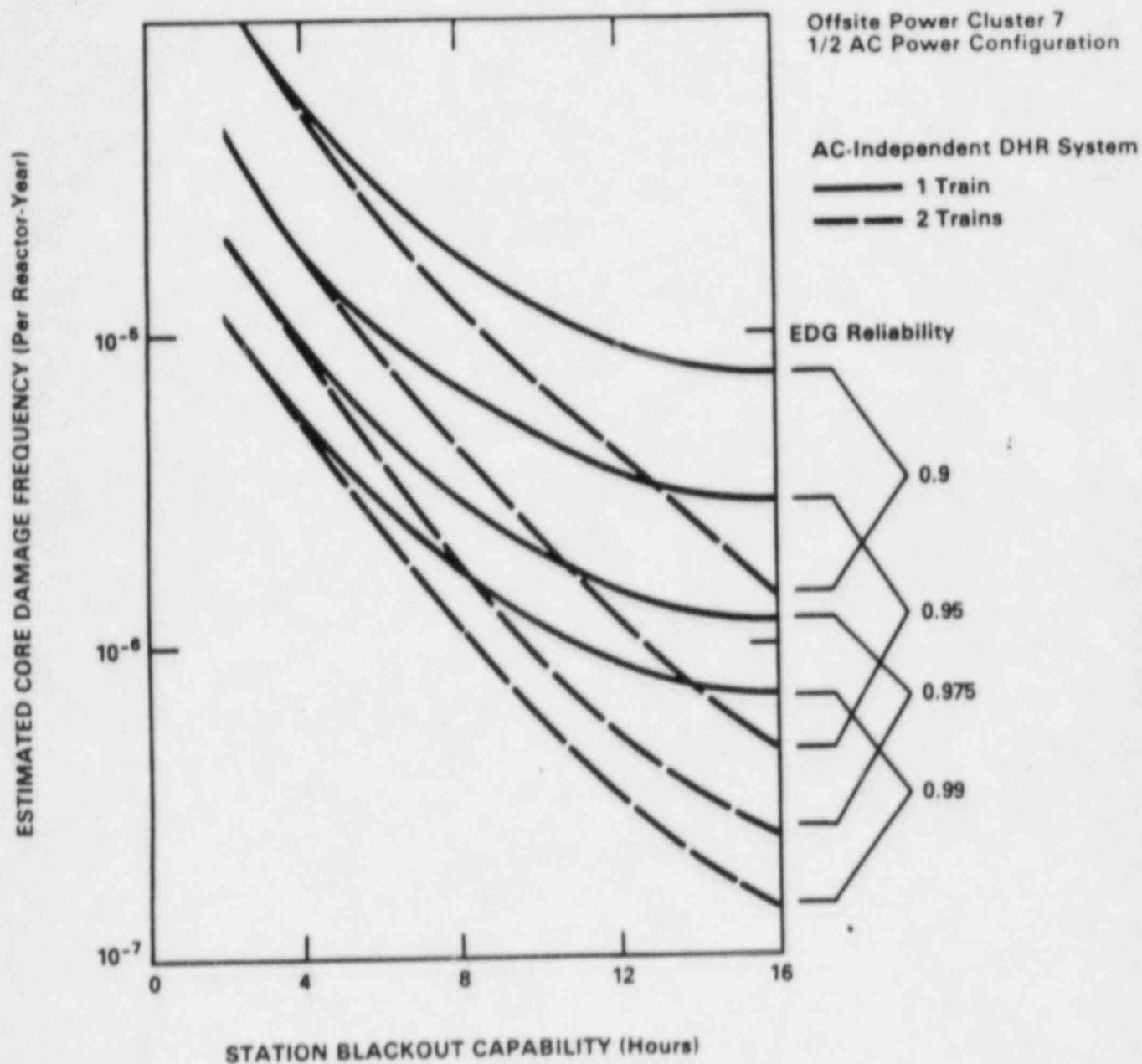


Figure 8.2 Sensitivity of estimated station blackout-core damage frequency to emergency diesel generator reliability, AC-independent decay heat removal reliability, and station blackout coping capability

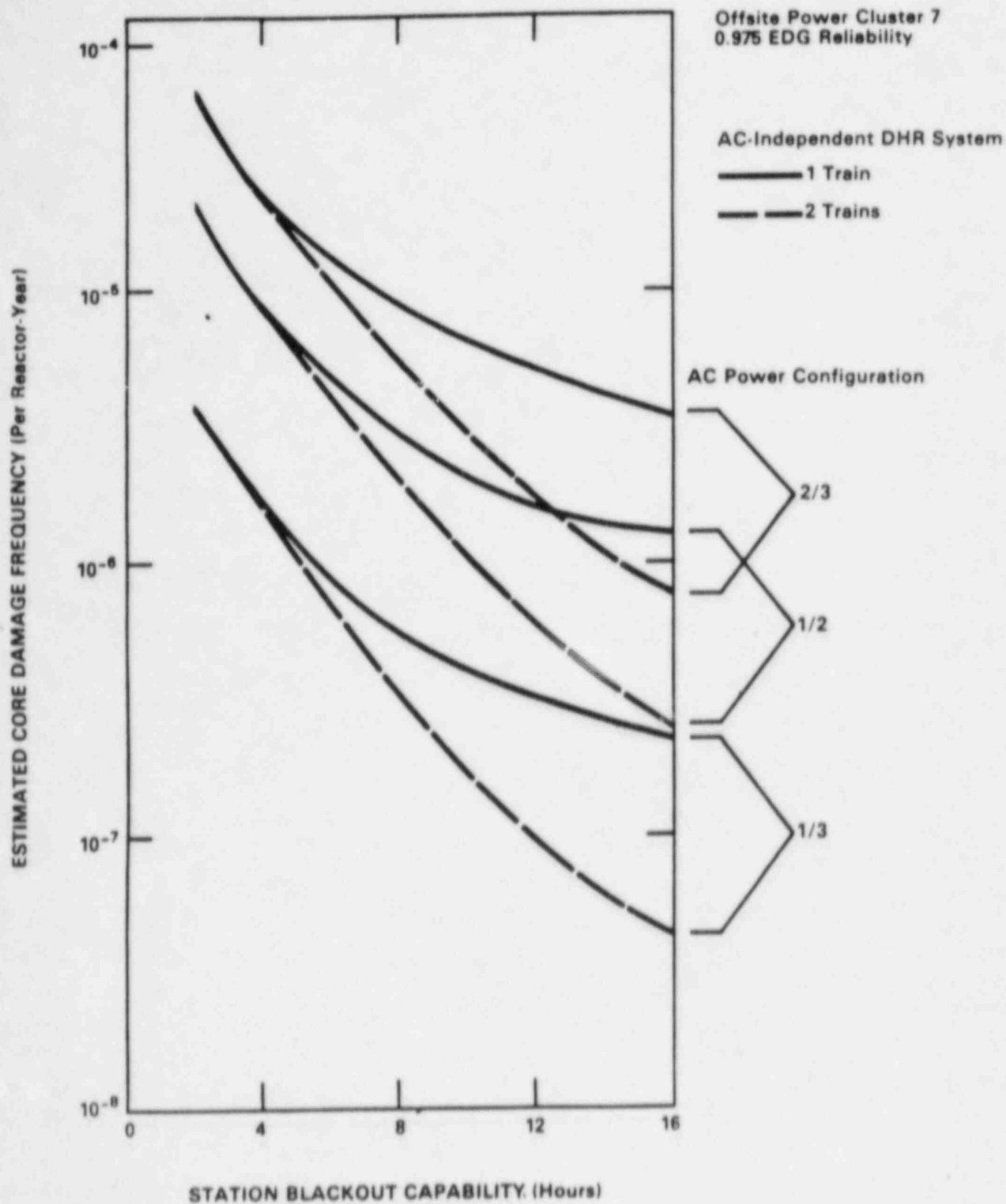


Figure 8.3 Sensitivity of estimated station blackout-core damage frequency to emergency AC power configurations, AC-independent decay heat removal reliability, and station blackout coping capability

QUESTION 8. WHAT IS THE BASIS FOR THE ASSUMPTION THAT ALL PLANTS CAN NOW COPE WITH STATION BLACKOUT FOR TWO HOURS? IF THE RULE WOULD REQUIRE A MINIMUM OF FOUR HOURS OF COPING CAPABILITY, WHAT IS THE RELEVANCE OF THE ABOVE ASSUMPTION?

ANSWER.

THE MAIN CONSIDERATIONS FOR COPING WITH A STATION BLACKOUT ARE THE CAPACITY OF THE WATER SUPPLIES (E.G. CONDENSATE STORAGE TANK) THAT CAN BE USED TO REMOVE DECAY HEAT, THE CAPACITY OF THE DC POWER SYSTEM FOR THE OPERATION OF ESSENTIAL INSTRUMENTATION, CONTROLS AND LIGHTING, AND THE POTENTIAL LOSS OF PRIMARY SYSTEM COOLANT (DUE TO POTENTIAL REACTOR COOLANT PUMP SEAL LEAKAGE).

STAFF REVIEWS FOR PWRs UNDER TMI ACTION PLAN ITEM II.E.1.1, "AUXILIARY FEEDWATER SYSTEM EVALUATION", HAVE SHOWN THAT A WATER SUPPLY FOR AT LEAST TWO HOURS IS AVAILABLE UNDER STATION BLACKOUT CONDITIONS. FOR BWRs, SIMILAR REVIEWS HAVE SHOWN THAT A COMPARABLE CAPABILITY EXISTS FOR PLANTS WITH REACTOR CORE ISOLATION COOLING (RCIC) AND/OR HIGH PRESSURE CORE INJECTION (HPCI) SYSTEMS. FOR THE TWO BWR FACILITIES WITH

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QUESTION 8. (CONTINUED)

ISOLATION CONDENSERS AND NO RCIC OR HPCI, AS LONG AS WATER IS ADDED TO THE ISOLATION CONDENSER, THE CORE COOLING CAPABILITY CAN BE MAINTAINED.

STAFF REVIEWS OF THE DC BATTERY CAPABILITY FOR BWRs AND PWRs ALSO SHOW A BATTERY CAPACITY OF AT LEAST TWO HOURS. THIS DURATION COULD PROBABLY BE EXTENDED BY SHEDDING NON-ESSENTIAL LOADS UNDER STATION BLACKOUT CONDITIONS.

THE EFFECT OF REACTOR COOLANT LOSS HAS BEEN EVALUATED BY THE LICENSEE FOR THE ST. LUCIE FACILITIES. THESE EVALUATIONS INDICATE THAT CORE COOLING IS MAINTAINED FOR APPROXIMATELY FOUR HOURS ASSUMING A PRIMARY SYSTEM LEAKAGE RATE OF 16 GPM. CONSEQUENTLY, IT IS EXPECTED THAT MOST PWRs SHOULD HAVE AT LEAST A TWO-HOUR CAPABILITY.

THE RULE DOES NOT INCLUDE A SPECIFIC REQUIREMENT OF TIME FOR COPING CAPABILITY. THE REGULATORY GUIDE PROVIDES AN EASILY USED METHOD THAT A LICENSEE CAN USE TO SELECT EITHER A FOUR-HOUR CAPABILITY OR AN EIGHT-HOUR CAPABILITY WHICH WOULD BE ACCEPTABLE TO THE STAFF IN MEETING THE REQUIREMENTS OF THE RULE. THE GUIDE ALSO PROVIDES FOR LICENSEES WHO WISH TO MAKE A

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QUESTION 8. (CONTINUED)

SEPARATE ARGUMENT FOR A SHORTER TIME PERIOD BASED ON THE SPECIFIC CAPABILITIES OF THEIR PLANT. (THIS IS BECAUSE THE OBJECTIVE OF STATION BLACKOUT FREQUENCY OF ABOUT 10^{-5} /REACTOR-YEAR OR LESS CAN BE ACHIEVED FOR SOME DESIGNS AND SITE-CONFIGURATIONS WITH COPING CAPABILITY OF LESS THAN FOUR HOURS.)

THE RELEVANCE OF THE INFORMATION REGARDING EXISTING COPING CAPABILITY IS IN ESTIMATING THE COST OF IMPLEMENTING THE RULE. SYSTEMS FOR COPING WITH STATION BLACKOUT FOR SOME DURATION ARE ALREADY IN PLACE. THE PROPOSED RULE AND ASSOCIATED REGULATORY GUIDE WOULD ASSURE THAT THE LENGTH OF TIME THAT THE NECESSARY SYSTEMS WILL FUNCTION IS SUCH THAT STATION BLACKOUT IS A RELATIVELY SMALL CONTRIBUTOR TO TOTAL CORE MELT FREQUENCY.

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QUESTION 9. REGARDING THE FOREIGN EXPERIENCE IDENTIFIED ON VIEWGRAPH 7 OF THE STAFF BRIEFING PACKAGE: A) WHICH COUNTRIES REQUIRE GREATER PROTECTION (IN TERMS OF PREVENTION AND/OR MITIGATION) FOR STATION BLACKOUT THAN CALLED FOR IN THE STAFF PROPOSED RULE? B) WHAT IS THE RATIONALE FOR NOT REQUIRING A SIMILAR LEVEL OF PROTECTION AT THE U.S. PLANTS AS THAT APPARENTLY BEING ACHIEVED AT FOREIGN PLANTS? C) WHAT STATION BLACKOUT REQUIREMENTS HAVE BEEN BACKFITTED AT FOREIGN PLANTS? D) WHAT DOES THE STAFF KNOW ABOUT THE FOREIGN COST-BENEFIT ANALYSES ASSOCIATED WITH DECISIONS ON WHETHER TO LOWER THE STATION BLACKOUT RISKS?

ANSWER.

THE FOLLOWING PROVIDES OUR UNDERSTANDING OF THE FOREIGN EXPERIENCE WITH THE STATION BLACKOUT ISSUE:

- A) IN FRANCE, NUCLEAR POWER STATIONS ARE ABLE TO COPE WITH A STATION BLACKOUT LASTING THREE DAYS. (SEE RESPONSE TO QUESTION 3 FROM COMMISSIONER BERNTHAL FOR ADDITIONAL INFORMATION.) IN BRITAIN, THE SIZEWELL B

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QUESTION 9. (CONTINUED)

FACILITY INCLUDES A SEPARATE AC-INDEPENDENT CHARGING PUMP FOR REACTOR COOLANT PUMP SEAL COOLING. IN ADDITION, MANY EUROPEAN FACILITIES HAVE MORE REDUNDANT ONSITE AC POWER SUPPLIES (DIESELS) THAN IN THIS COUNTRY.

- B) THE STAFF BELIEVES THAT IMPLEMENTATION OF THE PROPOSED RULE WILL REDUCE THE RISK FROM STATION BLACKOUT SO THAT IT IS NO LONGER A SIGNIFICANT CONTRIBUTOR. REQUIRING FURTHER IMPROVEMENTS FOR STATION BLACKOUT BEYOND THE STAFF'S RECOMMENDATIONS MAY NOT BE COST EFFECTIVE.
- C) THE FRENCH ARE BACKFITTING THEIR 900 MWE PLANTS WITH A STEAM-DRIVEN GENERATOR THAT CAN PROVIDE POWER FOR A PUMP TO COOL THE REACTOR COOLANT PUMP SEALS AND POWER FOR ESSENTIAL INSTRUMENTATION AND CONTROLS DURING A STATION BLACKOUT.
- D) THE STAFF HAS NO DETAILED INFORMATION ON FOREIGN COST-BENEFIT ANALYSES. HOWEVER, THE BACKFIT ON FRENCH PWRs IS ESTIMATED BY THE FRENCH TO COST ABOUT \$600 THOUSAND PER PLANT.

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QUESTION 10. THE FRENCH HAVE EVIDENTLY ADOPTED THE FOLLOWING
SAFETY GOAL AND BACKFITTING REGULATION:

"THE FREQUENCY OF OCCURRENCE OF ACCIDENTS BEYOND
DESIGN THAT POTENTIALLY INVOLVE FUEL DAMAGE MUST
BE IN THE ORDER OF 10^{-7} PER REACTOR YEAR (RY) OR
LESS TO BE ADMISSIBLE WITHOUT ANY MITIGATION
ACTION. IF THE PROBABILITY WERE HIGHER,
MITIGATING ACTIONS WOULD BE REQUIRED ACCORDING
TO THE FRENCH NUCLEAR SAFETY REGULATION."
(EMPHASIS ADDED) (SEE, NUCLEAR SAFETY 26 [4]
JULY-AUGUST 1985, P. 427).

THE FRENCH HAVE EVIDENTLY APPLIED THESE
PRINCIPLES IN DECIDING TO BACKFIT THEIR REACTORS
WITH RESPECT TO STATION BLACKOUT AND OTHER SAFETY
ISSUES. THUS, IT APPEARS THAT THE FRENCH, AND
PERHAPS MANY OTHER FOREIGN COUNTRIES, ARE
REQUIRING AND ACHIEVING A SIGNIFICALLY GREATER
LEVEL OF SAFETY THAN THE U.S. REACTORS. IS MY
PERCEPTION CORRECT?

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QUESTION 10. (CONTINUED)

ANSWER.

THE FRENCH GOAL FOR CORE UNCOVERY OR CORE MELT IS 10^{-7} PER REACTOR-YEAR FOR STATION BLACKOUT EVENTS AND OTHER "FAMILIES OF EVENTS" SUCH AS TOTAL LOSS OF FEEDWATER. THIS IS LESS THAN THE U.S. OBJECTIVE OF 10^{-5} PER REACTOR-YEAR FOR STATION BLACKOUT. THE U.S. OBJECTIVE WOULD MAKE STATION BLACKOUT A SMALL CONTRIBUTOR TO TOTAL CORE DAMAGE FREQUENCY, WHEREAS IF THE FRENCH GOAL IS ACHIEVED, IT WOULD BE AN INSIGNIFICANT CONTRIBUTOR. HOWEVER, THERE COULD BE SUBSTANTIALLY INCREASED COSTS TO ACHIEVE THE LOWER GOAL. THIS MONEY COULD POSSIBLY BE SPENT MORE EFFECTIVELY TO REDUCE RISKS FROM OTHER ACCIDENT SEQUENCES WITH CORE DAMAGE FREQUENCIES GREATER THAN 10^{-5} PER REACTOR-YEAR.

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