

**ORIGINAL**

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the matter of:  
  
COMMISSION MEETING  
  
Affirmation/Discussion and Vote  
  
(Public Meeting)

Docket No.

Location: Washington, D. C.  
Date: Thursday, May 1, 1986

Pages: 1 - 4

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1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION  
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6 Public Session  
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9 AFFIRMATION/DISCUSSION AND VOTE  
10

11 1717 H Street, N.W.

12 Room 1130

13 Washington, D.C.

14 Thursday, May 1, 1986  
15

16 The Commission met in public session, pursuant to  
17 notice, at 11:55 a.m., the Honorable Nunzio J. Palladino,  
18 Chairman of the Commission, presiding.

19 COMMISSIONERS PRESENT:

20 Nunzio J. Palladino, Chairman of the Commission

21 Frederick M. Bernthal, Member of the Commission

22 Thomas M. Roberts, Member of the Commission

23 Lando W. Zech, Jr., Member of the Commission

24 STAFF SEATED AT COMMISSION TABLE:

25 S. Chilk, SECY

## P R O C E E D I N G S

CHAIRMAN PALLADINO: Would you please come to order.

This is an affirmation session, and I will ask the Secretary to lead us through the item we have on the agenda.

MR. CHILK: The paper, Mr. Chairman, is SECY 85-279, a revised Advanced Reactor Policy Statement.

The Commission is being asked in this paper to approve the issuance of an Advanced Reactor Policy Statement. The primary objectives of the policy statement are to encourage early as possible interaction with the applicants, vendors, and government agencies with the NRC to provide all interested parties, including the public, with the Commission's views concerning the desired characteristics of the advanced reactor designs, and to express the Commission's intent to issue timely comment on the implication of such designs for safety and regulatory process.

The Chairman, Commissioners Roberts, Bernthal and Zech agree. I have attached the approved policy statement which is attached to our Memorandum of April 30th.

Commissioner Roberts, while approving, is deeply concerned about the statement -- page 6 of the statement, specifically, whereby the Commission commits advanced reactor designs to comply with a forthcoming safety goals policy statement before the safety goals policy statement is finalized, and while the final wording is still fluid.

1 Commissioner Asselstine, although unable to attend  
2 this affirmation, has disapproved the policy statement. His  
3 separate views are attached.

4 Would you please affirm your votes.

5 CHAIRMAN PALLADINO: Aye.

6 COMMISSIONER ROBERTS: Aye.

7 COMMISSIONER ZECH: Aye.

8 CHAIRMAN PALLADINO: Did you vote?

9 COMMISSIONER BERNTHAL: Well, actually, I had a  
10 minor editorial change I was going to suggest. We ought to  
11 give the opportunity to do those things. It's purely for  
12 consistency. There was a lot of discussion about  
13 "anticipates" versus "expects" throughout this document, and  
14 there is one instance where correction of consistency was not  
15 made, and that is on page 2, I think, in the summary, whereas  
16 everywhere else we are now saying and agreed to say the  
17 Commission expects an advanced reactor will provide more  
18 margin prior to exceeding safety limits, et cetera, et  
19 cetera. There is an "anticipates" that remained in the  
20 summary in the introduction there, so we are now using both  
21 words, and I think we probably ought to be consistent with  
22 what we agreed later on in the document.

23 If that is too big a change, then I guess it doesn't  
24 matter that much.

25 MR. CHILK: Why don't I make the change and walk it

1 around --

2 COMMISSIONER BERNTHAL: Yes, I think we ought to try  
3 and be consistent on that.

4 CHAIRMAN PALLADINO: All right, so our approval is  
5 subject to --

6 MR. CHILK: Subject to this one-word change.

7 CHAIRMAN PALLADINO: -- this one-word change, if  
8 possible. Okay. All right.

9 Now are you ready to vote?

10 MR. CHILK: Will you all affirm your votes on that,  
11 please?

12 CHAIRMAN PALLADINO: Aye.

13 COMMISSIONER BERNTHAL: Aye.

14 COMMISSIONER ROBERTS: Aye.

15 COMMISSIONER ZECH: Aye.

16 CHAIRMAN PALLADINO: Anything more to come before  
17 us?

18 MR. CHILK: No, Mr. Chairman.

19 CHAIRMAN PALLADINO: All right. Thank you very  
20 much. We will adjourn the affirmation.

21 [Whereupon, at 11:58 a.m., the affirmation was  
22 concluded.]

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2 REPORTER'S CERTIFICATE  
3

4 This is to certify that the attached events of a  
5 meeting of the U.S. Nuclear Regulatory Commission entitled:  
6

7 TITLE OF MEETING: Affirmation/Discussion and Vote (Public Meeting)  
8 PLACE OF MEETING: Washington, D.C.  
9 DATE OF MEETING: Thursday, May 1, 1986  
10

11 were held as herein appears, and that this is the original ,  
12 transcript thereof for the file of the Commission taken  
13 stenographically by me, thereafter reduced to typewriting by  
14 me or under the direction of the court reporting company, and  
15 that the transcript is a true and accurate record of the  
16 foregoing events.

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2. 10 CFR Pt 50, Policy for  
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NUCLEAR REGULATORY COMMISSION

10 CFR PART 50

POLICY FOR REGULATION OF  
ADVANCED NUCLEAR POWER PLANTS

AGENCY: NUCLEAR REGULATORY COMMISSION

ACTION: FINAL POLICY STATEMENT

SUMMARY: THE COMMISSION INTENDS TO IMPROVE THE LICENSING ENVIRONMENT FOR ADVANCED NUCLEAR POWER REACTORS TO MINIMIZE COMPLEXITY AND UNCERTAINTY IN THE REGULATORY PROCESS. THIS STATEMENT GIVES THE COMMISSION'S POLICY REGARDING THE REVIEW OF, AND DESIRED CHARACTERISTICS ASSOCIATED WITH, ADVANCED REACTORS. THIS POLICY STATEMENT IS A REVISION OF THE "PROPOSED POLICY FOR REGULATION OF ADVANCED NUCLEAR POWER PLANTS" THAT WAS PUBLISHED FOR COMMENT ON MARCH 26, 1985 (50 FR 11884).

THE COMMISSION'S PRIMARY OBJECTIVES IN ISSUING AN ADVANCED REACTOR POLICY STATEMENT ARE THREEFOLD:

- ° FIRST, TO ENCOURAGE THE EARLIEST POSSIBLE INTERACTION OF APPLICANT, VENDORS, AND GOVERNMENT AGENCIES, WITH THE NRC;
- ° SECOND, TO PROVIDE ALL INTERESTED PARTIES, INCLUDING THE PUBLIC, WITH THE COMMISSION'S VIEWS CONCERNING THE DESIRED CHARACTERISTICS OF ADVANCED REACTOR DESIGNS; AND

- ° THIRD, TO EXPRESS THE COMMISSION'S INTENT TO ISSUE TIMELY COMMENT ON THE IMPLICATIONS OF SUCH DESIGNS FOR SAFETY AND THE REGULATORY PROCESS.

SUCH INTERACTION AND GUIDANCE EARLY IN THE DESIGN PROCESS SHOULD ENHANCE STABILITY AND PREDICTABILITY IN THE LICENSING AND REGULATION OF ADVANCED REACTORS.

ADVANCED PEACTORS ARE CONSIDERED HERE TO BE THOSE REACTORS THAT ARE SIGNIFICANTLY DIFFERENT FROM CURRENT GENERATION LIGHT WATER REACTORS UNDER CONSTRUCTION OR IN OPERATION. THE COMMISSION EXPECTS THAT THESE DESIGNS WILL REFLECT THE BENEFITS OF SIGNIFICANT RESEARCH AND DEVELOPMENT WORK, AND INCLUDE THE EXPERIENCE GAINED IN OPERATING THE MANY POWER AND DEVELOPMENT REACTORS BOTH IN THE UNITED STATES AND THROUGHOUT THE WORLD. THE COMMISSION ANTICIPATES THAT ADVANCED REACTORS WOULD PROVIDE MORE MARGIN PRIOR TO EXCEEDING SAFETY LIMITS AND/OR UTILIZE SIMPLIFIED, INHERENT, PASSIVE, OR OTHER INNOVATIVE MEANS TO RELIABLY ACCOMPLISH THEIR SAFETY FUNCTIONS. THE COMMISSION EXPECTS, AS A MINIMUM, AT LEAST THE SAME DEGREE OF PROTECTION OF THE PUBLIC AND THE ENVIRONMENT THAT IS REQUIRED FOR CURRENT GENERATION LWRs. FOR THE LONGER TERM, THE COMMISSION EXPECTS DESIGNS TO PROVIDE ENHANCED MARGINS OF SAFETY. TO PROVIDE REGULATORY GUIDANCE DURING THE DEVELOPMENT PHASE OF ADVANCED

REACTOR DESIGN, THE COMMISSION WISHES TO ENCOURAGE THE EARLIEST POSSIBLE INTERACTION BETWEEN THE NPC AND OTHER GOVERNMENT AGENCIES, REACTOR DESIGNERS, AND POTENTIAL LICENSEES.

THIS ADVANCED REACTOR POLICY STATEMENT SETS FORTH THE GENERAL CHARACTERISTICS OF ADVANCED REACTOR DESIGN, WHICH THE COMMISSION BELIEVES ADVANCED REACTORS SHOULD EXHIBIT, TO INCREASE ASSURANCE OF SAFETY, TO IMPROVE PUBLIC UNDERSTANDING, AND TO PROMOTE MORE EFFECTIVE REGULATION. AS THE AGENCY RESPONSIBLE FOR ASSURING THE PROTECTION OF THE PUBLIC FROM THE POTENTIAL HAZARDS OF NUCLEAR POWER PLANTS, THE COMMISSION WILL KEEP THE PUBLIC INFORMED OF ITS JUDGMENT ON THE SAFETY ASPECTS OF ADVANCED REACTOR DESIGNS AS SUCH DESIGNS COME BEFORE THE COMMISSION.

A REPORT WHICH DISCUSSES THE REVISIONS TO THE POLICY STATEMENT WILL BE PUBLISHED SHORTLY AS NUREG-XXX "TITLE." A COPY OF NUREG-XXX WILL BE AVAILABLE FOR INSPECTION AT THE COMMISSION'S PUBLIC DOCUMENT ROOM, 1717 H STREET, N.W., WASHINGTON, D.C.

## REGULATORY POLICY FOR ADVANCED REACTORS

THE COMMISSION INTENDS TO IMPROVE THE LICENSING ENVIRONMENT FOR ADVANCED NUCLEAR POWER REACTORS AND TO MINIMIZE COMPLEXITY AND UNCERTAINTY IN THE REGULATORY PROCESS. THIS IS A STATEMENT OF THE COMMISSION'S POLICY REGARDING THE REVIEW OF, AND DESIRED CHARACTERISTICS ASSOCIATED WITH, ADVANCED REACTORS. THIS POLICY STATEMENT IS A REVISION OF THE "PROPOSED POLICY FOR REGULATION OF ADVANCED NUCLEAR POWER PLANTS" THAT WAS PUBLISHED FOR COMMENT ON MARCH 26, 1985 (50 FR 11884).

THE COMMISSION'S PRIMARY OBJECTIVES IN ISSUING AN ADVANCED REACTOR POLICY STATEMENT ARE THREEFOLD:

- ° FIRST, TO ENCOURAGE THE EARLIEST POSSIBLE INTERACTION OF APPLICANT, VENDORS, AND GOVERNMENT AGENCIES, WITH THE NRC;
- ° SECOND, TO PROVIDE ALL INTERESTED PARTIES, INCLUDING THE PUBLIC, WITH THE COMMISSION'S VIEW CONCERNING THE DESIRED CHARACTERISTICS OF ADVANCED REACTOR DESIGNS; AND
- ° THIRD, TO EXPRESS THE COMMISSION'S INTENT TO ISSUE TIMELY COMMENT ON THE IMPLICATIONS OF SUCH DESIGNS FOR SAFETY AND THE REGULATORY PROCESS.

SUCH INTERACTION AND GUIDANCE EARLY IN THE DESIGN PROCESS SHOULD ENHANCE STABILITY AND PREDICTABILITY IN THE LICENSING AND REGULATION OF ADVANCED REACTORS.

THE COMMISSION CONSIDERS THE TERM "ADVANCED" TO APPLY TO REACTORS THAT ARE SIGNIFICANTLY DIFFERENT FROM CURRENT GENERATION LIGHT WATER REACTORS (LWRs) NOW UNDER CONSTRUCTION, OR IN OPERATION AND TO INCLUDE REACTORS THAT PROVIDE ENHANCED MARGINS OF SAFETY OR UTILIZE SIMPLIFIED INHERENT OR OTHER INNOVATIVE MEANS TO ACCOMPLISH THEIR SAFETY FUNCTIONS.

CURRENTLY, CERTAIN HIGH TEMPERATURE GAS-COOLED REACTORS (HTGRs), LIQUID METAL REACTORS (LMRs), AND LIGHT WATER REACTORS (LWRs) OF INNOVATIVE DESIGN ARE CONSIDERED ADVANCED DESIGNS.

#### LEGISLATIVE BACKGROUND

THE COMMISSION'S POLICY WITH RESPECT TO REGULATION OF ADVANCED REACTORS IS GUIDED BY THE LEGISLATIVE BACKGROUND. THE ENERGY ORGANIZATION ACT OF 1974, WHICH ESTABLISHED THE NUCLEAR REGULATORY COMMISSION, SPECIFICALLY DELEGATED TO NRC "LICENSING AND RELATED REGULATORY AUTHORITY" FOR DEMONSTRATION NUCLEAR REACTORS OTHER THAN THOSE ALREADY IN EXISTENCE "...WHEN OPERATED AS PART OF THE POWER GENERATION FACILITIES OF AN ELECTRIC

UTILITY SYSTEM, OR WHEN OPERATING IN ANY OTHER MANNER FOR THE PURPOSE OF DEMONSTRATING THE SUITABILITY FOR COMMERCIAL APPLICATION OF SUCH A REACTOR... "THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (NOW THE DEPARTMENT OF ENERGY) WAS CHARGED WITH "...ENCOURAGING AND CONDUCTING RESEARCH AND DEVELOPMENT, INCLUDING DEMONSTRATION OF COMMERCIAL FEASIBILITY AND PRACTICAL APPLICATIONS OF THE EXTRACTION, CONVERSION, STORAGE, TRANSMISSION, AND UTILIZATION PHASES RELATED TO THE DEVELOPMENT AND USE OF ENERGY FROM... NUCLEAR...SOURCES."

UNDER SECTION 205 OF THE ENERGY REORGANIZATION ACT, THE NRC MUST PROVIDE A "LONG-TERM PLAN FOR PROJECTS FOR THE DEVELOPMENT OF NEW OR IMPROVED SAFETY SYSTEMS FOR NUCLEAR POWER PLANTS." THE NRC IS PRECLUDED FROM DESIGNING, OR DOING RESEARCH ON, COMPLETE NEW DESIGNS FOR THE PURPOSE OF ESTABLISHING OR DEVELOPING THEIR COMMERCIAL POTENTIAL. <sup>1/</sup>

#### PREVIOUS EXPERIENCE

THE COMMISSION HAS HAD EXPERIENCE IN THE REGULATION OF HTGRs AND LMRs AS WELL AS IN THE REGULATION OF LWRs. THE NRC HAS REVIEWED SEVERAL APPLICATIONS FOR HTGR CONSTRUCTION PERMITS, AND A CONCEPTUAL DESIGN FOR A GAS-COOLED BREEDER REACTOR, AND

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<sup>1/</sup> THE GENERAL PRINCIPLE DEFINING THE SCOPE OF NRC'S RESEARCH CAN BE DESCRIBED AS AVOIDING A CONFLICT OF INTEREST-- "[NRC] SHOULD NEVER BE PLACED IN POSITION TO GENERATE, AND THEN HAVE TO DEFEND, BASIC DESIGN DATA OF ITS OWN" AS EXPRESSED IN THE CONFERENCE REPORT TO THE ENERGY REORGANIZATION ACT OF 1974



HAS GRANTED AN OPERATING LICENSE TO PEACH BOTTOM-1 AND TO FORT ST. VRAIN. THE NRC ALSO EXPENDED SUBSTANTIAL EFFORT FROM 1975 TO 1979 IN REVIEWING GENERAL ATOMIC'S STANDARD HIGH-TEMPERATURE, GAS-COOLED NUCLEAR REACTOR STEAM SUPPLY SYSTEM (GASSAR). IN ADDITION, THE NRC HAS SUPPORTED A MODEST PROGRAM OF SAFETY RESEARCH ON GAS-COOLED REACTORS EVERY YEAR SINCE THE AGENCY'S INCEPTION.

THE COMMISSION HAS ALSO HAD EXPERIENCE IN THE REVIEW AND LICENSING OF LMRs. IN THE PAST THE FERMI-1 AND SEFOR REACTORS WERE REVIEWED AND LICENSED, DOE'S FAST FLUX TEST FACILITY (FFTF) WAS REVIEWED AND APPROVED BUT NOT LICENSED, AND A FORMAL CONSTRUCTION PERMIT LICENSING PROCEEDING WAS CONDUCTED FOR THE CLINCH RIVER BREEDER REACTOR (CRBR). THE CRBR WAS SUBJECT TO THE SAME REGULATORY PROCESS AS ANY CURRENT COMMERCIAL NUCLEAR POWER PROJECT.

FINALLY, THE COMMISSION NOTES THAT THE PRECEDENT FOR THE BROAD POLICY APPROACH TO ADVANCED REACTOR REGULATION, AS PROPOSED HERE, IS FIRMLY ESTABLISHED IN THE 1979 NONPROLIFERATION ALTERNATIVE SYSTEMS ASSESSMENT PROGRAM (NASAP), WHEREIN THE NRC CONSIDERED THE SAFETY AND LICENSABILITY OF A VARIETY OF ADVANCED REACTOR CONCEPTS WITHIN THE CONTEXT OF NONPROLIFERATION



OBJECTIVES. THE CONCEPTS CONSIDERED AND REPORTED ON BY THE NRC IN THE 1979 STUDY RANGED FROM PRELIMINARY CONCEPTUAL DESIGNS TO VARIATIONS OF EXISTING (LWP) POWER PLANTS DESIGNS.

#### COMMISSION POLICY

CONSISTENT WITH ITS LEGISLATIVE MANDATE, THE COMMISSION'S POLICY WITH RESPECT TO REGULATING NUCLEAR POWER REACTORS IS TO ASSURE ADEQUATE PROTECTION OF THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT. REGARDING ADVANCED REACTORS, THE COMMISSION EXPECTS, AS A MINIMUM, AT LEAST THE SAME DEGREE OF PROTECTION OF THE PUBLIC AND THE ENVIRONMENT THAT IS REQUIRED FOR CURRENT GENERATION LWRs. FURTHERMORE, THE COMMISSION EXPECTS THAT ADVANCED REACTORS WILL PROVIDE ENHANCED MARGINS OF SAFETY AND/OR UTILIZE SIMPLIFIED, INHERENT, PASSIVE, OR OTHER INNOVATIVE MEANS TO ACCOMPLISH THEIR SAFETY FUNCTIONS. THE COMMISSION ALSO EXPECTS THAT ADVANCED REACTOR DESIGNS WILL COMPLY WITH THE COMMISSION FORTHCOMING SAFETY GOAL POLICY STATEMENT.

AMONG THE ATTRIBUTES WHICH COULD ASSIST IN ESTABLISHING THE ACCEPTABILITY OR LICENSABILITY OF A PROPOSED ADVANCED REACTOR DESIGN, AND WHICH THEREFORE SHOULD BE CONSIDERED IN ADVANCED DESIGNED ARE:

- ° HIGHLY RELIABLE AND LESS COMPLEX SHUTDOWN AND DECAY HEAT REMOVAL SYSTEMS. THE USE OF INHERENT OR PASSIVE MEANS TO ACCOMPLISH THIS OBJECTIVE IS ENCOURAGED (NEGATIVE TEMPERATURE COEFFICIENT, NATURAL CIRCULATION),
- ° LONGER TIME CONSTANTS AND SUFFICIENT INSTRUMENTATION TO ALLOW FOR MORE DIAGNOSIS AND MANAGEMENT PRIOR TO REACHING SAFETY SYSTEMS CHALLENGE AND/OR EXPOSURE OF VITAL EQUIPMENT TO ADVERSE CONDITIONS,
- ° SIMPLIFIED SAFETY SYSTEMS WHICH, WHERE POSSIBLE, REDUCE REQUIRED OPERATOR ACTIONS, EQUIPMENT SUBJECTED TO SEVERE ENVIRONMENTAL CONDITIONS, AND COMPONENTS NEEDED FOR MAINTAINING SAFE SHUTDOWN CONDITIONS. SUCH SIMPLIFIED SYSTEMS SHOULD FACILITATE OPERATOR COMPREHENSION, RELIABLE SYSTEM FUNCTION, AND MORE STRAIGHT-FORWARD ENGINEERING ANALYSIS,
- ° DESIGNS THAT MINIMIZE THE POTENTIAL FOR SEVERE ACCIDENTS AND THEIR CONSEQUENCES BY PROVIDING SUFFICIENT INHERENT SAFETY, RELIABILITY, REDUNDANCY, DIVERSITY AND INDEPENDENCE IN SAFETY SYSTEMS,

- ° DESIGNS THAT PROVIDE RELIABLE EQUIPMENT IN THE BALANCE OF PLANT, (OF SAFETY-SYSTEM INDEPENDENCE FROM BALANCE OF PLANT) TO REDUCE THE NUMBER OF CHALLENGES TO SAFETY SYSTEMS.
- ° DESIGNS THAT PROVIDE EASILY MAINTAINABLE EQUIPMENT AND COMPONENTS.
- ° DESIGNS THAT REDUCE POTENTIAL RADIATION EXPOSURES TO PLANT PERSONNEL.
- ° DESIGNS THAT INCORPORATE DEFENSE-IN-DEPTH PHILOSOPHY BY MAINTAINING MULTIPLE BARRIERS AGAINST RADIATION RELEASE, AND BY REDUCING THE POTENTIAL FOR AND CONSEQUENCES OF SEVERE ACCIDENTS.
- ° DESIGN FEATURES THAT CAN BE PROVEN BY CITATION OF EXISTING TECHNOLOGY OR WHICH CAN BE SATISFACTORILY ESTABLISHED BY COMMITMENT TO A SUITABLE TECHNOLOGY DEVELOPMENT PROGRAM.

IF SPECIFIC ADVANCED REACTOR DESIGNS WITH SOME OR ALL OF THE ABOVE OF THE FOREGOING ATTRIBUTES ARE BROUGHT TO THE NRC FOR COMMENT AND/OR EVALUATION, THE COMMISSION CAN DEVELOP

PRELIMINARY DESIGN SAFETY EVALUATIONS AND LICENSING CRITERIA FOR THEIR SAFETY RELATED ASPECTS. COMBINATIONS OF SOME OR ALL OF THE ABOVE ATTRIBUTES MAY HELP OBTAIN EARLY LICENSING APPROVAL WITH MINIMUM REGULATORY BURDEN. DESIGNS WITH SOME OR ALL OF THESE ATTRIBUTES ARE ALSO LIKELY TO BE MORE READILY UNDERSTOOD BY THE GENERAL PUBLIC. INDEED, THE NUMBER AND NATURE OF THE REGULATORY REQUIREMENTS MAY DEPEND ON THE EXTENT TO WHICH AN INDIVIDUAL ADVANCED REACTOR DESIGN INCORPORATES GENERAL ATTRIBUTES SUCH AS THOSE LISTED ABOVE. HOWEVER, UNTIL SUCH TIME AS CONCEPTUAL DESIGNS ARE SUBMITTED, THE COMMISSION BELIEVES THAT REGULATORY GUIDANCE MUST BE SUFFICIENTLY GENERAL TO AVOID PLACING UNNECESSARY CONSTRAINTS ON THE DEVELOPMENT OF NEW DESIGN CONCEPTS.

TO PROVIDE FOR MORE TIMELY AND EFFECTIVE REGULATION OF ADVANCED REACTORS, THE COMMISSION ENCOURAGES THE EARLIEST POSSIBLE INTERACTION OF APPLICANTS, VENDORS, OTHER GOVERNMENT AGENCIES, AND THE NRC TO PROVIDE FOR EARLY IDENTIFICATION OF REGULATORY REQUIREMENTS FOR ADVANCED REACTORS, AND TO PROVIDE ALL INTERESTED PARTIES, INCLUDING THE PUBLIC, WITH A TIMELY, INDEPENDENT ASSESSMENT OF THE SAFETY CHARACTERISTICS OF ADVANCED REACTOR DESIGNS. SUCH LICENSING INTERACTION AND GUIDANCE EARLY IN THE DESIGN PROCESS, WILL CONTRIBUTE TOWARD MINIMIZING COMPLEXITY AND ADDING STABILITY AND PREDICTABILITY IN THE LICENSING AND REGULATION OF ADVANCED REACTORS.

WHILE THE NRC ITSELF DOES NOT DEVELOP NEW DESIGNS, THE COMMISSION INTENDS TO DEVELOP THE CAPABILITY FOR TIMELY ASSESSMENT AND RESPONSE TO INNOVATIVE AND ADVANCED DESIGNS THAT MIGHT BE PRESENTED FOR NRC REVIEW. PRIOR EXPERIENCE HAS SHOWN THAT NEW REACTOR DESIGNS -- EVEN VARIATIONS OF ESTABLISHED DESIGNS -- MAY INVOLVE TECHNICAL PROBLEMS THAT MUST BE SOLVED IN ORDER TO ASSURE ADEQUATE PROTECTION OF THE PUBLIC HEALTH AND SAFETY. THE EARLIER SUCH DESIGN PROBLEMS ARE IDENTIFIED, THE EARLIER SATISFACTORY RESOLUTION CAN BE ACHIEVED. PROSPECTIVE APPLICANTS ARE REMINDED THAT, WHILE THE NRC WILL UNDERTAKE TO REVIEW AND COMMENT ON NEW DESIGN CONCEPTS, THE APPLICANTS ARE RESPONSIBLE FOR ALL DOCUMENTATION AND RESEARCH NECESSARY TO SUPPORT ANY SPECIFIC LICENSE APPLICATION. (NRC RESEARCH IS CONDUCTED TO PROVIDE THE TECHNICAL BASES FOR RULEMAKING AND REGULATORY DECISIONS; TO SUPPORT LICENSING AND INSPECTION ACTIVITIES; AND TO INCREASE NRC'S UNDERSTANDING OF PHENOMENA FOR WHICH ANALYTICAL METHODS ARE NEEDED IN REGULATORY ACTIVITIES).

DURING THE INITIAL PHASE OF ADVANCED REACTOR DEVELOPMENT, THE COMMISSION PARTICULARLY ENCOURAGES DESIGN INNOVATIONS WHICH ENHANCE SAFETY AND RELIABILITY (SUCH AS THOSE DESCRIBED ABOVE) AND WHICH GENERALLY DEPEND ON TECHNOLOGY WHICH IS EITHER PROVEN OR CAN BE DEMONSTRATED BY A STRAIGHT-FORWARD TECHNOLOGY DEVELOPMENT PROGRAM. IN THE ABSENCE OF A SIGNIFICANT HISTORY OF OPERATING EXPERIENCE ON AN ADVANCED CONCEPT REACTOR, PLANS

FOR INNOVATIVE USE OF PROVEN TECHNOLOGY AND/OR NEW TECHNOLOGY DEVELOPMENT PROGRAMS SHOULD BE PRESENTED TO THE NRC FOR REVIEW AS EARLY AS POSSIBLE, SO THAT THE NRC CAN ASSESS HOW THE PROPOSED PROGRAM MIGHT INFLUENCE REGULATORY REQUIREMENTS. TO ACHIEVE THESE BROAD OBJECTIVES, AN ADVANCED REACTORS GROUP HAS BEEN ESTABLISHED IN THE OFFICE OF NUCLEAR REACTOR REGULATION. THIS GROUP WILL BE THE FOCAL POINT FOR NRC INTERACTION WITH THE DEPARTMENT OF ENERGY, REACTOR DESIGNERS AND POTENTIAL APPLICANTS, AND WILL COORDINATE THE DEVELOPMENT OF REGULATORY CRITERIA AND GUIDANCE FOR PROPOSED ADVANCED REACTORS. IN ADDITION, THE GROUP WILL MAINTAIN KNOWLEDGE OF ADVANCED REACTOR DESIGNS, DEVELOPMENTS AND OPERATING EXPERIENCE IN OTHER COUNTRIES, AND WILL PROVIDE GUIDANCE ON AN NRC-FUNDED ADVANCED REACTOR SAFETY RESEARCH PROGRAM TO ENSURE THAT IT SUPPORTS, AND IS CONSISTENT WITH, THE COMMISSION'S ADVANCED REACTOR POLICY. THE ADVANCED REACTORS GROUP WILL ALSO PROVIDE GUIDANCE REGARDING THE TIMING AND FORMAT OF SUBMITTALS FOR REVIEW. THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS) WILL PLAY A SIGNIFICANT ROLE IN REVIEWING PROPOSED ADVANCED REACTOR DESIGN CONCEPTS AND SUPPORTING ACTIVITIES.

## COMMISSION POSITION REGARDING POLICY STATEMENT QUESTIONS

SIX QUESTIONS PERTAINING TO THE PROPOSED POLICY FOR ADVANCED REACTORS WERE INCLUDED FOR COMMENT IN THE ORIGINAL POLICY STATEMENT. THE PUBLIC RESPONSES TO THESE QUESTIONS ARE SUMMARIZED IN THE "ABSTRACT OF COMMENTS" SECTION. AFTER CAREFUL CONSIDERATION OF THE PUBLIC COMMENTS THE COMMISSION POLICY WITH REGARD TO THE ISSUES RAISED IN EACH QUESTION IS AS FOLLOWS:

QUESTION 1. SHOULD NRC'S REGULATORY APPROACH BE REVISED TO REDUCE DEPENDENCE ON PRESCRIPTIVE REGULATIONS AND, INSTEAD, ESTABLISH LESS PRESCRIPTIVE DESIGN OBJECTIVES, SUCH AS PERFORMANCE STANDARDS? IF SO, IN WHAT ASPECTS OF NUCLEAR POWER PLANT DESIGN (FOR EXAMPLE, REACTOR CORE POWER DENSITY, REACTOR CORE HEAT REMOVAL, CONTAINMENT, AND SITING) MIGHT THE PERFORMANCE STANDARDS APPROACH BE APPLIED MOST EFFECTIVELY? HOW COULD IMPLEMENTATION OF THESE PERFORMANCE STANDARDS BE VERIFIED?

### COMMISSION RESPONSE

MANY OF THE COMMISSION'S EXISTING REGULATIONS, CRITERIA, AND GUIDELINES ARE OF A NONPRESCRIPTIVE NATURE, AND THE EXTENT TO WHICH THE COMMISSION'S PROPOSED SAFETY GOALS (WHICH ARE ALSO OF



A NONPRESCRIPTIVE NATURE) WILL BE USED IN THE REGULATION OF NUCLEAR REACTORS IS CURRENTLY BEING EVALUATED. IN THE REVIEW AND REGULATION OF ADVANCED REACTORS THE COMMISSION INTENDS TO MAKE USE OF EXISTING AND FUTURE REGULATIONS WHERE THEY ARE APPLICABLE TO ADVANCED REACTORS. MANY SUCH REGULATIONS ARE EXPECTED TO BE OF A NONPRESCRIPTIVE NATURE. THE AREAS WHERE EXISTING REGULATIONS AND GUIDELINES WOULD BE USED INCLUDE: QUALITY ASSURANCE, EQUIPMENT QUALIFICATION, EXTERNAL EVENTS, SABOTAGE, FIRE PROTECTION, RADIATION PROTECTION, AND OPERATOR TRAINING AND QUALIFICATION. IN DEVELOPING ADDITIONAL CRITERIA AND GUIDANCE TO ADDRESS THOSE CHARACTERISTICS WHICH DIFFER FROM LWRs, LESS PRESCRIPTIVE CRITERIA WILL BE CONSIDERED. THE USE OF LESS PRESCRIPTIVE CRITERIA WILL DEPEND UPON THE DESIGN IN QUESTION AND THE ABILITY TO VERIFY COMPLIANCE WITH THE CRITERIA. ADVANCED REACTOR DESIGNERS ARE ENCOURAGED AS PART OF THEIR DESIGN SUBMITTALS TO PROPOSE SPECIFIC REVIEW CRITERIA OR NOVEL REGULATORY APPROACHES WHICH NRC MIGHT APPLY TO THEIR DESIGNS.

QUESTION 2. SHOULD THE REGULATIONS FOR ADVANCED REACTORS REQUIRE MORE INHERENT SAFETY MARGIN FOR THEIR DESIGN? IF SO, SHOULD THE EMPHASIS BE ON PROVIDING FEATURES THAT PERMIT MORE TIME FOR OPERATOR RESPONSE TO OFF-NORMAL CONDITIONS, OR

SHOULD THE EMPHASIS BE ON PROVIDING SYSTEMS THAT ARE CAPABLE OF FUNCTIONING UNDER CONDITIONS THAT EXCEED THE DESIGN BASIS?

COMMISSION RESPONSE

THE COMMISSION ENCOURAGES THE INCORPORATION OF ENHANCED MARGINS OF SAFETY IN ADVANCED DESIGNS AND WILL ENCOURAGE THE USE OF DESIGNS THAT ACCOMPLISH THEIR SAFETY FUNCTIONS IN AS RELIABLE AND SIMPLIFIED A FASHION AS PRACTICAL. THE COMMISSION CONSIDERS INHERENT OR PASSIVE SAFETY SYSTEMS TO HAVE THE POTENTIAL FOR HIGH RELIABILITY AND ENCOURAGES THE CONSIDERATION OF SUCH MEANS (IN LIEU OF ACTIVE SYSTEMS) IN ADVANCED DESIGNS.

TO ENCOURAGE SUCH ACTION THE COMMISSION, IN ITS REVIEW OF THESE ADVANCED DESIGNS, WILL LOOK FAVORABLY ON DESIGNS WITH GREATER SAFETY MARGIN AND/OR HIGHLY RELIABLE SAFETY SYSTEMS. SUCH DESIRABLE FEATURES CAN BE DESIGN-RELATED OR CAN TAKE THE FORM OF REDUCED ADMINISTRATIVE REQUIREMENTS.

QUESTION 3. SHOULD LICENSING REGULATIONS FOR ADVANCED REACTORS MANDATE SIMPLIFIED DESIGNS WHICH REQUIRE THE FEWEST OPERATOR ACTIONS, AND THE MINIMUM NUMBER OF COMPONENTS NEEDED FOR ACHIEVING AND MAINTAINING SAFE SHUTDOWN CONDITIONS, THEREBY

FACILITATING OPERATOR COMPREHENSION AND RELIABLE  
SYSTEM FUNCTION FOR OFF-NORMAL CONDITIONS?

COMMISSION RESPONSE

THE COMMISSION WILL ENCOURAGE DESIGNS WHICH ARE SIMPLER AND MORE RELIABLE IN ACCOMPLISHING THEIR SAFETY FUNCTIONS. WHILE CURRENT GENERATION NUCLEAR POWER PLANTS, IN OPERATION OR UNDER CONSTRUCTION REPRESENT NO UNDUE RISK TO EITHER THE PUBLIC OR THE ENVIRONMENT, THE COMMISSION BELIEVES THAT REACTORS WITH IMPROVED SAFETY CHARACTERISTICS CAN AND WILL BE DEVELOPED. SUCH IMPROVED SAFETY CHARACTERISTICS SUPPORT THE COMMISSION'S LONG-RANGE GOAL OF MINIMIZING THE RISK TO THE PUBLIC AND THE ENVIRONMENT THROUGH THE "ALARA" APPROACH.

QUESTION 4. SHOULD THE NRC DEVELOP GENERAL DESIGN CRITERIA FOR ADVANCED REACTORS BY MODIFYING THE EXISTING REGULATIONS, WHICH WERE DEVELOPED FOR THE CURRENT GENERATION OF LIGHT WATER REACTORS, OR BY DEVELOPING A NEW SET OF GENERAL DESIGN CRITERIA APPLICABLE TO SPECIFIC CONCEPTS WHICH ARE BROUGHT BEFORE THE COMMISSION?

COMMISSION RESPONSE

IN DEVELOPING LICENSING CRITERIA FOR ADVANCED REACTORS, THE COMMISSION INTENDS TO BUILD UPON EXISTING REGULATIONS WHEREVER PRACTICAL, AS DISCUSSED IN THE RESPONSE TO QUESTION NO. 1. IN FOLLOWING THIS APPROACH, IT IS THE COMMISSION'S INTENT TO ESTABLISH, FOR EACH DESIGN REVIEWED, THE LICENSING CRITERIA THAT APPLY TO THAT DESIGN. AS STATED IN THE RESPONSE TO QUESTION NO. 1, THESE CRITERIA WILL BE A COMBINATION OF APPLICABLE LWR CRITERIA AND CRITERIA DEVELOPED TO ADDRESS THE UNIQUE CHARACTERISTICS OF THAT DESIGN. REACTOR DESIGNERS ARE ENCOURAGED TO PROPOSE SPECIFIC CRITERIA AND NOVEL REGULATORY APPROACHES WHICH MIGHT APPLY TO THEIR DESIGN.

QUESTION 5. SHOULD THE NRC FAVOR ADVANCED REACTOR DESIGNS THAT CONCENTRATE THE PRIMARY SAFETY FUNCTIONS IN VERY FEW LARGE SYSTEMS (RATHER THAN IN MULTIPLE SUBSYSTEMS), THEREBY MINIMIZING THE NEED FOR COMPLEX BENEFIT AND COST BALANCING IN THE ENGINEERING OF SAFE REACTORS?

COMMISSION RESPONSE

WHILE THE NRC WILL NOT NECESSARILY FAVOR ONE DESIGN APPROACH OVER ANOTHER IN REGARD TO THE NUMBER OF SAFETY SYSTEMS, THE NRC WILL ENCOURAGE THE USE OF SIMPLIFIED SYSTEMS AND SYSTEMS OF HIGH RELIABILITY FOR THE ACCOMPLISHMENT OF SAFETY FUNCTIONS.

QUESTION 6.      WHAT DEGREE OF PROOF WOULD BE SUFFICIENT FOR THE NRC TO FIND THAT A NEW DESIGN IS BASED ON TECHNOLOGY WHICH IS EITHER PROVEN OR CAN BE DEMONSTRATED BY A SATISFACTORY TECHNOLOGY DEVELOPMENT PROGRAM? FOR EXAMPLE, IS IT NECESSARY OR ADVISABLE TO REQUIRE A PROTOTYPICAL DEMONSTRATION OF AN ADVANCED REACTOR CONCEPT PRIOR TO FINAL LICENSING OF A COMMERCIAL FACILITY?

COMMISSION RESPONSE

THE COMMISSION REQUIRES PROOF OF PERFORMANCE OF CERTAIN SAFETY-RELATED COMPONENTS, SYSTEMS OR STRUCTURES PRIOR TO ISSUING A LICENSE ON A DESIGN. FOR LWR'S THIS PROOF HAS TRADITIONALLY BEEN IN THE FORM OF ANALYSIS, TESTING, AND

RESEARCH DEVELOPMENT SUFFICIENT TO DEMONSTRATE THE PERFORMANCE OF THE ITEM IN QUESTION. SIMILAR PROOF OF PERFORMANCE FOR CERTAIN COMPONENTS, SYSTEMS OR STRUCTURES FOR ADVANCED REACTORS WILL ALSO BE REQUIRED. THE REQUISITE PROOF WILL BE DESIGN DEPENDENT. THEREFORE, THE COMMISSION'S SPECIFIC ASSESSMENT OF A SAFETY TECHNOLOGY DEVELOPMENT PROGRAM FOR AN ADVANCED REACTOR DESIGN, OR OF THE POSSIBLE NEED FOR A PROTOTYPICAL DEMONSTRATION OF THAT DESIGN CAN BE DETERMINED ONLY BY REVIEW OF A SPECIFIC DESIGN. HOWEVER, THE COMMISSION FAVORS THE USE OF PROTOTYPICAL DEMONSTRATION FACILITIES AS AN ACCEPTABLE WAY OF RESOLVING MANY SAFETY RELATED ISSUES.

FOR THE COMMISSION

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SAMUEL J. CHILK  
SECRETARY OF THE COMMISSION

DATED AT WASHINGTON, D.C.

THIS \_\_\_\_\_ DAY OF APRIL, 1986

### Dissenting Views of Commissioner Asselstine

I do not believe that this advanced reactor policy statement provides the sound regulatory basis needed to support a new generation of nuclear power plants in this country. This policy statement encourages, but does not require, safety improvements in advanced reactor design, and expresses a willingness on NRC's part to conduct safety reviews of advanced reactor design concepts so that NRC will be in a position to act on any future plant or design license application. The primary decision made in developing this policy is the commitment to maintain a small advanced reactor group within the Agency that would serve as the focal point for interaction with reactor design groups. However it appears that even this commitment may be in jeopardy given current budgetary constraints.

I believe that more is needed to articulate an effective regulatory policy and to ensure a successful program for future nuclear power plants in this country, whether those plants are of a type similar to current light water reactors or whether they are of more fundamentally different design. Such a policy should reconsider the Commission's regulatory practices of the past thirty years. Those past practices can be characterized as primarily a reactive regulatory regime to what the designers propose. It leaves resolution of issues to what one industry executive has called the rough, tough surly competitive elements. Safety systems are limited because of cost considerations. Containment capabilities are minimized to reduce costs. Core power densities have been driven to the limits of materials capabilities and our understanding of decay heat removal phenomena. And



the balance of plant is designed to lower standards than the reactor systems to minimize costs. These competitive forces are what led to the level of safety achieved in the current generation of nuclear power plants and are in part responsible for the poor performance of some of our plants.

The NRC and AEC before it have often avoided developing stringent specifications or design requirements because of a fear that if the Commission were to be too specific in its requirements, the emerging industry might be slowed in its growth and innovation might be discouraged. That argument might have had some validity in the 1960's and 1970's when the current generation of reactors was being designed without the benefit of significant operating experience or data. However, now that we have considerable worldwide experience with a large variety of nuclear reactor designs, I believe it is time for NRC to become more proactive in what it will require of future generations of reactors.

Following the TMI-2 accident, the notion of a demarcation between the current generation of plants and a future generation of plants was raised, with the distinction that the latter would be designed based on a reformulation of the Siting Criteria and General Design Criteria to reflect all that had been learned over the years, including the broader lessons of TMI-2. Thus, the TMI Action Plan was developed with the current generation of plants in mind, leaving open the question of possible broader changes for a future generation of plants. One such broad change could be to go beyond the so-called single failure criterion which experience shows may

not be serving us well. The June 9, 1985 accident at Davis-Besse is a case in point where 14 separate failures occurred.

Many foreign countries are requiring four independent trains of safety systems whereas NRC requires only two. When NRC reviews advanced designs such as the one being jointly developed by a U.S. vendor and a foreign country, the NRC staff does not require as prudent additional safety features being required by the foreign country. Rather, Commission practices and procedures require a cost-benefit analysis to justify any additional safety feature. This analysis is typically incomplete and often crude. Furthermore, the Commission gives little consideration to the enormous uncertainties in reactor risks in its decisionmaking process. This approach to reactor safety needs improvement.

There has been insufficient thought and effort in developing a map for the future. The Advanced Reactor Policy Statement provides no guidance on what containment capabilities will be required; on whether the single failure criterion is adequate for the future; on acceptable core power densities (an issue which has significant bearing on the core meltdown risks to the public); and on the root causes of the core meltdown risks that might be addressed by design improvements in a future generation of reactors. Nor is there guidance on what standards the balance of plant must meet. Nothing is said about the fuel cycle and the process for licensing the fuel cycle associated with some of the advanced designs currently being examined. For example, when and in what way will the Commission reopen the aborted proceeding on plutonium recycle. And, finally the Commission gives

essentially no guidance on whether a prototypical plant will be required before allowing widespread use of that design. I would have expected that NRC would approach a future generation of nuclear power plants with an attitude of correcting past weaknesses. Unfortunately, the Advanced Reactor Policy Statement does not reflect that kind of attitude.

Other countries with extensive nuclear power programs appear to be designing, constructing, operating and maintaining better nuclear power plants than those of this country. Foreign countries are demanding more safety and reliability in their current generation of plants than the NRC is requiring of the U.S. plants. Yet, this Advanced Reactor Policy Statement accepts the next generation of U.S. power plants if such a design provides a level of safety equivalent to that achieved in the U.S. designs that were completed over 10 years ago. I do not think such a policy serves the country well. My concern is not merely that we should keep up with others. Rather, my concern is that the current generation of plants is still surprising us in their performance. As the Commission has recently acknowledged to the Congress, the current generation of nuclear power plants in this country can best be characterized as a complex technology that is not fully mature. There remain great uncertainties in the level of risk they pose to the public. In such circumstances, I believe prudent decisionmaking should come down on the side of improved safety, not only for the current generation of plants but for the next generation as well.

If there is to be a future generation of nuclear power plants and if the nuclear option is to be an important element of the nation's future energy

mix, then the NRC, the vendors, the utilities, and the Congress must ensure that the next generation of power plants is substantially better than the current generation. The next generation of plants should be more reliable, more forgiving, simpler, easier to construct, easier to operate, and easier to maintain than the current generation. Any design that does not accomplish this is not acceptable in my view. I say this for a straightforward reason. We cannot afford to will to the future reactor designs that have a fifty percent chance of a core meltdown every ten to twenty years in a population of 100 reactors. We should not will to the future the great uncertainties in safety levels that exist today. Nor should we will to the future consumer reactor designs that have a 50 to 60 percent capacity factor.

We must step back and examine the strengths and weaknesses of past and current designs and the approaches taken in getting where we are today. Only then, in my view, can we intelligently map a course for the future. I am encouraged that there is a segment within the industry that is undertaking a fresh look at the nuclear technology. The forward-looking members of the industry are attempting to generate a set of requirements that, from the standpoint of the utilities, must be met before utilities will consider placing new orders. I find it disappointing that the NRC is unwilling to generate a set of safety requirements for the next generation of power plants.