UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 4, 1996

MEMORANDUM TO: James M. Taylor
Executive Director for Operations

FROM: Edward L. Jordan, Chairman
Committee to Review Generic Requirements

SUBJECT: MINUTES OF CRGR MEETINGS NUMBER ~~285~~ 286 and ~~286~~ 287

Ref Topsan 10/20/89

The Committee to Review Generic Requirements (CRGR) met on Thursday, May 9, 1996 from 1:00 to 4:30 p.m. and Friday, May 17, 1996 from 8:00 a.m. to 12:00 p.m. to review the revised site criteria rule. The proposed final rulemaking involves revisions to 10 CFR 50 and 10 CFR 100 with respect to site suitability and nuclear power plant seismic design. The review package consisted of a number of documents associated with the rule change itself, as well as the accompanying regulatory guides and Standard Review Plan modifications. A list of attendees for the two meetings is provided in Attachment 1(a) and 1(b), respectively. The highlights of the Committee's expedited review of this rule change were provided to you on May 20, 1996 via Attachment 2.

The CRGR had reviewed the original proposed rule on this subject in March, 1992 during Meeting No. 217. Subject to various comments, the Committee endorsed the proposed rule for publication. The proposed rule was published in October 1992. At the May 9, 1996 briefing, the staff informed the Committee that due to a number of factors, including some adverse comments on the package, the proposed rule had been withdrawn and a second proposed rule was issued for comment in 1994. A schedule adopted by the staff called for a Commission briefing on June 3, 1996. However, the voluminous CRGR review package was not sent to the Committee until Monday, May 6, 1996; this package did not have OGC concurrence. To support the EDO briefing on May 23rd, the CRGR scheduled a briefing session on May 9th and a review session on May 17th. This was the first opportunity that the Committee had to comment on the form and content of the revised (non-seismic) site criteria, which significantly deviated from the first proposed rule (1992 version.) The Committee is concerned that the schedule did not provide proper allowance for the time needed for CRGR review.

On May 9th, the Committee was briefed by the staff on the revised rule. The major areas of staff's briefing included the considerations of the seismic as well as radiological aspects of reactor siting. Attachment 3 contains the presentation material used by the staff. Following the discussion at this meeting, the Committee noted that the seismic portion of the rule represents a major improvement. The Committee also agreed to a full scope review of the revised rule on May 17, 1996, with lesser discussion on the seismic part unless specific issues needed additional consideration, or if new concerns warranted attention.

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There was no major discussion on the seismic part during the CRGR meeting on May 17th. The Committee was generally satisfied with the revisions in the seismic area and had some comments with which the staff agreed. However, the Committee expressed a concern about the wording of the proposed new Appendix-S to Part 50 which differs somewhat from the wording that remains in Part 100, Appendix-A, Section VI, which is applicable to the existing operating plants. It was unclear if a subtle regulatory difference is intended by the choice of different wording in the new requirements. Specifically, the use of the verb "must" and "will" in the new Appendix-S to Part 50 in place of "shall" in the existing Part 100. The Committee stressed that, in the interest of consistency in the format and context of NRC regulations, unless a change in requirements is intended in relocating Part 100, Appendix-A text to Appendix-S, Part 50, there is no justification in paraphrasing the Part 100 language. The staff did not offer a clear explanation, however, the staff assured the Committee to re-review the use of the wording to avoid any unnecessary and unintentional confusions.

On May 17th the CRGR review of the revised rule largely focused on the non-seismic considerations of the revisions. The Committee primarily focused on the policy and guidance relating site acceptability to radiological dose limitations and population distribution. Attachment 4 contains the details. The CRGR noted that the portion of this rule which deals with release of fission products into containment does account for research and probabilistic risk assessment insights, and is much more realistic than the present rule and guidance. However, some other important insights gained from severe accident research are not taken into account in this rule.

The CRGR specifically commented on the question of calculating EAB and LPZ boundary doses during the arbitrarily chosen two-hour (first vs. worst) period, rather than cumulative exposure over the entire exposure period, and the assumption that a hypothetical individual would remain in the cloud path and not evacuate. Also, the Committee discussed the fact that the role of emergency planning and response in terms of dose saving to individuals at the outer boundary of the EAB or LPZ is not acknowledged, which would no doubt result in lower doses in practice. Furthermore, ground shine was also not taken into account as a significant, or even dominant, dose contributor.

In reference to the disagreement between NRR and RES staff concerning the "first two hour" vs. the "worst two hour," the CRGR did not take a position in favor of either, but noted that the choice of a two-hour exposure period itself is arbitrary. Additionally, the Committee noted, that the use of the "worst two hours" (and to a lesser degree, even the use of the "first two hours") could in some cases affect the ESF design requirements (i.e., containment sprays) and, therefore, would couple siting to design.

The CRGR believes that siting should be de-coupled from design. The Committee is informed that a recommendation will be made to the Commission late this year regarding a possible follow-up Phase II (Part 100) rulemaking effort. The Committee supports a follow-up Phase II rulemaking as a vehicle for further addressing this objective.

Although some important insights of probabilistic risk analyses, and some aspects of severe accident research, are not reflected in the new rule, based on the considerations that (1) the seismic portion of the rule represents a major improvement; (2) the proposed rule in the non-seismic area is an improvement, albeit modest, to the present rule and guidance; (3) the public comment process did not result in major disagreement; and (4) it is not likely that significant further improvement could be achieved in a reasonable period of time, the Committee does not object to the issuance of this rule.

In accordance with the EDO's July 18, 1983 directive concerning "Feedback and Closure of CRGR Review," a written response is required from the cognizant office to report agreement or disagreement with the CRGR recommendations in these minutes. The response is to be forwarded to the CRGR Chairman and if there is disagreement with the CRGR recommendations, to the EDO for decision making.

Questions concerning these meeting minutes should be referred to Raji Tripathi (415-7584).

Attachments: As stated

cc: Commission (3)
SECY
J. Lieberman, OE
P. Norry, ADM
L. Norton, OIG
K. Cyr, OGC
J. Larkins, ACRS
D. Morrison, RES
W. Russell, NRR
C. Paperiello, NMSS
T. Martin, RI
S. Ebneter, RII
H. Miller, RIII
L. Callan, RIV
F. Miraglia, NRR
J. Murphy, RES
D. Dambly, OGC
E. Merschoff, RII
M. Knapp, NMSS
K. Barr, RII
J. Greeves, NMSS
W. Brach, NMSS

Distribution (Minutes of the CRGR Meetin No. 285 and 286):

CRGR RF
CRGR SF
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L. Soffer
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J. Lee
T. Essig
F. Congel
B. Zalcman
C. Ader
T. King
D. Drozd
G. Bagchi
R. Kenneally
A. Murphy
J. Johnson
R. Emch
C. Miller
R. Rothman
R. McMullen
R. Architzel

Attachment 1 to the Minutes of CRGR Meeting No. 285 and 286

Attachment 1-a

List of Attendees
CRGR Meeting No. 285
May 9, 1996

CRGR Members

D. Ross
F. Miraglia
J. Murphy
D. Dambly
W. Brach for M. Knapp
K. Barr for Ellis Merschoff

CRGR Staff

R. Tripathi
J. Conran (Part time)

NRC Staff

L. Soffer
N. Chokshi
J. Lee
T. Essig
F. Congel
B. Zalcman
C. Ader
T. King
D. Drozd
G. Bagchi
R. Kenneally

List of Attendees
CRGR Meeting No. 286
May 17, 1996

CRGR Members

D. Ross
B. Grimes (for F. Miraglia)
J. Murphy
D. Dambly
W. Brach for M. Knapp
Ellis Merschoff

CRGR Staff

R. Tripathi
J. Conran

NRC Staff

L. Soffer
N. Chokshi
J. Lee
A. Murphy
J. Johnson
R. Emch
C. Miller
T. King
D. Drozd
G. Bagchi
B. Zalcman
R. Rothman
R. McMullen
R. Architzel

ACRS Staff

A. Singh

Attachment 2 to the Minutes of CRGR Meeting No. 285 and 286

May 20, 1996

MEMORANDUM TO: James M. Taylor
Executive Director for Operations

FROM: Edward L. Jordan, Chairman /s/ by D. F. Ross
/for/ Committee to Review Generic Requirements

SUBJECT: EXPEDITED CRGR REVIEW OF THE PROPOSED FINAL REVISIONS TO 10 CFR 100, "REACTOR SITE CRITERIA"

The Committee to Review Generic Requirements (CRGR) met on May 9 and May 17, 1996 to review, at the request of the Director, RES, the final rulemaking package associated with the revised Reactor Site Criteria. The proposed final rulemaking involves revisions to 10 CFR 50 and 10 CFR 100 with respect to site suitability and nuclear power plant seismic design. The review package consisted of a number of documents associated with the rule change itself, as well as the accompanying regulatory guides and Standard Review Plan modifications.

The CRGR first reviewed its jurisdiction. The Committee agreed that inasmuch as the guidance package was forward-fit only, the term "backfit" does not apply. In this sense, the package is not subject to the terms and conditions of 10 CFR 50.109. The Committee also agreed that the material was within the scope of the CRGR charter. We did express the view that the staff should verify that current plants which might apply for license renewal and license amendments would not be subject to the new (Subpart B) requirements as embodied in the package. The staff affirms that the operating plants when applying for license renewal and license amendments will not be subjected to this rule change.

The Committee considered the technical aspects, which may be divided into two broad areas: seismic and non-seismic. In general, the Committee supported the changes in the seismic area, and made several comments in this area. The details of the CRGR comments in this area will be presented in the meeting minutes, and the staff has agreed to our suggestions. Thus, we endorse this portion of the rule.

In the non-seismic area, the Committee primarily focused on the policy and guidance relating site acceptability to radiological dose limitations and population distribution. Specifically, the Committee noted that the present dose calculation which is used for reactor siting, and has been used for almost 35 years, has the following characteristics and assumptions:

- A major accident is hypothesized such that the potential hazards would not be exceeded by any other accident generally considered credible.

- The containment leaks at its demonstrable leak rate, i.e., does not suffer gross failure.
- Some credit may be given for fission product removal systems.
- There is an exclusion area such that an individual located at any point on its boundary for two hours immediately following the onset of the fission product release would not receive a total radiation dose in excess of 25 rem or a total thyroid dose in excess of 300 rem.
- There is a low population zone (LPZ) such that an individual located at any point on its outer boundary exposed to the radioactive cloud during the entire period of passage (taken to be 30 consecutive not exceed the same dose limits.

The proposed final rule as reviewed by the CRGR contained[1] most of the features of the original Part 100 as promulgated by the AEC in 1962. The portion of this rule which deals with release of fission products into containment does account for research insights, and is much more realistic than the present rule and guidance. However, some other important insights gained from severe accident research are not taken into account in this rule, for example:

- In many cases studied, the risk-dominating accidents do not involve the containment at all (e.g., interfacing LOCA and steam generator tube rupture which bypass the containment). Furthermore, for some sequences there is the possibility of consequent early containment failure or late failure. The analytical and experimental research insights include early containment failure likelihoods due to pressure loads from direct containment heating or melt-through, and late containment failure from thermal-hydraulic loadings and hydrogen combustion.
- Modern probabilistic risk analysis, which couples accident sequences, core response, fission product release, and containment response, proceeds in an orderly way to account for public risk. The proposed rule omits some of this orderly process.

Relationship to 50.47, Appendix-E:

Although the dose calculation accounts for the likely variations in wind direction, it is not credible that an indiyidual would remain at the outer boundary of the LPZ for 30 successive days[2] and, in general, the role of

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[1]Although relocated from 10 CFR Part 100 to Part 50.

[2]In fact, page 10 of the proposed Federal Register Notice, in effect, conceded that the concept of a 30-day exposure is somewhat unlikely.

emergency planning and response in terms of dose saving to individuals at the outer boundary of the EAB or LPZ is not acknowledged. While this may be acceptable for purposes of siting, it would be instructive for the statement of considerations to note that such emergency response would no doubt result in lower doses in practice.

De-coupling of Siting to Design (non-seismic):

Concerning the question of calculating EAB and LPZ boundary doses during the "first" vs the "worst" two-hour period, the CRGR observed that there are artificial assumptions involved in both approaches. Examples discussed were: (a) the selection of a two-hour period instead of one-hour or three-hour period; (b) choice of the two-hour exposure period itself (say, from six hours through eight hours following onset of fission product release, rather than cumulative exposure over the entire eight-hour period; and (c) the assumption that a hypothetical individual would remain in the cloud path and not evacuate. The Committee also noted that ground shine was not taken into account as a dose contributor. Inasmuch as both approaches are based on similar and somewhat arbitrary assumptions, the CRGR did not take a position in favor of either. The Committee noted, however, that the use of the "worst" two hours could in some cases affect the ESF design requirements (i.e., containment sprays) and, therefore, would couple siting to design.

The CRGR believes that siting should be de-coupled from design. We understand that a recommendation will be made to the Commission late this year regarding a possible follow-up to Phase II (Part 100) rulemaking effort. The Committee supports a follow-up to Phase II rulemaking as a vehicle for further addressing this objective.

Comments about the CRGR Review Process:

The CRGR reviewed the original proposed rule on this subject in March, 1992 during Meeting No. 217. Subject to various comments, the Committee endorsed the proposed rule for publication. The proposed rule was published in October 1992. At the May 9, 1996 briefing, the staff informed the Committee that due to a number of factors, including some adverse comments on the package, the proposed rule had been withdrawn and a second proposed rule was issued for comment in 1994. A schedule was adopted by the staff which called for a Commission briefing on June 3, 1996. However, the CRGR review package (well over 500 pages) was not sent to the CRGR until Monday, May 6, 1996. The staff wanted a disposition in time to support the EDO briefing on May 23rd. The CRGR scheduled a briefing session on May 9th and a review session on May 17th. This was the first opportunity that the Committee had to comment on the form and content of the revised (non-seismic) site criteria, which significantly deviated from the first proposed rule (1992 version.) The Committee is concerned that the schedule did not provide proper allowance for the time needed for CRGR review.

Conclusions and Bases:

Although some important insights of probabilistic risk analyses, and some aspects of severe accident research, are not reflected in the new rule, the Committee concluded that:

- The seismic portion of the rule represents a major improvement.
- The proposed rule in the non-seismic area is an improvement, albeit modest, to the present rule and guidance.
- The public comment process did not result in major disagreement.
- It is not likely that significant further improvement could be achieved in a reasonable period of time.

Based on the above factors, the Committee does not object to the issuance of this rule.

Conclusions and Bases:

Although some important insights of probabilistic risk analyses, and some aspects of severe accident research, are not reflected in the new rule, the Committee concluded that:

- The seismic portion of the rule represents a major improvement.
- The proposed rule in the non-seismic area is an improvement, albeit modest, to the present rule and guidance.
- The public comment process did not result in major disagreement.
- It is not likely that significant further improvement could be achieved in a reasonable period of time.

Based on the above factors, the Committee does not object to the issuance of this rule.

Distribution:
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DATE	05/ /96		05/ /96		05/ /96					

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Attachment 3 to the Minutes of CRGR Meeting No. 285 and 286

Presentation Material Used by the Staff for Briefing During CRGR Meeting No. 285 May 9, 1996

DRAFT FINAL RULE
REVISION OF
10 CFR PARTs 50, 100

PRESENTATION TO
COMMITTEE TO REVIEW GENERIC REQUIREMENTS

MAY 9, 1996

LEONARD SOFFER
NILESH C. CHOKSHI
U.S. NUCLEAR REGULATORY COMMISSION

OUTLINE

- CHRONOLOGY AND OVERVIEW OF CURRENT RULE
- SEISMIC ASPECTS OF PROPOSED REVISION
  - SEISMIC AND GEOLOGIC SITING CRITERIA
  - USE OF PROBABILISTIC SEISMIC HAZARDS IN DETERMINING DESIGN BASIS GROUND MOTION
  - EARTHQUAKE ENGINEERING CRITERIA
- NON-SEISMIC ASPECTS OF PROPOSED REVISION
  - MAJOR DEVELOPMENTS AND EXPERIENCE IN REACTOR SITING
  - PROPOSED REVISIONS
  - ELEMENTS OF DRAFT FINAL RULE

CHRONOLOGY

- 10 CFR 100 ISSUED - APRIL 1962
- 10 CFR 100, APPENDIX A ISSUED - NOV. 1973
- CRGR REVIEW OF FIRST PROPOSED REVISION - MAR. 1992
- FIRST PROPOSED REVISION ISSUED FOR COMMENT - OCT. 1992
- FIRST PROPOSED REVISION WITHDRAWN - MAR. 1994
- SECOND PROPOSED REVISION ISSUED FOR COMMENT - OCT. 1994
- COMMENT PERIOD ENDS ON SECOND PROPOSED REVISION - MAY 1995
- CHAIRMAN BRIEFED - APRIL 1, 1996
- ACRS BRIEFED - APRIL 11, 1996

CURRENT RULE

- CURRENT RULE - 10 CFR 100 (APRIL 1962). REQUIRES:
  - EXCLUSION AREA - IMMEDIATE ZONE AROUND REACTOR. NO RESIDENTS.
  - LOW POPULATION ZONE (LPZ) - ZONE OUTSIDE EXCLUSION AREA. MAY CONTAIN RESIDENTS, BUT NOT DENSELY POPULATED CENTER.
  - POPULATION CENTER DISTANCE - MAY BE NO CLOSER THAN ONE AND ONE-THIRD TIMES THE LPZ RADIUS.
- FISSION PRODUCT RELEASE WITHIN CONTAINMENT POSTULATED. CONTAINMENT ASSUMED TO BE INTACT, BUT LEAKING. DOSES TO HYPOTHETICAL INDIVIDUALS MUST NOT EXCEED 25 REM WHOLE BODY AND 300 REM THYROID AT:
  - EXCLUSION AREA BOUNDARY (EAB) FOR 2 HRS AFTER ONSET OF RELEASE,
  - LPZ OUTER RADIUS FOR COURSE OF ACCIDENT (30 DAYS).
- DOSE CRITERIA ALLOWS FLEXIBILITY. NO NUMERIC CRITERIA FOR EAB, LPZ AND POP. CENTER DISTANCE. STAFF GUIDANCE ON DOSE CALCULATIONS AND POPULATION DENSITY ARE IN REGULATORY GUIDES (1.3, 1.4, 1.145, 4.7).
- PRESENT APPENDIX A SPECIFIES SEISMIC AND GEOLOGIC SITE CRITERIA.

REVISION TO PART 100 APPENDIX A

PRESENTED TO THE
COMMITTEE TO REVIEW GENERIC REQUIREMENTS
MAY 9, 1996

NILESH C. CHOKSHI
U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF ENGINEERING TECHNOLOGY
OFFICE OF NUCLEAR REGULATORY RESEARCH
(301) 415-6013

OUTLINE OF PRESENTATION

1. OVERVIEW

2. USE OF PROBABILISTIC SEISMIC HAZARD ANALYSIS IN DETERMINING DESIGN BASIS GROUND MOTION

3. EARTHQUAKE ENGINEERING CRITERIA

WHY REVISION OF APPENDIX A IS NECESSARY

- APPENDIX A DOES NOT REFLECT THE ADVANCES IN EARTH SCIENCE AND SEISMIC ENGINEERING SINCE 1973
- CONTAINS REQUIREMENTS AND VERY DETAILED & PRESCRIPTIVE GUIDANCE
- CONFLICTING INTERPRETATIONS OF APPENDIX A OFTEN LED TO TIME CONSUMING DISCUSSIONS AND PROLONGED THE LICENSING PROCESS
- THERE HAVE BEEN DIFFICULTIES IN THE APPLICATION ARISING FROM THE MULTIPLE DEFINITIONS OF OPERATING BASIS EARTHQUAKE
  - OBE IS AT LEAST 1/2 SSE (SAFE SHUTDOWN EARTHQUAKE) - AS APPLIED, POSSIBLE FOR OBE TO HAVE MORE DESIGN SIGNIFICANCE THAN SSE
  - SHUTDOWN IF OBE IS EXCEEDED, BUT NO CRITERIA FOR EXCEEDANCE OR GUIDANCE FOR SHUTDOWN OR RESTART

OBJECTIVES OF PROPOSED REVISION

- DECOUPLE SITING REQUIREMENTS FROM DESIGN OR ENGINEERING REQUIREMENTS - FACILITATE PART 52 APPLICATIONS
- MOVE THE DETAILED GUIDANCE FROM THE REGULATION TO REGULATORY GUIDES
- UPDATE THE TECHNICAL REQUIREMENTS IN THE REGULATION TO REFLECT CURRENT KNOWLEDGE
- REDEFINE OPERATING BASIS EARTHQUAKE (OBE)
- PROVIDE GUIDANCE ON RESTART FOLLOWING OBE TRIGGERED SHUTDOWN

REVISION TO APPENDIX A (10 CFR 100.23)
GEOLOGICAL SITING CRITERIA

NEW SECTION 100.23, ENTITLED "GEOLOGIC AND SEISMIC SITING FACTORS" HAS BEEN STREAMLINED AND CONTAINS BASIC SITING REQUIREMENTS. THESE ARE:

- GEOLOGICAL, SEISMOLOGICAL & ENGINEERING CHARACTERISTICS OF SITE MUST BE INVESTIGATED.

- SAFE SHUTDOWN EARTHQUAKE GROUND MOTION MUST BE DETERMINED.

- POTENTIAL FOR SURFACE DEFORMATION MUST BE DETERMINED.

- DESIGN BASES FOR SEISMICALLY INDUCED FLOODS & WATER WAVES MUST BE DETERMINED.

REGULATORY GUIDE 1.165, "GUIDANCE FOR DETERMINING THE SAFE SHUTDOWN EARTHQUAKE FOR NUCLEAR POWER PLANT," ALLOWS EITHER CONDUCTING A PROBABILISTIC SEISMIC HAZARD ANALYSIS OR A DETERMINISTIC ANALYSIS SUPPORTED BY AN UNCERTAINTY ANALYSIS.

REVISION OF APPENDIX A
(EARTHQUAKE ENGINEERING) (10 CFR 50 APPENDIX S)

- HIGHLIGHTS OF CHANGES IN EARTHQUAKE ENGINEERING

  - APPLICANT SELECTS THE OBE VALUE

    * IF OBE IS 1/3 SSE, NO EXPLICIT RESPONSE OR DESIGN ANALYSIS IS REQUIRED

    * IF OBE IS GREATER THAN 1/3 SSE, EXPLICIT RESPONSE AND DESIGN ANALYSIS ARE REQUIRED (CURRENT REQUIREMENTS)

  - IF OBE IS EXCEEDED, ORDERLY SHUTDOWN IS REQUIRED

    * DRAFT REGULATORY GUIDE CONTAINS EXCEEDANCE CRITERIA AND SHUTDOWN GUIDANCE (R.G. 1.166)

    * DRAFT REGULATORY GUIDE CONTAINS RESTART GUIDANCE (R.G. 1.167)

REGULATORY GUIDANCE

- REGULATORY GUIDE 1.165, GUIDANCE FOR DETERMINING THE SAFE SHUTDOWN EARTHQUAKE FOR NUCLEAR POWER PLANTS. THIS GUIDANCE IS PRIMARILY PROBABILISTIC, COUPLED WITH STRONG RELIANCE ON SITE-SPECIFIC INVESTIGATIONS

- REVISION TO SRP 2.5.2 OUTLINES HOW THE STAFF WILL REVIEW AN APPLICATION UNDER THE NEW REGULATION THAT USES THE PROBABILISTIC PROCEDURES

- REVISION OF SRP 2.5.1 AND 2.5.3 TO MAKE CONFORMABLE CHANGES BASED ON NEW REGULATION

- REVISION TO REGULATORY GUIDE 1.12 ON SEISMIC INSTRUMENTATION

- NEW REGULATORY GUIDES 1.166 AND 1.167 ON PLANT SHUTDOWN FOR OBE EXCEEDANCE AND FOR PLANT RESTART RESPECTIVELY

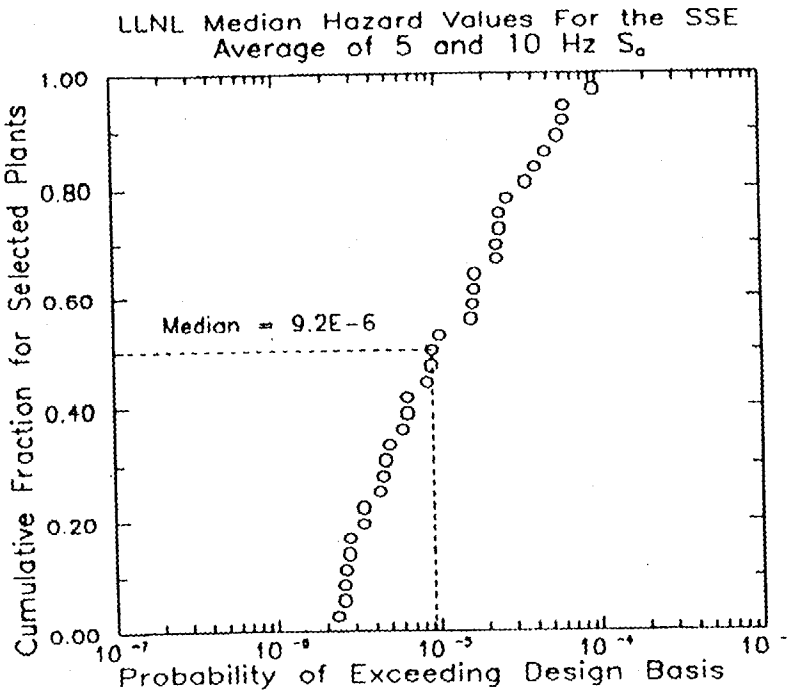
USE OF PROBABILISTIC SEISMIC HAZARD ANALYSIS IN DETERMINING DESIGN BASIS GROUND MOTION

PROPOSED SEISMIC SITING - KEY ELEMENTS

- TARGET EXCEEDANCE PROBABILITY SET BY EXAMINING CURRENT NUCLEAR POWER PLANTS
- CONDUCT PROBABILISTIC SEISMIC HAZARD ANALYSIS
- CONDUCT SITE SPECIFIC AND REGION SPECIFIC GEOSCIENCE INVESTIGATIONS
- CHECK TO DETERMINE IF GEOSCIENCE INVESTIGATION CHANGE PROBABILISTIC RESULTS
- CALCULATE SITE SPECIFIC GROUND MOTION FOR PLANT
- STAFF REVIEW OF APPLICANTS' SUBMITTAL
- UPDATE OF DATA BASE AND PROBABILISTIC METHODOLOGY EVERY TEN YEARS

Procedure for Estimating Controlling Earthquakes

- **Choose a Probability of Exceedance (Reference Probability) level. This reference probability is selected using the cumulative distribution of exceeding the Safe Shutdown Earthquake Ground Motion (SSE) of existing plants that used Regulatory Guide 1.60 design response spectra or similar spectra as their design basis.**

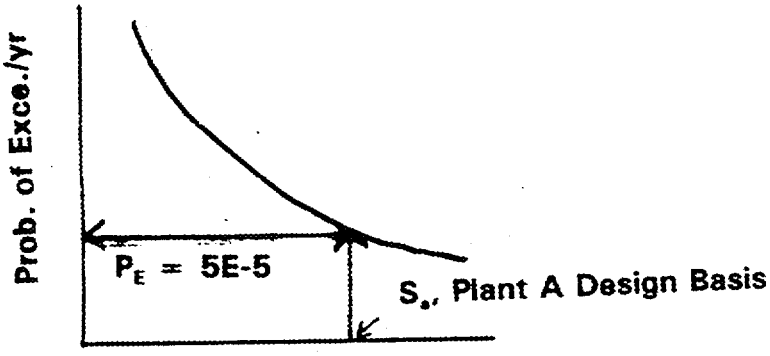


KEY ELEMENTS OF THE PROPOSED REGULATORY GUIDE APPROACH

DEVELOPMENT OF TARGET EXCEEDANCE PROBABILITY

CONSIDERED PLANTS DESIGNED TO REGULATORY GUIDE 1.60 OR SIMILAR SPECTRA

PLANT A



MEDIAN HAZARD CURVE FOR SITE A*

PLANT	PROB. OF EXCEEDING DESIGN BASIS
A	5E-5
B	4E-5
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.	.
.	. ← MEDIAN 1E-5 (USING LLNL PSHA)
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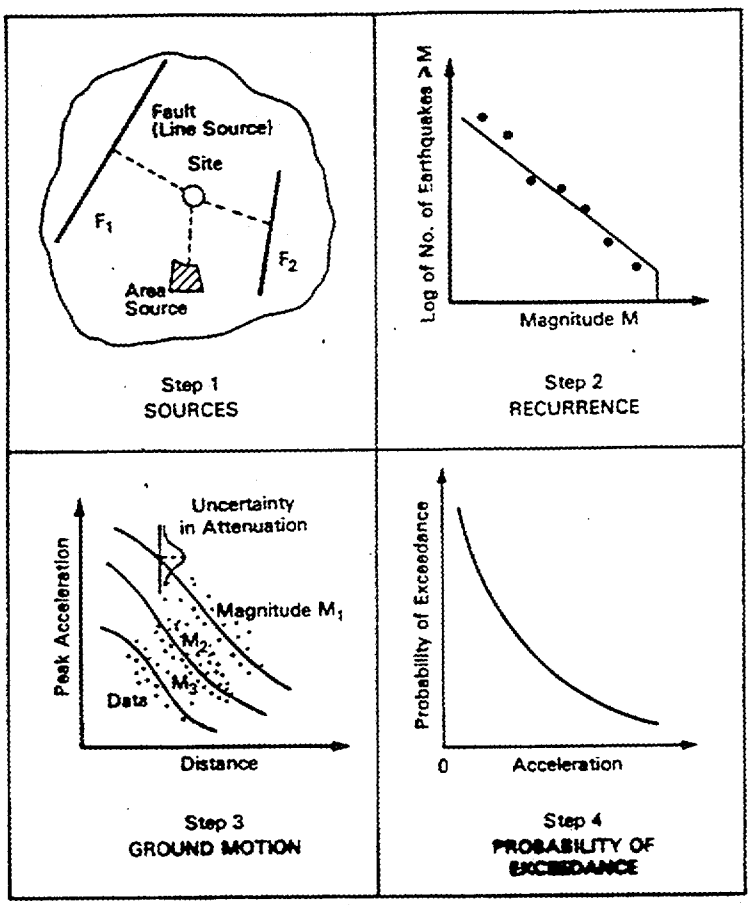
* DEVELOPED BY LLNL FOR ALL EASTERN SITES

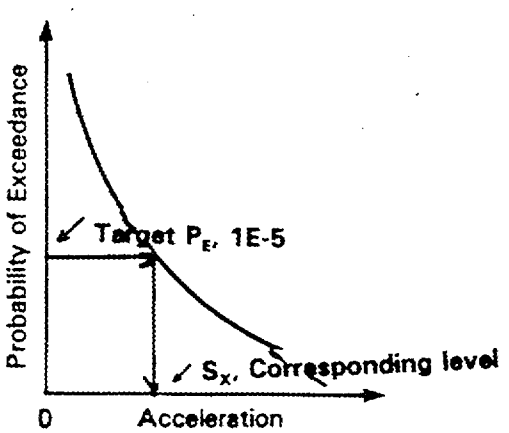
KEY ELEMENTS OF THE PROPOSED REGULATORY GUIDE APPROACH

CONDUCT PROBABILISTIC SEISMIC HAZARD ANALYSIS



Basic Steps of Probabilistic Seismic Hazard Analysis

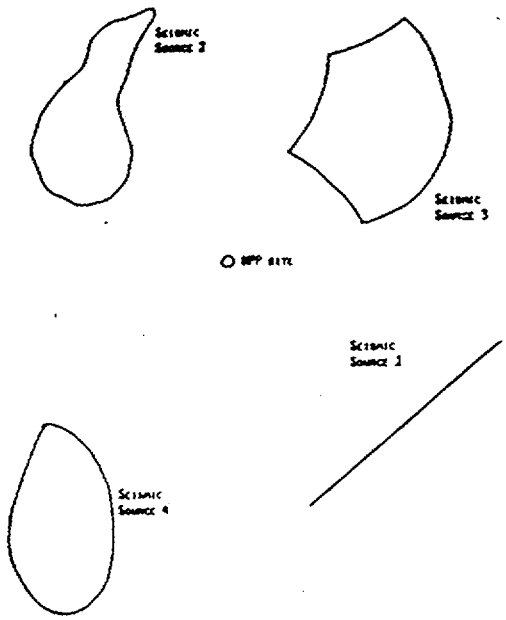
EXAMPLE SITE X



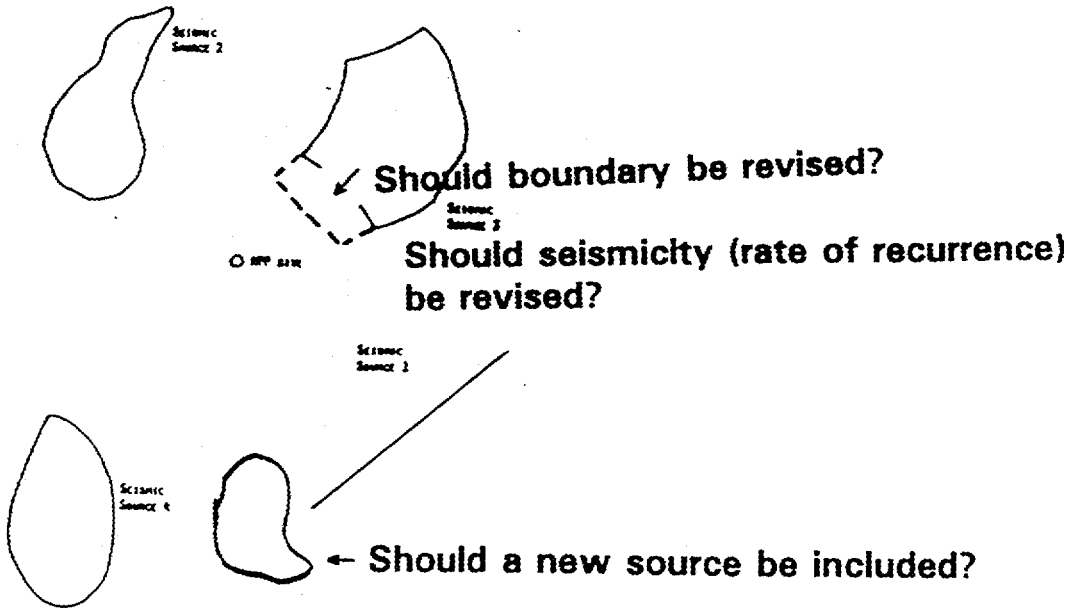
SITE X MEDIAN HAZARD CURVE

KEY ELEMENTS OF THE PROPOSED REGULATORY GUIDE APPROACH

DETERMINE IF GEOSCIENCE INVESTIGATIONS ARE CONSISTENT WITH THE PROBABILISTIC MODEL



A SOURCE MAP USED IN THE PROBABILISTIC ANALYSIS

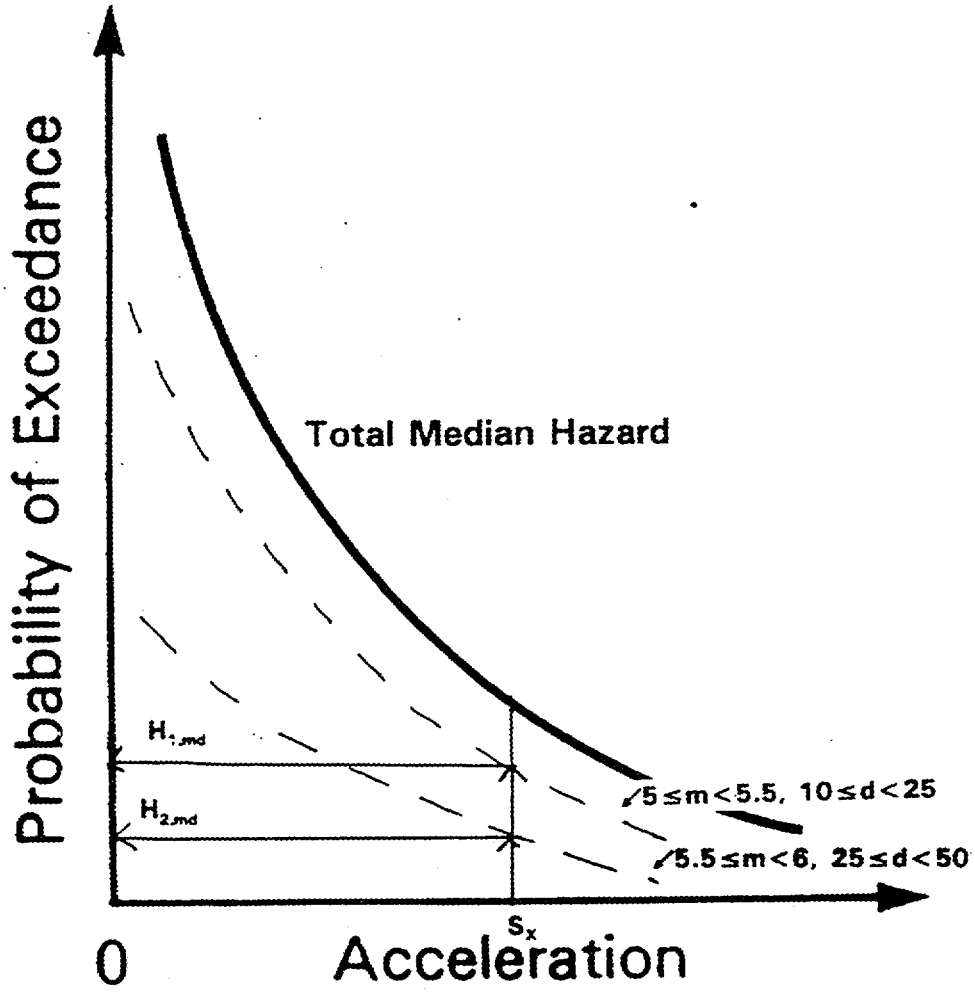


POSSIBLE IMPACT OF GEOSCIENCE INVESTIGATIONS

KEY ELEMENTS OF THE PROPOSED REGULATORY GUIDE APPROACH

CONDUCT PROBABILISTIC SEISMIC HAZARD ANALYSIS (CONT'D)

DEAGGREGATION



CONTROLLING MAGNITUDE AND DISTANCE

$$\bar{M} = \sum_m \sum_d mH_{md} \Big/ \sum_m \sum_d H_{md}$$

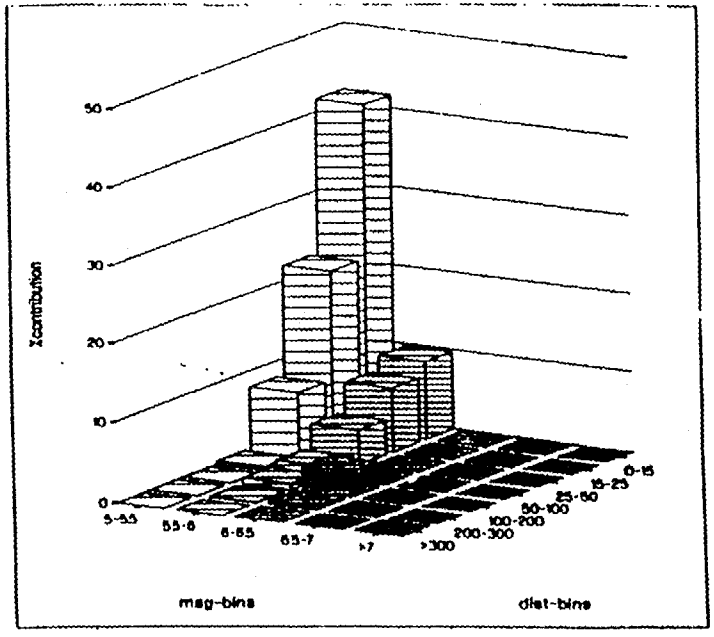
$$\log \bar{D} = \sum_m \sum_d \log(d) H_{md} \Big/ \sum_m \sum_d H_{md}$$

Procedure for Estimating Controlling Earthquakes at a Site (Ct'd)

- Magnitude and distance of controlling earthquakes are determined using results of the seismic de-aggregation

Contribution of Magnitude-Distance Intervals to Total Hazard

Distance Range of Bin (km)	Magnitude Range of Bin				
	5 - 5.5	5.5 - 6	6 - 6.5	6.5 - 7	>7
0-15	0.417	0.087	0.000	0.000	0.000
15-25	0.320	0.079	0.000	0.000	0.000
25-50	0.070	0.042	0.000	0.000	0.000
50-100	0.004	0.014	0.001	0.000	0.000
100-200	0.000	0.008	0.031	0.000	0.000
200-300	0.000	0.001	0.004	0.000	0.000
> 300	0.000	0.000	0.000	0.000	0.000



NTROLLING MAGNITUDE AND DISTANCE

$$\bar{M} = \sum_{m}\sum_{d} mH_{md} \Big/ \sum_{m}\sum_{d} H_{md}$$

$$\log \bar{D} = \sum_{m}\sum_{d} \log(d)H_{md} \Big/ \sum_{m}\sum_{d} H_{md}$$

Interpretation of Controlling Earthquakes

- Consistency between determination of controlling earthquakes and past design earthquakes

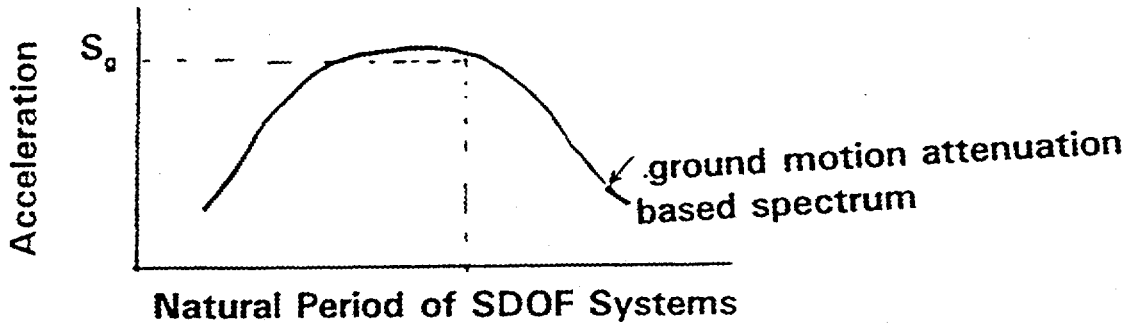
Site No.	Controlling Earthquakes		Past Seismic Design	
	Magnitude	Distance (km)	Magnitude	Distance (km)
1	5.4	18	5.0	15
2	5.6 7.2	24 275	5.8 7	15 250
3	5.5	14	5.3	15
4	5.6	14	5.3	15
5	5.7	14	5.7	15
6	5.5	16	5.3	15
7	5.3 7.3	18 340	4.8 7.3	15 370
8	5.7	14	6	15
9	5.6	14	5.8	15

KEY ELEMENTS OF THE PROPOSED REGULATORY GUIDE APPROACH

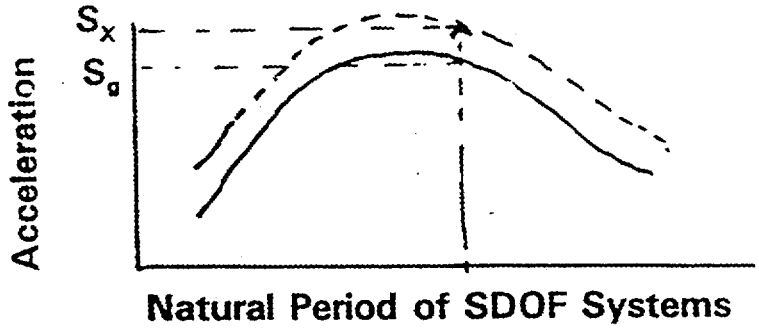
SITE-SPECIFIC SPECTRAL SHAPE AND DETERMINATION OF SSE

USE $\bar{M}$ AND $\bar{D}$ AND SRP 2.5.2 PROCEDURES, FOR EXAMPLE

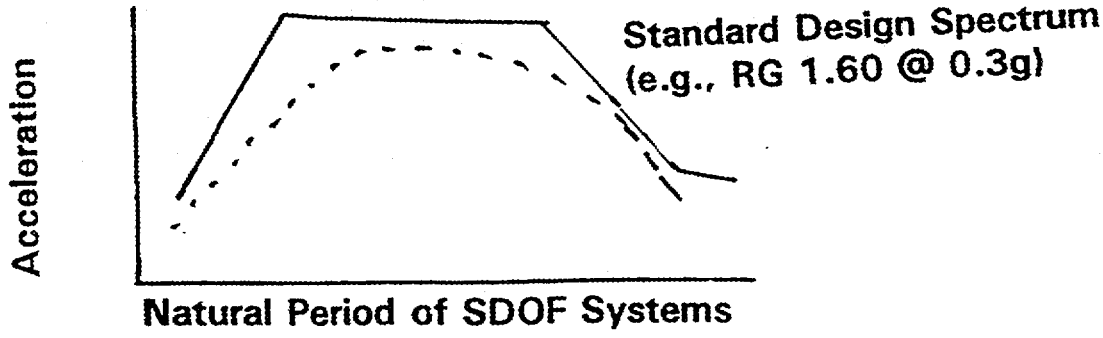
- A SUITE OF TIME-HISTORIES TO REPRESENT $\bar{M} \pm \Delta M$ AND $\bar{D} \pm \Delta DKM$ AND SITE CONDITIONS
- USE OF REPRESENTATIVE GROUND MOTION ATTENUATION MODELS (FUNCTION OF M AND D)



SCALE THIS SHAPE TO S_X



COMPARE WITH SPECTRA USED IN STANDARD DESIGN



NRC STAFF REVIEW

FROM PROPOSED REVISION OF SRP SECTION 2.5.2

"The staff will review the controlling earthquakes and associated ground motions at the site derived from the applicant's probabilistic hazard analysis to be sure that they are either consistent with the controlling earthquakes/ground motions used in licensing of (a) other licensed facilities at the site, (b) nearby plants, or (c) plants licensed in similar seismogenic regions, or the reasons they are not consistent are understood."

EARTHQUAKE ENGINEERING CRITERIA

CURRENT EARTHQUAKE ENGINEERING CRITERIA
(APPENDIX A TO 10 CFR PART 100)

INCLUDES BOTH SITING AND ENGINEERING DESIGN CRITERIA

DEFINES THE SAFE SHUTDOWN EARTHQUAKE AND OVERLY CONSTRAINTS THE OPERATING BASIS EARTHQUAKE

DEFINES SAFETY RELATED STRUCTURES, SYSTEMS, AND COMPONENTS

DEFINES THE MINIMUM VALUE OF THE SSE

REQUIRES PLANT SHUTDOWN IF THE OBE IS EXCEEDED

IDENTIFIES ACCEPTABLE ANALYTICAL METHODS

DESIGN FOR SURFACE FAULTING, SEISMICALLY INDUCED FLOODS AND WATER WAVES, AND SOIL CONSIDERATIONS

NEW EARTHQUAKE ENGINEERING CRITERIA
(APPENDIX S TO 10 CFR PART 50)

SEPARATE SITING FROM DESIGN

SITING REMAINS IN PART 100, DESIGN RELOCATED INTO PART 50

NO SIGNIFICANT CHANGES FROM OCTOBER 1992 PROPOSED RULE

CRITERIA APPLIES TO PART 52 OR PART 50 APPLICANTS ON OR AFTER THE EFFECTIVE DATE OF THE FINAL RULE (CRITERIA WILL NOT BE APPLIED TO EXISTING PLANTS)

PART 52 APPLICANTS

* DESIGN CERTIFICATION
* COMBINED LICENSE

PART 50 APPLICANTS

* CONSTRUCTION PERMIT
* OPERATING LICENSE

SAFE SHUTDOWN EARTHQUAKE GROUND MOTION (SSE)

THE CONTROL POINT MOTION HAS BEEN CHANGED FROM THE FOUNDATION-LEVEL TO THE FREE-FIELD AT THE FREE GROUND SURFACE

THE MINIMUM SSE IS AT LEAST 0.1G (SAME AS APPENDIX A TO PART 100)

OPERATING BASIS EARTHQUAKE GROUND MOTION (OBE)

THE APPLICANT CHOOSES THE VALUE OF THE OBE:

IF ONE-THIRD OR LESS OF THE SSE, AN EXPLICIT OBE RESPONSE OR DESIGN ANALYSIS IS NOT REQUIRED

IF GREATER THAN ONE-THIRD OF THE SSE, AN EXPLICIT OBE RESPONSE AND DESIGN ANALYSIS IS REQUIRED

REQUIRED PLANT SHUTDOWN

LICENSEE MUST SHUTDOWN THE PLANT IF VIBRATORY GROUND MOTION EXCEEDING THE OBE, OR SIGNIFICANT PLANT DAMAGE OCCURS

LICENSEE TO CONSULT WITH THE COMMISSION AND PROPOSE A PLAN FOR A TIMELY SAFE SHUTDOWN OF THE NUCLEAR POWER PLANT IF SYSTEMS, STRUCTURES, OR COMPONENTS NECESSARY FOR A SAFE SHUTDOWN OR TO MAINTAIN A SAFE SHUTDOWN ARE NOT AVAILABLE

REGULATORY GUIDANCE

REGULATORY GUIDE 1.12, REVISION 2, NUCLEAR POWER PLANT INSTRUMENTATION FOR EARTHQUAKES

REGULATORY GUIDE 1.166, PRE-EARTHQUAKE PLANNING AND IMMEDIATE NUCLEAR POWER PLANT OPERATOR POST-EARTHQUAKE ACTIONS

REGULATORY GUIDE 1.167, RESTART OF A NUCLEAR POWER PLANT SHUT DOWN BY A SEISMIC EVENT

OVERVIEW OF EARTHQUAKE RESPONSE

PRE-EARTHQUAKE

- OPERABLE SEISMIC INSTRUMENTATION
- SELECT AND INSPECT STRUCTURES AND EQUIPMENT (BASE-LINE)

POST-EARTHQUAKE

- WALKDOWN
- EVALUATION OF GROUND MOTION RECORDS TO DETERMINE IF OBE EXCEEDED

SOLID STATE DIGITAL TIME-HISTORY ACCELEROGRAPHS THAT WILL ENABLE DATA PROCESSING AT THE PLANT SITE WITHIN 4 HOURS

INSTRUMENTATION SENSORS PLACED IN THE FREE-FIELD, BUILDING FOUNDATIONS AND AT ELEVATION IN THE BUILDING

INSTRUMENTATION SENSORS ARE NOT LOCATED ON EQUIPMENT, PIPING, OR SUPPORTS

REGULATORY GUIDE 1.166

PRE-EARTHQUAKE PLANNING AND IMMEDIATE NUCLEAR POWER PLANT OPERATOR POST-EARTHQUAKE ACTIONS

ENDORSES SPECIFIC SECTIONS OF EPRI NP-6695, "GUIDELINES FOR NUCLEAR POWER PLANT RESPONSE TO AN EARTHQUAKE"

OBE EXCEEDANCE CRITERIA

PLANT SHUTDOWN

EMPHASIZES AN ORDERLY PLANT SHUTDOWN; ASSURE THAT PLANT SHUTDOWN EQUIPMENT IS OPERATIONAL

ALTERNATIVE CRITERIA IF FREE-FIELD SEISMIC INSTRUMENTATION IS INOPERABLE

REGULATORY GUIDE 1.167
RESTART OF A NUCLEAR POWER PLANT SHUT DOWN BY A SEISMIC EVENT

ENDORSES SPECIFIC SECTIONS OF EPRI NP-6695, "GUIDELINES FOR NUCLEAR POWER PLANT RESPONSE TO AN EARTHQUAKE"

PROVIDES GUIDELINES FOR PERFORMING VISUAL INSPECTIONS AND TESTS OF EQUIPMENT AND STRUCTURES PRIOR TO PLANT RESTART

PROVIDES GUIDELINES FOR PERFORMING LONG-TERM EVALUATIONS TO DETERMINE THE EFFECTS OF AN EARTHQUAKE

DRAFT FINAL RULE
REVISION OF 10 CFR PARTs 50 AND 100
NON-SEISMIC ASPECTS

PRESENTED TO
COMMITTEE TO REVIEW GENERIC REQUIREMENTS

MAY 9, 1996

LEONARD SOFFER
U.S. NUCLEAR REGULATORY COMMISSION

U.S. EXPERIENCE AND THE ROLE OF REACTOR SITING

- VIRTUALLY ALL POWER REACTORS IN U.S. HAVE BEEN SITED USING PART 100. PRESENTLY, 110 OPERATING REACTORS IN THE U.S. ON 69 SITES. ABOUT 2000 REACTOR-YEARS OF U.S. OPERATING EXPERIENCE. ALSO:
  - ABOUT 20 SITES REVIEWED AND APPROVED; BUT CURRENTLY NO OPERATING REACTORS,
  - ABOUT 10 SITES REVIEWED BUT NOT APPROVED.
- SUBSTANTIAL BASE OF SITING EXPERIENCE EXISTS. NUMEROUS RISK STUDIES INDICATES THAT THE PRIMARY REMAINING FACTORS THAT INFLUENCE PUBLIC HEALTH AND SAFETY ARE REACTOR DESIGN, CONSTRUCTION AND OPERATION.
- SITING FACTORS ARE IMPORTANT FOR:
  - ASSURING (WITH DESIGN) THAT RADIOLOGICAL DOSES FROM NORMAL OPERATION AND POSTULATED ACCIDENTS ARE ACCEPTABLY LOW,
  - THAT NATURAL PHENOMENA AND MAN-RELATED HAZARDS IN THE SITE VICINITY ARE DESCRIBED AND ACCOUNTED FOR IN PLANT DESIGN,
  - THAT SITE CHARACTERISTICS ARE AMENABLE TO DEVELOPMENT OF EMERGENCY PLANS AND SECURITY PLANS,
  - MAINTAINING COMMISSION POLICY OF SITING AWAY FROM DENSELY POPULATED CENTERS.

MAJOR DEVELOPMENTS IN REACTOR SITING PRACTICE (1962-PRESENT)

- DEVELOPMENT AND IMPLEMENTATION OF EFFECTIVE FISSION PRODUCT REMOVAL SYSTEMS
- STAFF GUIDANCE ON PROXIMITY TO POPULATION CENTERS
- RELATIONSHIP OF SITING AND EMERGENCY PLANNING
- INCLUSION OF HUMAN-RELATED HAZARDS
- IMPROVED SEVERE ACCIDENT INSIGHTS AND REVISED ACCIDENT SOURCE TERMS

PURPOSE OF PART 100

- DETERMINES SITE PARAMETERS (EAB, LPZ, POP.CTR. DIST.) PROVIDING ACCEPTABLE SEPARATION DISTANCES BETWEEN PLANT AND MEMBERS OF PUBLIC.

- PROVIDES A PERFORMANCE MEASURE OF THE ACCIDENT MITIGATION CAPABILITY OF THE PLANT. SETS REQUIREMENTS FOR CONTAINMENT LEAK RATE, FISSION PRODUCT CLEANUP SYSTEMS, ETC.

- DEMONSTRATES THAT EXCESSIVE DOSES TO THE PUBLIC ARE UNLIKELY EVEN IN EVENT OF A DEGRADED CORE ACCIDENT AND FISSION PRODUCT RELEASE INTO CONTAINMENT (AS LONG AS CONTAINMENT REMAINS INTACT).

  - TO NEAREST INDIVIDUAL AT EAB FOR EARLY PHASE OF ACCIDENT,
  - TO INDIVIDUAL AT LPZ OUTER RADIUS OVER COURSE OF ACCIDENT.

- WHAT DOESN'T PART 100 DO?

  - DOES NOT DETERMINE CONTAINMENT DESIGN (THIS IS DONE BY PRESSURE/TEMP CONDITIONS OF LOCA).

  - DOES NOT CONTROL SEVERE ACCIDENT RISK. RISK IS DOMINATED BY CORE-MELT ACCIDENTS WHERE CONTAINMENT FAILS OR IS BYPASSED.

REASONS FOR REVISING PART 100

- ISSUANCE OF PART 52 WITH USE OF EARLY SITE PERMITS
- RECOGNITION THAT DOSE CALC. AFFECTING PLANT DESIGN MORE THAN SITING.
  - ALLOWABLE CONTAINMENT LEAK RATE,
  - FISSION PRODUCT CLEANUP SYSTEM PERFORMANCE (SPRAYS, FILTERS),
  - ISOLATION VALVE TIMING, DRAWDOWN TIME ON SECONDARY CONT. ANNULUS.
- INCORPORATE CHANGES IN SITING PRACTICE AND ALLOW FOR UPDATED ACCIDENT SOURCE TERMS
  - REQUIRE PLANTS TO BE "AWAY FROM" DENSELY POPULATED CENTERS,
  - REQUIRE MAN-RELATED HAZARDS TO BE EVALUATED,
  - SITES CHARACTERISTICS MUST BE AMENABLE TO DEVELOPMENT OF ADEQUATE SECURITY PLANS AND EMERGENCY PLANS,
  - REVISE DOSE CRITERION TO REFLECT REVISED ACCIDENT SOURCE TERMS.
- INCORPORATE ADVANCES IN SEISMIC ANALYSIS AND EARTHQUAKE ENGINEERING
- EFFORT INITIATED IN 1990 TO DECOUPLE SITING FROM DESIGN.

PROPOSED REVISIONS
(NON-SEISMIC)

- FIRST PROPOSED REVISION (OCT. 1992) - NO DOSE CALCULATIONS FOR SITING. NUMERICAL CRITERIA FOR EAB SIZE AND POP. DENSITY IN RULE. PROPOSED RULE TO CONSIST OF TWO SUBPARTS; SUBPART A FOR CURRENT PLANTS; SUBPART B FOR FUTURE PLANTS.

- MAJOR COMMENTS - DOSE CALCULATIONS SHOULD BE RETAINED. RULE TOO PRESCRIPTIVE, CONSERVATIVE, INCOMPATIBLE WITH CONCERNS OF INTERNATIONAL COMMUNITY. RULE WITHDRAWN MARCH 28, 1994.

- SECOND PROPOSED REVISION (OCT. 1994) - SOURCE TERM AND DOSE CRITERIA RELOCATED TO PART 50.34, AND RETAINED FOR SITING.
  - SECTION 100.21, CONTAINS BASIC NON-SEISMIC CRITERIA WITHOUT NUMERICAL VALUES.
  - NUMERICAL VALUES FOR POP. DENSITY IN REVISED REG. GUIDE 4.7.
  - DOSE CRITERION OF 25 REM TEDE. DOSE EVALUATED OVER ANY TWO-HOUR PERIOD.

PUBLIC COMMENT HIGHLIGHTS - (NON-SEISMIC)

- INDUSTRY (7 COMMENTS) - GENERALLY FAVORABLE; BUT SIGNIFICANT CONCERNS IN SOME AREAS
  - USE OF TEDE IS APPROPRIATE
  - DOSE CRITERION OF 25 REM IS MORE RESTRICTIVE THAN CURRENT CRITERIA (ONE INDUSTRY COMMENT THAT 25 REM IS APPROPRIATE).
  - NO NEED FOR AN ORGAN "CAPPING" DOSE.
  - USE OF ANY 2 HOUR PERIOD TO EVALUATE DOSE IS CONFUSING, ILLOGICAL.
- PUBLIC INTEREST GROUP (1 COMMENT) - GENERALLY UNFAVORABLE. PROPOSED RULE IS AN UNDUE CONCESSION TO FOREIGN INTERESTS.
  - USE OF TEDE ACCEPTABLE
  - DOSE CRITERION OF 25 REM APPROPRIATE
  - DOSE TO ANY SINGLE ORGAN SHOULD BE NO MORE THAN ONE-THIRD OF TOTAL
  - NO COMMENT ON DOSE EVALUATION PERIOD

ELEMENTS OF DRAFT FINAL RULES

BASIC REACTOR SITE CRITERIA (10 CFR 100.21)

- SITE ATMOSPHERIC DISPERSION CHARACTERISTICS MUST BE SUCH THAT:
  - RADIOLOGICAL DOSES FOR NORMAL OPERATION WILL BE MET, AND
  - RADIOLOGICAL CONSEQUENCES OF POSTULATED ACCIDENTS WILL MEET THE DOSE CRITERIA IN SECTION 50.34.

- POTENTIAL HAZARDS ASSOCIATED WITH PHYSICAL CHARACTERISTICS OF SITE (E.G., GEOLOGY, HYDROLOGY) AND HUMAN-RELATED ACTIVITIES NEARBY (E.G., INDUSTRY, AIRPORTS) WILL POSE NO UNDUE RISK TO PLANT.

- SITE CHARACTERISTICS MUST BE SUCH THAT
  - ADEQUATE SECURITY PLANS AND MEASURES CAN BE DEVELOPED, AND
  - ADEQUATE EMERGENCY PLANS CAN BE DEVELOPED.

- REACTOR SITES SHOULD BE LOCATED AWAY FROM VERY DENSELY POPULATED CENTERS; LOW DENSITY AREAS PREFERRED; OTHER SITES MAY BE ACCEPTABLE.

POPULATION CRITERIA
(PROPOSED RULE)

- PROPOSED RULE ESTABLISHES THREE CATEGORIES OF SITES WITH REGARD TO POPULATION DENSITY OR PROXIMITY, BUT WITHOUT NUMERICAL VALUES.

  - REACTORS SHOULD BE LOCATED AWAY FROM VERY DENSELY POPULATED CENTERS;

  - AREAS OF LOW POPULATION DENSITY ARE PREFERRED;

  - FOR SITES NOT IN EITHER OF ABOVE TWO CATEGORIES, CONSIDERATION WILL BE GIVEN TO OTHER FACTORS, SUCH AS SAFETY, ENVIRONMENTAL OR ECONOMICS, AND SITE MIGHT BE FOUND ACCEPTABLE.

POPULATION CRITERIA
(PROPOSED REVISION 2 REG. GUIDE 4.7)

- NUMERICAL VALUE OF POPULATION DENSITY REFLECTS CONSIDERATION OF SEVERE ACCIDENTS AND U.S. GEOGRAPHIC/DEMOGRAPHIC CONDITIONS.

  - SITES WHERE POPULATION DENSITY DOES NOT EXCEED 500 PERSONS PER SQ. MILE AT ANY DISTANCE OUT TO 20 MILES ARE PREFERRED.

  - REACTORS SHOULD NOT BE LOCATED WHERE THE POPULATION DENSITY IS WELL IN EXCESS OF ABOVE VALUE.

  - POPULATION PROJECTIONS TO BE CONSIDERED FOR ABOUT 5 YEARS FROM INITIAL SITE APPROVAL; TRANSIENT POPULATION ALSO FACTORED IN.

  - POPULATION GROWTH AFTER SITE APPROVAL EXPECTED; CHANGES TO BE FACTORED INTO SITE EMERGENCY PLANS.

- REFERENCE TO MINIMUM EXCLUSION AREA AND LPZ SIZES DELETED.

RISK INSIGHTS

- STAFF INVESTIGATED MEETING SAFETY GOAL VS. SIZE OF EXCLUSION AREA. THIS BASED ON CURRENT PLANTS, USING RISK INSIGHTS FROM NUREG-1150.
  - PROMPT FATALITY QHO OF THE SAFETY GOAL (5×10^{-7} PER YEAR) IS MET FOR ALL EAB SIZES OF ABOUT 0.1 MILE OR GREATER.
  - LATENT CANCER FATALITY QHO (2×10^{-6} PER YEAR) EASILY MET.
  - THIS SIZE (0.1 MILE) ENCOMPASSES ALL CURRENT OPERATING PLANTS, AND ALL SITES REVIEWED AND APPROVED BY THE STAFF.

- STAFF INVESTIGATED INDIVIDUAL RISK OF PERMANENT RELOCATION AS A RESULT OF LAND CONTAMINATION. USING SEVERE ACCIDENT RELEASE BASED ON OPERATING PLANTS, RISK IS LOW (LESS THAN 10^{-6} PER YEAR) AT ALL DISTANCES, AND DECLINES SIGNIFICANTLY BEYOND ABOUT 20 MILES.

ELEMENTS OF DRAFT FINAL RULES (CONTINUED)

SOURCE TERM AND DOSE CRITERIA (10 CFR 50.34)

- SOURCE TERM AND DOSE CRITERIA RELOCATED TO PART 50.34
- DOSE CRITERIA REVISED FROM 25 REM WHOLE BODY AND 300 REM THYROID TO 25 REM TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE).
- DOSE TO AN INDIVIDUAL AT EXCLUSION AREA BOUNDARY NOT TO EXCEED 25 REM TEDE FOR ANY TWO HOUR PERIOD FOLLOWING FISSION PRODUCT RELEASE.
- NO SPECIFIC SOURCE TERM REQUIRED; MAY BE USED WITH CURRENT OR REVISED SOURCE TERMS.

DIFFERING OPINION BY OFFICE OF RESEARCH

- OFFICE OF RESEARCH RECOMMENDS THAT DOSE BE EVALUATED FOR THE TWO HOUR PERIOD BEGINNING WITH FUEL FAILURE, RATHER THAN ANY TWO-HOUR PERIOD.

DOSE EVALUATION PERIOD - RES DIFFERING VIEW

- RES DIFFERING VIEW - FIRST 2 HOURS AFTER ONSET OF FUEL FAILURE
  - CONSISTENT WITH CURRENT PRACTICE - USED FOR CE SYSTEM 80+.
  - CONSISTENT WITH RISK INSIGHTS (RISK INSENSITIVE TO LEAK RATE).
    * PRA POLICY STATEMENT
    * 10 CFR 50, APP. J RULE CHANGE
  - FIRST 2 HOURS PROVIDES GOOD TEST OF CAPABILITY FOR EARLY PUBLIC PROTECTION; TENDS NOT TO DUPLICATE LPZ DOSE. RELEASE CONSISTENT WITH "SUBSTANTIAL MELTDOWN" REQUIREMENT IN PART 100.
  - PROVIDES INCENTIVE TO DESIGNERS TO DELAY ONSET OF CORE DAMAGE, WHILE ENSURING A SUBSTANTIAL CHALLENGE TO CONTAINMENT.

- RES AGREES THAT, FOR THE AP-600 DESIGN, PRESENTLY THERE IS INSUFFICIENT EXPERIENCE AND UNDERSTANDING OF THE INTERACTION BETWEEN THE SOURCE TERM AND THE THERMAL/HYDRAULIC BEHAVIOR OF THE CONTAINMENT DURING AN ACCIDENT. UNTIL A BETTER UNDERSTANDING OF THESE PHENOMENA BECOME AVAILABLE, RES BELIEVES THAT THE SOURCE TERM SHOULD BE APPLIED MORE CONSERVATIVELY (THAN THE RES PROPOSAL) FOR THE AP-600 DESIGN TO ACCOUNT FOR THIS LACK OF EXPERIENCE. THIS ISSUE MERITS SPECIAL ATTENTION OUTSIDE THE FRAMEWORK OF THE RULE.

ACRS REVIEW

- ACRS BRIEFED ON DRAFT FINAL RULE. LETTER TRANSMITTED APRIL 22, 1996.

- RECOMMENDATIONS:

  - PROPOSED FINAL RULE DEALING WITH SEISMIC ASPECTS SHOULD BE ISSUED,

  - CAREFUL DEFINITIONS OF TEDE LIMITS THAT ARE MINDFUL OF ORGAN DOSE WEIGHTING FACTORS OF PART 20 SHOULD BE IN FINAL RULE,

  - ACRS NOT PERSUADED BY RES RATIONALE IN FAVOR OF FIRST TWO-HOUR DOSE CALCULATION,

  - PROPOSED FINAL RULE (USING WORST 2 HOURS) AND REG. GUIDES SHOULD BE ISSUED.

BACKUP VIEWGRAPHS

DISTRIBUTION OF EXCLUSION AREA SIZES
(U.S. OPERATING REACTORS)

EXCLUSION AREA SIZE, METERS	No. OF SITES
< 300	1
300 - 400	3
400 - 500	9
500 - 640	11
640 - 800	11
> 800	34
TOTAL	69

TOTAL EFFECTIVE DOSE EQUIVALENT

- TOTAL EFFECTIVE DOSE EQUIVALENT EQUALS DEEP DOSE EQUIVALENT (EXTERNAL EXPOSURES) PLUS COMMITTED EFFECTIVE DOSE EQUIVALENT (INTERNAL EXPOSURES).

- DEEP DOSE EQUIVALENT IS THE SAME AS PRESENT WHOLE BODY DOSE.

- THE COMMITTED EFFECTIVE DOSE EQUIVALENT IS OBTAINED BY MULTIPLYING THE DOSE TO A GIVEN ORGAN BY A WEIGHTING FACTOR APPLICABLE TO THAT ORGAN AND SUMMING OVER ALL BODY ORGANS.

RISK EQUIVALENCY OF CURRENT DOSE CRITERIA AND TEDE

- STAFF EXAMINED CURRENT DOSE CRITERIA TO SELECT A TEDE VALUE EQUIVALENT IN RISK.
- RISK OF LATENT CANCER FATALITY VS. CANCER INCIDENCE NOT THE SAME.
- RISKS ASSOCIATED WITH CURRENT DOSE CRITERIA:

  -FOR 25 REM WHOLE BODY
  RISK OF LATENT CANCER FATALITY = 2.5×10^{-2}
  RISK OF LATENT CANCER INCIDENCE = 5×10^{-2}

  -FOR 300 REM THYROID
  RISK OF LATENT CANCER FATALITY = 2.1×10^{-3}
  RISK OF LATENT CANCER INCIDENCE = 2.1×10^{-2}

- BASED ON RISK OF LATENT CANCER FATALITY, CURRENT DOSE CRITERIA ARE EQUIVALENT TO 27 REM TEDE.
- BASED ON RISK OF CANCER INCIDENCE, CURRENT DOSE CRITERIA ARE EQUIVALENT TO ABOUT 35 REM TEDE.
- LATENT CANCER FATALITY RISK USED IN SAFETY GOAL; THIS ALSO LEADS TO SELECTION OF LOWER VALUE OF 27 REM TEDE.

Attachment 4 to the Minutes of CRGR Meeting No. 285 and 286

Final Rule on Revisions to 10 CFR Part 100, Reactor Site Criteria," and Revision to 10 CFR Part 50 and Associated Regulatory Guides and Standard Review Plan Sections

(CRGR Meeting No. 285 and 286 - May 9 and 17, 1996, respectively)

TOPIC

The topic for CRGR briefing by the staff included (1) final rule revising 10 CFR Part 100, "Reactor Site Criteria" for future plants, and (2) final rule codifying geologic and seismic siting factors for new plants. The staff's objective in proceeding with these rule changes is to provide a better regulatory basis for siting of the nuclear power plants by de-coupling decisions of site suitability from those involving nuclear power plant seismic design. Because the revised criteria are not applicable to the existing plants, and the licensing basis for existing plants must remain part of regulations, therefore, the non-seismic and seismic reactor site criteria for current plants are proposed to be retained as Subpart A and Appendix-A to 10 CFR Part 100, respectively. The new Subpart B would apply to site applications received on or after the effective date of the final rule. Additional new criteria are added to Part 100. Criteria not associated with site selection or establishment of the Safe Shutdown Earthquake Motion (SSE) are placed in 10 CFR Part 50, consistent with the location of other design requirements being in Part 50.

This rulemaking at the proposed stage was reviewed by CRGR during the 217th meeting on March 19, 1992. Subsequently, the staff issued the first proposed revision for comments in October 1992, withdrew this revision in March 1994, and re-issued the second revision in October 1994. However, the second revision was not submitted for CRGR review. The staff worked under the direction of the Commission and believed that the changes did not warrant CRGR (or for that matter ACRS) re-review. Therefore, neither Committees were informed of the deviations from the original course.

The ACRS reviewed the final rule on April 11, 1996, and endorsed the proposed revisions for issuance.

BACKGROUND

(i) Memorandum, dated nil, from D. L. Morrison to E. L. Jordan, "Revisions of 10 CFR Part 100, Reactor Site criteria, Revisions to 10 CFR Part 50, New Appendix-S to Part 50 (Final Rules) and Associated Regulatory Guides and Standard Review Plan Sections." The cognizant staff had directly provided the members with the review material on May 6, 1996 (no CRGR Review Item No.). This package had not been concurred upon by OGC. The attachments are as follows:

1. Summary of Public Comments (October 1994 publication)

2. Chairman's questions

3. ACRS Letter

4. Commission Paper

5. Federal Register Notice of Rulemaking

6. Resolution of Public Comments - Seismic and Earthquake Engineering Rule

7. Regulatory Guide 4.7 (General Site Suitability Criteria)

8. Regulatory Guide 1.12, Revision 2 (Seismic Instr.) (Draft was DG-1033)

9. Resolution of Public Comments on DG-1033

10. Regulatory Guide 1.166 (Plant Shutdown) (Draft was DG-1034)

11. Resolution of Public Comments on DG-1034

12. Regulatory Guide 1.167 (Plant Restart) (Draft was DG-1035)

13. Resolution of Public Comments on DG-1035

14. Regulatory Guide 1.1.65 (Seismic Sources) (DG-1032)

15. SRP Section 2.5.1, Revision 3 (Basic Geologic and Seismic Information)

16. SRP Section 2.5.2, Revision 3 (Vibratory Ground Motion)

17. SRP Section 2.5.3, Revision 3 (Surface Faulting)

18. Resolution of Public Comments on DG-1032, and SRP 2.5.1., 2.5.2 & 2.5.3)

19. Regulatory Analysis

20. Environmental Assessment

(ii) Response to Chairman's questions, dated April 30, 1996.

(iii) Specific Comments from Dr. Ross, received on May 7, 1996.

(iv) Draft Issue Sheet e-mailed from Raji Tripathi to the CRGR members on May 8, 1996.

(v) Memorandum, dated May 10, 1996, from D. L. Morrison to E. L. Jordan, "Revisions of 10 CFR Part 100, Reactor Site criteria, Revisions to 10 CFR Part 50, New Appendix-S to Part 50 (Final Rules) and Associated Regulatory Guides and Standard Review Plan Sections." This transmittal forwards supplemental information to item (i) above. Only the pages revised since staff's briefing to the Committee on the 7th of May 1996 were included.

ISSUES/CONCERNS

1. During the May 9th meeting, first the CRGR reviewed its jurisdiction. The Committee agreed that inasmuch as the guidance package was forward-fit only, the term "backfit" does not apply to this rule change, therefore, the incoming package was not subject to the terms and conditions of 10 CFR 50.109. However, the Committee also agreed that the material was within the scope of the CRGR charter.

2. The CRGR expressed a concern that the schedule did not provide proper allowance for the time needed for CRGR review, and additional revised material was furnished to the Committee just before the May 17th meeting.

   The CRGR reviewed the original proposed rule on this subject in March, 1992 during Meeting No. 217. Subject to various comments, the Committee endorsed the proposed rule for publication. The proposed rule was published in October 1992. At the May 9, 1996 CRGR briefing, the staff informed the Committee that due to a number of factors, including some adverse comments on the package, the proposed rule had been withdrawn and a second proposed rule was issued for comment in 1994. A schedule was adopted by the staff which called for a Commission briefing on June 3, 1996. However, the CRGR review package (well over 500 pages) was not sent to the CRGR until Monday, May 6, 1996. Because the staff wanted a disposition in time to support the EDO briefing on May 23rd, the CRGR scheduled a briefing session on May 9th and a review session on May 17th. This was the first opportunity that the Committee had to comment on the form and content of the revised (non-seismic) site criteria, which significantly deviated from the first proposed rule (1992 version.)

3. The Committee did express the view that the staff should verify that current plants which might apply for license renewal and license amendments would not be subject to the new (Subpart B) requirements as embodied in the package. The staff affirmed that the operating plants when applying for license renewal and license amendments will not be subjected to this rule change.

4. The CRGR noted that the seismic portion of the rule represents a major improvement.

   The Committee expressed some concerns regarding the wording of the proposed final revised rule. In the draft Federal Register Notice of Rulemaking, the verb "must" is used several places. In particular, on pages 38 and 39, in the following two sentences (underlined for quick reference):

   a. "The nuclear power plant must be designed so that, if the Safe Shutdown Earthquake occurs, certain structures, systems and components will remain functional and within applicable stress, strain, and deformation limits."

   b. "When subjected to the effects of the Operating Basis Earthquake in combination with normal operating loads, all structures, systems and of the nuclear plant necessary for continued operation without undue

risk to the public must remain functional and within applicable stress, strain, and deformation limits."

The Committee raised concerns about the wording of the proposed new Appendix-S to 10 CFR Part 50 differs somewhat from the wording that remains in 10 CFR Part 100, Appendix-A, Section VI which is applicable to the existing operating plants, e.g.:

i. The underlined phrase at the end of the sentence 1.a, does not appear in the analogous sentence in existing Part 100, Appendix-A.

This addition poses a question whether the phrase at the end of the sentence addressing the new Appendix-S SSE design requirements is intended to impose more stringent requirements than the existing Part 100.

ii. The existing Part 100, Appendix-A wording uses the verb "shall" instead of "must" and, in fact, states that certain (safety-related) SSC's "shall be designed to" remain functional, instead of "must remain functional" if an SSE occurs.

Is there some subtle regulatory difference intended by the choice of wording in the requirements for the new 10 CFR Part 50 Appendix-S requirements as compared to the existing 10 CFR Part 100, Appendix-A requirements? Unless a change in requirements is intended in relocating 10 CFR Part 100, Appendix-A language to Appendix-S, 10 CFR Part 50, there is no justification in paraphrasing the 10 CFR Part 100 language.

The staff did not offer a clear explanation, however, assured the Committee to re-review the use of the wording to avoid any unnecessary and unintentional confusions.

The Committee was generally satisfied with the revisions in the seismic area and subject to some comments with which the staff agreed, endorsed it for publication.

5. There are some weaknesses in the approach. For example, in many cases studied, the risk-dominating accidents do not involve the containment at all (e.g., interfacing LOCA and steam generator tube rupture which bypass the containment). Additionally, for some sequences there is the possibility of consequent early containment failure or late failure. It is true that the design process for a robust containment reduces markedly the likelihood of gross failure. Therefore, early failures (and by-pass sequences) could dominate risk in a relative sense, in that gross failure probabilities have been reduced. Modern probabilistic risk analysis, which couples accident sequences, core response, fission product release, and containment response, proceeds in an orderly way to account for public risk. The proposed rule omits some of this orderly process.

6. Concerning the question of calculating EAB and LPZ boundary doses during the "first" vs. the "worst" two-hour period, the CRGR observed that there are artificial assumptions involved in both approaches. Examples discussed were: (a) the selection of a two-hour period instead of one-hour or three-hour period; (b) choice of the two-hour exposure period

itself (e.g., from six hours through eight hours following onset of fission product release rather, than cumulative exposure over the entire eight-hour period); and (c) the assumption that a hypothetical individual would remain in the cloud path and not evacuate.

7. Concerning the question of calculating EAB and LPZ boundary doses during the Committee commented on the arbitrarily chosen two-hour (first vs. worst) period, rather than cumulative exposure over the entire exposure period, and the assumption that a hypothetical individual would remain in the cloud path and not evacuate. Inasmuch as both approaches are based on similar and somewhat arbitrary assumptions, the CRGR did not take a position in favor of either two-hour time periods. The Committee noted, however, that the use of the "worst two hours" (and to a lesser degree, even the use of the "first two hours") could in some cases affect the ESF design requirements (i.e., containment sprays) and, therefore, would couple siting to design.

8. The role of emergency planning and response in terms of dose saving to individuals at the outer boundary of the EAB or LPZ is not acknowledged, which would no doubt result in lower doses in practice.

9. Ground shine was not taken into account as a significant, or even dominant, dose contributor.

10. The disagreement between NRR and RES staff concerning the "first two hour" vs. the "worst two hour" still remains unresolved.

BACKFIT CONSIDERATIONS

Revisions apply only to future plants, therefore, are not a backfit for the currently operating plants. The staff affirmed that the operating plants when applying for license renewal and license amendments will not be subjected to this rule change.