ISSUE DATE: June 1, 1982

MEETING MINUTES ON ACRS SUBCOMMITTEE

ON EXTREME EXTERNAL PHENOMENA

APRIL 30, 1982

The ACRS Subcommittee on Extreme External Phenomena met on April 30, 1982 at 1717-H Street, N.W. Washington, D.C. The purpose of this meeting was to consider and discuss hydrometereorological data and methods which may be useful in estimating the probabilities of extreme flood conditions, that is, conditions approaching or beyond the design basis for U.S. Nuclear Power Plants. The Subcommittee was particular interested in hearing from knowledgeable parties as to: (1) the nature and magnitude of the uncertainties and probability estimates, (2) global or regional weather changes which could conceibably occur within the expected plant lifetimes, (3) the state-of-the-art understanding of the parameters which significantly influence and produce extreme rainfall, storms, and flooding, and (4) prospects for and current efforts for fruitful research in understanding flood-probability estimation.

The Subcommittee heard presentations from persons associated from NRC/NRR, NRC/RES, U.S. Bureau of Reclamation, IBM, and NOAA.

The meeting was attended by the following:

Attendees

D. Okrent, Subcommittee Chairman
C. Siess, ACRS Member
W. Baldewicz, ACRS Fellow
R. Savio, ACRS Staff*

*Dr. R. Savio, Federal Designated Employee for this meeting.

A copy of the notice for this meeting is included as Attachment A. A list of Attendees is included as Attachment B. The schedule for this meeting is included as Attachment C, and the handouts for this meeting are included in the ACRS files. Selected portions of the handouts are included as Attachment D. The meeting was begun at approximately 8:30 a.m. and was adjourned at approximately 4:00 pm. All portions of this meeting was held in open session. No written statements or requests for time to make oral statements were received from members of the public.

Introduction

Dr. Okrent begun the meeting with a short introductory statement in which he summarized the purpose of the Subcommittee meeting. Dr. Okrent indicated that his intent was to allow the maximum amount of opportunity for discussion from the meeting attendees, and encouraged the invited speakers and attending members of the public to participate in the discussions.

NRR/NRC Current Practi-e - G. Lear, NRC/NRR

Mr. Lear summarized the NRC's current regulatory practices. The methods currently used by the NRC staff are determinisitic in nature. There have been attempts to quantitify the recurrence intervals for the design base floods which result from this procedure, but these methods have not been used directly in the licensing process. The present NRC practices allow combined events to be excluded from consideration if it can be shown that the frequency of occurrence is 10^{-7}/year or less.

Mr. Hulman and Mr. Lear of the NRC Staff discussed the development of the NRC licensing procedures for the establishment of a design basis flood as related to river basins and rainfall. The design basis events are developed from postulated events such as dam failure and/or consideration of possible rainfall and runoff conditions with some guidance from observed history. The procedures for developing a design basis rainfall (Maximum Probable Precipitation or PMP) developed by NOAA. Runoff conditions in practiced are assumed to correspond to saturated ground conditions. The NRC review of the SEP plants has uncovered at least one plant (Yankee Rowe) which could not be licensed under the current criteria. As in the case of the Safe Shutdown Earthquake, the NRC Staff does not have specific probabilistic criteria for setting the design basis flood. The design base flood events established by the current NRC procedures have not been exceeded in the time in which they have been in use. Parameters which are used in the calculation of the design base flood (such as maximum rainfall) have been exceeded.

There appears to be significant controversy over the scientific adequacy of the procedures which are being used as to whether or not the results of the procedures are appropriate for the estimation of design basis events. The design basis events which are established by these procedures are being critized for being unduely conservative and for not being conservative enough. Research had been planned which was intended to address this controversy but has been eliminated because of budget cuts. The need for research of this type is addressed in the Long Range Research Plan, but at this time no specific plan or budget proposal exist.

The treatment of the design basis flood is addressed in the current draft of the "Implementation Plan for Safety Goals". This section of the plan is included in Attachment D. This draft states that it is not likely that absolute probabilities for extreme floods will be able to be calculated with any accuracy within the near future, but that additional research might provide the NRC Staff with the means for making relative comparisons of flood occurrence versus other plant challenging events.

The applicable regulations and Regulatory Guides are summarized on page 1 of Attachment D. The specific procedures used by the NRC Staff in developing a design basis flood is summarized on page 2 of Attachment D.

There was some discussion as to how alternate criteria could be developed for reactors which were sited before the implementation of the NRC's for estimating a design basis flood were established. It is noted that there are several operating reactors which are not at a grade level which would keep a design basis flood from entering the plant area. They are designed to prevent an accident when the site is flooded. Quad Cities was the first plant to have to deal with this question. These plants use a combination of procedures and hardware modifications which involve shuting the plant down and placing them in a configuration in which decay heat can be removed even with the site flooded.

Combined Deterministic/Probabilistic Approach by E. L. Peck - Hydex Corporation

Dr. Peck discussed a proposal for estimating the probabilities for extreme flood conditions at nuclear power plant sites. Dr. Peck's proposal is based on the conclusion that the statistical approach based on the analysis of stream

flow records would not provide a reliable record for estimating the probabilities of extreme flood conditions. The method would involve using an approach similar to the deterministic approaches now in use, coupled with occurrence frequencies which could be developed for the individual element of the approach. Combination of the various elements would result in estimates of the occurrence frequency for the design basis event at the uncertainties associated with the estimate. The approach would permit experts in individual diciplines to deal with the individual parameters in the methodology. There was some discussion as to the viability of this approach. Opinions were expressed that one would encounter a wide range of opinions as to the uncertainties associated with the estimation of the various parameters and that the total uncertainity in the procedure would end up being very large.

Comparing PMC to Historic Storms by L. C. Schreiner - Bureau of Reclamation

Mr. Schreiner discussed studies performed by the hydrometrological section of the national weather service which compared rainfall measurements with PMP estimates. The studies provide some perspective on the relationship between the PNP and the maximum observed rainfalls. In the Eastern U.S., of the 675 storms studied, 177 had a range depths (for the areas size and duration considered) that was greater than or equal to 50% of the PMP. Storms which deposit a very heavy rainfall over small areas has been observed in the record. Most notable among these, was the Smethport, Pennsylvania storm of July 17-18, 1942 of which an observed 30.8 inches of rainfall fell in 4 1/2 hours. This is a world record rainfall for a duration of this length. The comparison of observed rainfalls

with regional PMP is reasonably consistent indicating that the method for PMP estimating the PMP is consistent for the various areas in the United States.

Implications for PRA by B. Buchbinder - NRR/RES

Mr. Buchbinder described the flood risk assessment methodology work already performed or planned by the NRC Staff. The FLOE, code which uses Baysian flood estimation techniques was developed to predict flood occurrence probability versus flood levels. This is, to date, the only PRA orientated work which has been sponsored by the NRC to assess flood risk. No flood research was included in the FY82 and FY83 budget due to funding limitations. The Long Range Research Plan includes proposals for work orientated towards the risk basis evaluation of flooding. It is proposed that reactor sites be characterized by the types of threat posed by floods or severe storms, and that the risk level inherent in this be compared to other equally credible events. Work would then progress toward the calculation of the conditional probabilities of core melt given the loss of the plant safety functions via flood event. The frequency versus severity relationship for floods/storms scenarios would be examined from this perspective, and methods for incorporating flood risk consideration in IREP like reactor risk assessment are being developed. The Staff and the PRAs that have been done for plants to date have not identified external flooding as a significant contribution for core melt risk. It was noted that flood risk was both a site and plant specific contributor and that other plants might exist in which the flood risk was a significant contributor to core melt.

Flood Probability Estimation-Statistical Approach by J. R. Wallis, IBM

Mr. Wallis indicated that rainfall or flood probability estimates are feasible based on existing data base. The techniques may be limited by the data base to floods with recurrence times of less than 1000 to 10,000 years. Mr. Wallis believes that many of the proposed statistical methods for estimating large flood frequencies which are now in use are incorrect.

Effect of Cyclical Climate Changes by J. Mitchell, NOAA

Mr. Mitchell discussed the effect of climate cyclical changes on design basis floods. The magnitude of these effects appear at this point to be uncertain and in all likelihood would require long times (in excess of existing plant life times) to be significant. The time scale associated with various climatic are summarized on page 3 of Attachment D. Greenhouse (CO_2 layer) effects were discussed to some extent. It appears that detectable effects on the climate would not be seen for decades and significant changes would require hundreds of years.

MEETING ADJOURNED.

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NOTE: Additional meeting details can be obtained from a transcript of this meeting available in the NRC Public Document Room, 1717-H Street, N.W. Washington, D.C., or can be purchased from Alderson Reporting Company, Inc., 400 Virginia Avenue, S.W., Washington, D.C. 20024, (202) 554-2345.

ATTACHMENT A

CFR Part 1245, Subpart 2. NASA will negotiate the final terms and conditions and grant the exclusive license unless, within 60 days of the date of this Notice, the Director of Patent licensing receives written objections to the grant, together with supporting documentations. The Director of Patent Licensing will review all written responses to the Notice and then recommend to the Assistant General Counsel for Patent Matters whether to grant the exclusive license.

DATE: Comments to this notice must be received on or before June 11, 1982.

ADDRESS: National Aeronautics and Space Administration, Code GP-4, Washington, D.C. 20546.

FOR FURTHER INFORMATION CONTACT: Mr. John G. Mannix, (202) 755-3954.

Dated: April 5, 1982.

S. Neil Hosenball,

General Counsel.

[FR Doc. 82-9796 Filed 4-9-82; 8:45 am]

BILLING CODE 7510-01-M

[Notice (82-20)]

Intent To Grant an Option Agreement on an Exclusive Patent License

AGENCY: National Aeronautics and Space Administration.

ACTION: Notice of intent to grant an option agreement on an exclusive patent license.

SUMMARY: NASA hereby gives notice of intent to grant an option agreement to CARRE, Inc., Seneca, South Carolina, on a limited, exclusive, royalty-bearing, revocable license to practice the invention described in U.S. Patent Application No. 119,334 for "Method of Forming Dynamic Membrane on Stainless Steel Support," filed February 7, 1980, by the Administrator of the National Aeronautics and Space Administration on behalf of the United States of America. The proposed option agreement will be for a limited period of time and will contain appropriate terms and conditions to be negotiated in accordance with the NASA Patent Licensing Regulations, 14 CFR Part 1245, Subpart 2. NASA will negotiate the final terms and conditions and grant the option agreement unless, within 60 days of the date of this Notice, the Director of Patent Licensing receives written objections to the grant, together with supporting documentations. The Director of Patent Licensing will review all written responses to the Notice and then recommend to the Assistant General Counsel for Patent Matters whether to grant the option agreement.

DATE: Comments to this notice must be received on or before June 11, 1982.

ADDRESS: National Aeronautics and Space Administration, Code GP-4, Washington, D.C. 20546.

FOR FURTHER INFORMATION CONTACT: Mr. John G. Mannix, (202) 755-3954.

Dated: April 5, 1982.

S. Neil Hosenball,

General Counsel.

[FR Doc. 82-9797 Filed 4-9-82; 8:45 am]

BILLING CODE 7510-01-M

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards, Subcommittee on Extreme External Phenomena; Meeting

The ACRS Subcommittee on Extreme External Phenomena will hold a meeting on April 30, 1982, Room 1046, 1717 H Street, NW, Washington, DC. The Subcommittee will meet with the NRC regulatory staff and experts from outside NRC for presentations and discussions on hydrometeorological aspects of design basis flooding conditions for U.S. nuclear power plants.

In accordance with the procedures outlined in the **Federal Register** on September 30, 1981 (46 FR 47903), oral or written statements may be presented by members of the public, recordings will be permitted only during those portions of the meeting when a transcript is being kept, and questions may be asked only by members of the Subcommittee, its consultants, and Staff. Persons desiring to make oral statements should notify the Designated Federal Employee as far in advance as practicable so that appropriate arrangements can be made to allow the necessary time during the meeting for such statements.

The entire meeting will be open to public attendance.

The agenda for subject meeting shall be as follows:

Friday, April 30, 1982—8:30 a.m. until the conclusion of business

During the initial portion of the meeting, the Subcommittee, along with any of its consultants who may be present, will exchange preliminary views regarding matters to be considered during the balance of the meeting.

The Subcommittee will then hear presentations by and hold discussions with representatives of the NRC Staff, their consultants, and other interested persons regarding this review.

Further information regarding topics to be discussed, whether the meeting has been cancelled or rescheduled, the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefor can be obtained by a prepaid telephone call to the cognizant Designated Federal Employee, Dr. Richard Savio (telephone 202/634-3267) between 8:15 a.m. and 5:00 p.m., EST.

Dated: April 7, 1982.

John C. Hoyle,

Advisory Committee Management Officer.

[FR Doc. 82-9839 Filed 4-9-82; 8:45 am]

BILLING CODE 7590-01-M

Advisory Committee on Reactor Safeguards, Subcommittee on Watts Bar; Meeting

The ACRS Subcommittee on Watts Bar will hold a meeting on April 29 and 30, 1982 at the RAMADA INN WEST, 7821 Kingston Pike, Knoxville, TN. The subcommittee will review the application of Tennessee Valley Authority for an operating license for the Watts Bar Units 1 and 2.

In accordance with the procedures outlined in the **Federal Register** on September 30, 1981 (46 FR 47903), oral or written statements may be presented by members of the public, recordings will be permitted only during those portions of the meeting when a transcript is being kept, and questions may be asked only by members of the Subcommittee, its consultants, and Staff. Persons desiring to make oral statements should notify the Designated Federal Employee as far in advance as practicable so that appropriate arrangements can be made to allow the necessary time during the meeting for such statements.

The entire meeting will be open to public attendance except for those sessions during which the Subcommittee finds it necessary to discuss proprietary and Industrial Security information. One or more closed sessions may be necessary to discuss such information. (SUNSHINE ACT EXEMPTION 4). To the extent practicable, these closed sessions will be held so as to minimize inconvenience to members of the public in attendance.

The agenda for subject meeting shall be as follows:

Thursday, April 29, 1982—1:00 p.m. until the conclusion of business

Friday, April 30, 1982—8:30 a.m. until the conclusion of business

During the initial portion of the meeting, the Subcommittee, along with any of its consultants who may be present, will exchange preliminary views regarding matters to be considered during the balance of the meeting.

ATTACHMENT - B

TIME 8:15 am MEETING ROOM 1046

DATE April 30, 1982

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

MEETING

Extreme External Phenomena

ATTENDEES PLEASE SIGN BELOW

	(PLEASE PRINT) NAME	BADGE NO.	AFFILIATION
1	William S. Toivins	E0154	FEMA
2	Gareth W. Parry	E 0181	NUS Corp.
3	Leon Jensen	E0146	USER
4	Don Thomas	E0217	USGS
5	[illegible]	E0196	IBM
6	[illegible]	EA41.3	[illegible]
7	[illegible]	E0185	[illegible]
8	~~Don Quigley~~	E0185	~~NUS Corp~~
9	J. Murray Mitchell	E-0185	NOAA.
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..ME 8:15 am MEETING ROOM 1046

DATE April 30, 1982

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

MEETING

Extreme External Phenomena

ATTENDEES PLEASE SIGN BELOW

	(PLEASE PRINT) NAME	BADGE NO.	AFFILIATION
1	[illegible]	E-[illegible]	[illegible]
2	E. M. HANSEN	E-0138	National Weather Service
3	J. F. Miller	E-0223	" " "
4	[illegible]	E-0231	[illegible]
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TIME 8:15 am MEETING ROOM 1046

DATE April 30, 1982

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

MEETING

Extreme External Phenomena

ATTENDEES PLEASE SIGN BELOW

	(PLEASE PRINT) NAME	BADGE NO.	AFFILIATION
1	EUGENE L. PECK	E0244	HYDER CORP
2	ARTHUR G. CODWORTH, JR	E0113	U.S. BUREAU OF RECLAMATION
3	LEON C SCHREINER	E0171	" " "
4	Roy G Huffman	E0141	Army Corps Eng
5			
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ATTACHMENT-C

4/23/82

TENTATIVE SCHEDULE FOR
ACRS SUBCOMMITTEE MEETING ON
EXTREME EXTERNAL PHENOMENA
1717 H Street, N.W. - WASHINGTON, D.C.
APRIL 30, 1982 - Room 1046

April 30, 1982

	TOPIC	SPEAKER	TIME Including Discussion and Questions (50/50)
1.	Chairman's Remarks	D. Okrent, ACRS	8:15 - 8:20 am
2.	Some History	L. Hulman, NRC	8:20 - 8:45 pm
3.	NRR/NRC Current Practice	G. Lear, NRR	8:45 - 9:30 am
4.	Combined deterministic-probabilistic approach	E. L. Pick, Hydex Corp.	9:30 - 10:10 am
	***** BREAK *****		10:10 - 10:20 am
5.	Comparing PMP (Probably Maximum Precipitation) to Historical Storms	L. C. Schreiner Bureau of Reclamation	10:20 - 11:00 am
6.	Implications for PRA	B. Buchbinder, RES	11:00 - 11:40 am
	***** LUNCH *****		11:40 - 12:45 pm
7.	Flood-Probability Estimation Statistical Approach	J. R. Wallis, IBM	12:45 - 1:45 pm
8.	Comments on Possibilities of Climate Changes	J. M. Mitchell, NOAA	1:45 - 2:30 pm
	***** BREAK *****		2:30 - 2:40 pm
9.	Discussion & Final Remarks	ACRS, et al	2:40 - 3:45 pm
	Adjourn		3:45 pm

VUGRAPH C

CRITERIA FOR DESIGN BASIS FLOOD

CODE OF FEDERAL REGULATIONS

10 CFR PART 50, APP A - GDC #2

10 CFR PART 100, APP A - IV (c) AND V (c)

NRC - STANDARD REVIEW PLANS, NUREG 0800,
SECTIONS 2.4.1 - 2.4.14

REGULATORY GUIDES:

1.59 - "DESIGN BASIS FLOODS FOR NPP"

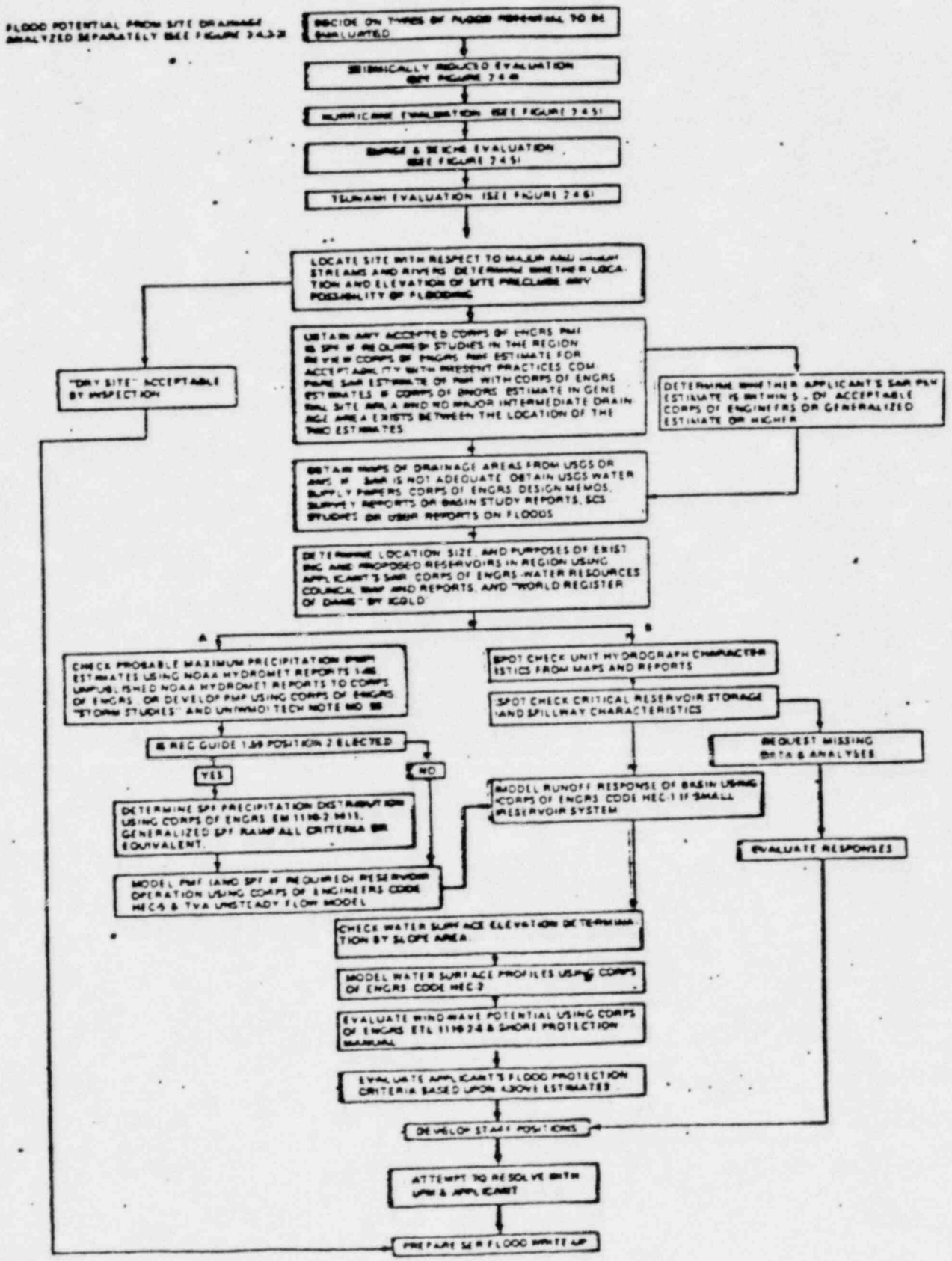
1.102 - "FLOOD PROTECTION FOR NPP"

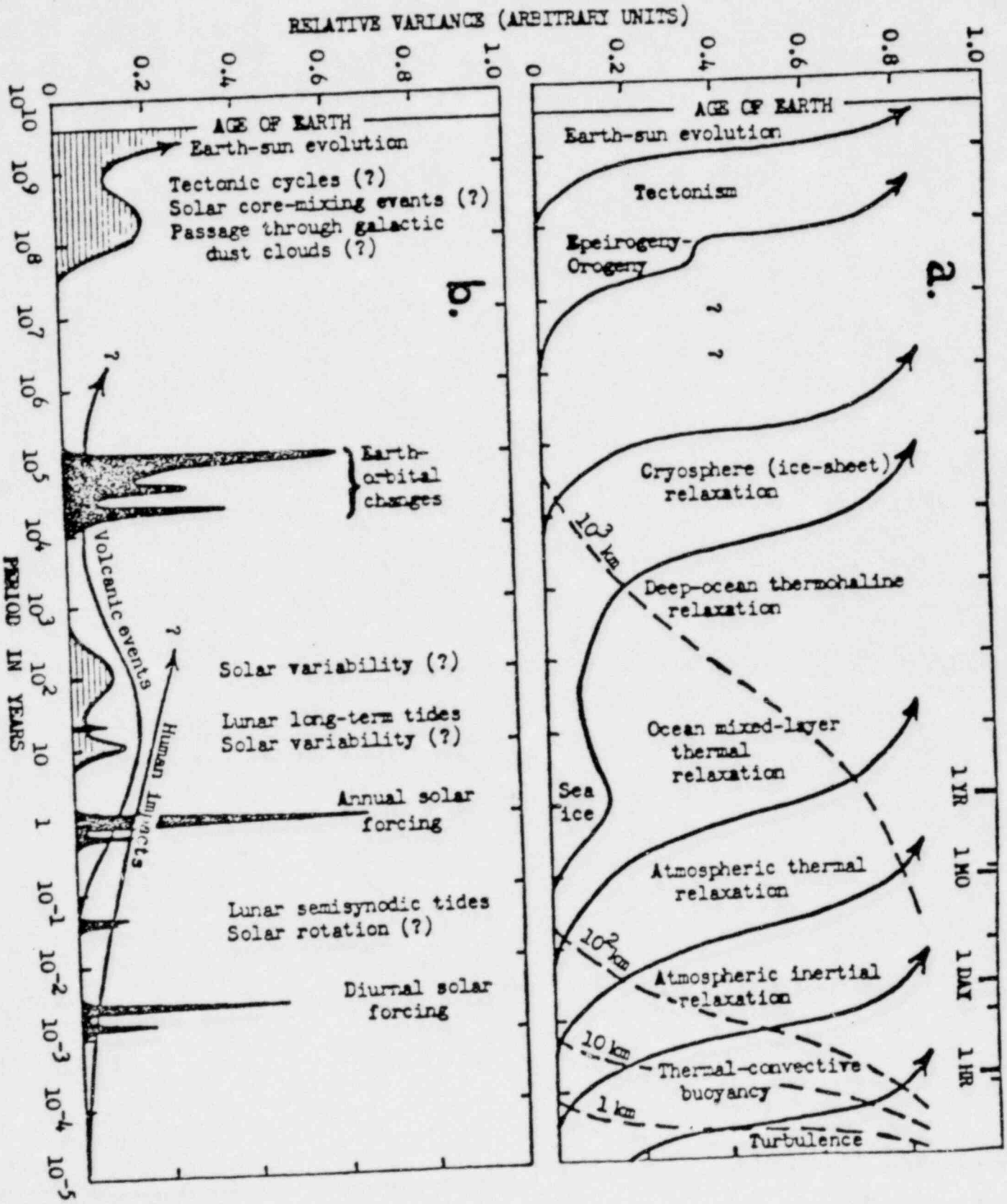
1.29 - "SEISMIC DESIGN CLASSIFICATION"

1.70 - "STANDARD FORMAT AND CONTENTS FOR SAR FOR NPP"

1.125 - "PHYSICAL MODELS FOR DESIGN AND OPERATION OF HYDRAULIC STRUCTURES AND SYSTEMS FOR NPP"

ANSI-N170-1976, "STANDARDS FOR DETERMINING DESIGN BASIS FLOODING AT POWER REACTOR SITES" (USED IN R.G. 1.59).


FLOOD POTENTIAL FROM SITE DRAINAGE ANALYZED SEPARATELY (SEE FIGURE 2.4.3-2)
DECIDE ON TYPES OF FLOOD PHENOMENA TO BE EVALUATED
SEISMICALLY INDUCED EVALUATION (SEE FIGURE 2.4.4)
HURRICANE EVALUATION (SEE FIGURE 2.4.5)
SURGE & SEICHE EVALUATION (SEE FIGURE 2.4.5)
TSUNAMI EVALUATION (SEE FIGURE 2.4.6)
LOCATE SITE WITH RESPECT TO MAJOR AND MINOR STREAMS AND RIVERS DETERMINE WHETHER LOCATION AND ELEVATION OF SITE PRECLUDE ANY POSSIBILITY OF FLOODING
"DRY SITE" ACCEPTABLE BY INSPECTION
OBTAIN ANY ACCEPTED CORPS OF ENGRS PMF OR SPF IF REQUIRING BY STUDIES IN THE REGION REVIEW CORPS OF ENGRS PMF ESTIMATE FOR ACCEPTABILITY WITH PRESENT PRACTICES COMPARE SMR ESTIMATE OF PMF WITH CORPS OF ENGRS ESTIMATES IF CORPS OF ENGRS ESTIMATE IN GENERAL SITE AREA AND NO MAJOR INTERMEDIATE DRAINAGE AREA EXISTS BETWEEN THE LOCATION OF THE TWO ESTIMATES
DETERMINE WHETHER APPLICANT'S SMR PMF ESTIMATE IS WITHIN 5% OF ACCEPTABLE CORPS OF ENGINEERS OR GENERALIZED ESTIMATE OR HIGHER
OBTAIN MAPS OF DRAINAGE AREAS FROM USGS OR OTHERS IF SMR IS NOT ADEQUATE OBTAIN USGS WATER SUPPLY PAPERS CORPS OF ENGRS DESIGN MEMOS, SURVEY REPORTS OR BASIN STUDY REPORTS, SCS STUDIES OR OTHER REPORTS ON FLOODS
DETERMINE LOCATION SIZE AND PURPOSES OF EXISTING AND PROPOSED RESERVOIRS IN REGION USING APPLICANT'S SMR CORPS OF ENGRS WATER RESOURCES COUNCIL MAP AND REPORTS AND "WORLD REGISTER OF DAMS" BY ICOLD
A
B
CHECK PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATES USING NOAA HYDROMET REPORTS 1-48, UNPUBLISHED NOAA HYDROMET REPORTS TO CORPS OF ENGRS OR DEVELOP PMP USING CORPS OF ENGRS "STORM STUDIES" AND UNITED HYDRO TECH NOTE NO 55
SPOT CHECK UNIT HYDROGRAPH CHARACTERISTICS FROM MAPS AND REPORTS
SPOT CHECK CRITICAL RESERVOIR STORAGE AND SPILLWAY CHARACTERISTICS
REQUEST MISSING DATA & ANALYSES
R REG GUIDE 1.59 POSITION 2 ELECTED
YES
NO
DETERMINE SPF PRECIPITATION DISTRIBUTION USING CORPS OF ENGRS EM 1110-2-1411, GENERALIZED SPF RAINFALL CRITERIA OR EQUIVALENT.
MODEL RUNOFF RESPONSE OF BASIN USING CORPS OF ENGRS CODE HEC-1 IF SMALL RESERVOIR SYSTEM
MODEL PMF (AND SPF IF REQUIRED) RESERVOIR OPERATION USING CORPS OF ENGINEERS CODE HEC-5 & TVA UNSTEADY FLOW MODEL
EVALUATE RESPONSES
CHECK WATER SURFACE ELEVATION DETERMINATION BY SLOPE AREA
MODEL WATER SURFACE PROFILES USING CORPS OF ENGRS CODE HEC-2
EVALUATE WIND-WAVE POTENTIAL USING CORPS OF ENGRS ETL 1110-2-8 & SHORE PROTECTION MANUAL
EVALUATE APPLICANT'S FLOOD PROTECTION CRITERIA BASED UPON ABOVE ESTIMATES
DEVELOP STAFF POSITIONS
ATTEMPT TO RESOLVE WITH APPLICANT
PREPARE SER FLOOD PROTECTION


RELATIVE VARIANCE (ARBITRARY UNITS)
0
0.2
0.4
0.6
0.8
1.0
AGE OF EARTH
Earth-sun evolution
Tectonic cycles (?)
Solar core-mixing events (?)
Passage through galactic dust clouds (?)
b.
Earth-orbital changes
Volcanic events
Human impacts
Solar variability (?)
Lunar long-term tides
Solar variability (?)
Annual solar forcing
Lunar semisynodic tides
Solar rotation (?)
Diurnal solar forcing
PERIOD IN YEARS
10^{10}
10^{9}
10^{8}
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
AGE OF EARTH
Earth-sun evolution
Tectonism
Epeirogeny-Orogeny
a.
Cryosphere (ice-sheet) relaxation
10^{3} km
Deep-ocean thermohaline relaxation
Ocean mixed-layer thermal relaxation
Sea ice
Atmospheric thermal relaxation
10^{2} km
Atmospheric inertial relaxation
10 km
Thermal-convective buoyancy
1 km
Turbulence
1YR
1MO
1DAY
1HR