

November 28, 1972

H. S. Isbin

GE BWR/6 MARK III CONTAINMENT

Attached for your information is a copy of a statement prepared by GE after receiving the Staff evaluation of the Mark III Containment concept.

Original Signed by  
J. C. McKinley

J. C. McKinley  
Staff Assistant

Attachment:

4 pages - Article entitled "AEC  
Evaluates Mark III Containment"  
undated

cc: ACRS Members

Filed: 1) GE-BWR/6 ✓  
2) RD 14-2

OFFICE ▶	ACRS				
SURNAME ▶	JCM:bjw				
DATE ▶	11/28/72				

Form AEC-318 (Rev. 9-55) AECM 0240 GPO c48-16-81465-1

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PDR FOIA  
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## AEC EVALUATES MARK III CONTAINMENT

The AEC last week issued its staff safety review of the General Electric Topical Report NEDO-10571 entitled "General Electric Boiling Water Reactor Mark III Containment Concept," thus bringing the GE generic licensing activity on the new product line offering BWR 6 and Mark III to another important level of accomplishment. The Mark III Containment review now proceeds to ACRS for their consideration.

While the AEC has some current concerns with Mark III about which they will desire further information, this recently received staff safety review states, "Although the conceptual nature of the information on the Mark III Containment presented to the Regulatory Staff at this time leaves many details unsettled, we believe that questions regarding most of these details can be resolved in our review of the first application that incorporates the Mark III Containment." This statement is very encouraging in that it is this conclusion which we were seeking from the Commission at this time based on the preliminary description in NEDO-10571.

With respect to the statement that there are details which remain unsettled, this, of course, is certainly the case since we have only filed our first topical, NEDO-10571, containing the concept level information. It is our plan to file the total required information package in March of 1973. Now that we have received acknowledgment by the AEC that "details can be resolved," we are moving on to a similar "concept level only" review with ACRS.

The main thrust of the GE program of generic review of BWR/6-Mark III, and the central theme in the AEC evaluation is the applicability of safety guides 3 and 7. Safety guide 3 establishes a very conservative fission product release assumption required in current reactor design bases and safety guide 7 establishes a similarly conservative hydrogen assumption for these same reactors. Neither guide, GE feels, takes any account of the degree of conservatism inherent in actual plant design features relating to these assumptions. The BWR/6-Mark III designs were specifically addressed to these AEC safety guide concerns, i.e. core and ECCS design is such that no fuel perforations and therefore no fuel fission product release occurs in the design basis accident and a trivial quantity of hydrogen is calculated. Thus, GE felt that these improvements were so significant that the applicability of the guides was a question that AEC should consider. It was also recognized by GE that the early AEC concept of decoupling (i.e. no dependence) of ECCS requirements and containment requirements was no longer in



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use by AEC since in the PWR ECCS approved model there is reliance upon containment backpressure to improve heat transfer. With the readily apparent very large margins in the BWR/6-Mark III designs, GE felt the AEC should consider if the additional margin obtained from the decoupling concept was still appropriate.

The history of these two safety guides is heavily involved in previous ACRS opinions on the related matters. It is known that ACRS is now reconsidering those early opinions largely because of GE's frequent expression of concern that such continued arbitrary conservatism stifles rather than promotes improvements such as BWR/6-Mark III and, in fact, can lead to designs not in the best interests of safety. Apparently, such consideration has lead ACRS to set up a subcommittee to specifically reevaluate safety guide 7. The AEC Staff evaluation must be read with the above background in mind. It is apparent that the AEC staff also wrestled with these concerns but has elected not to take a position at this time (they will "reconsider the GE comments on safety guides 3 and 7") but merely have applied the existing requirements while leaving room to implement any outcome of their own review or the ACRS review and other ongoing AEC matters such as the ECCS rulemaking hearing.

The AEC Staff discussion acknowledges the advantages of Mark III i.e. reduced requirements for sequential construction, lower design pressure and elimination of cask handling over spent fuel while at the same time reaching no conclusions on the improvements in Mark III in the areas of pipe whip, improved in-service inspection and seismic capability. Information on these latter areas was, of course, only presented in a conceptual manner so it was appropriate for AEC to conclude "that questions regarding most of these details can be resolved in our review of the first application that incorporates the Mark III Containmentment."

Three specific issues which AEC felt were important are identified in their evaluation. These are evaluated below in the context of the background above.

1. AEC believes the provisions of safety guides 3 and 7 as they now stand should apply to the Mark III Containmentment (This is Item 3 in their list). This means the decoupling concept is still to be employed on the BWR even though in other ways (e.g. interaction of containment function and ECCS performance) it is not applied to the PWR. The substantial margins that exist in BWR/6 are (1) zero core perforation is calculated compared to a fission product release equivalent to 100% fuel melting required by safety guide 3 giving a margin of much more than a factor of 100 and (2) 0.02% metal-water hydrogen release is calculated compared to 1% permitted in ECCS criteria (a margin of a factor of 50) or 5% required

by safety guide 7 (a margin of a factor of 250 in containment design). These are not recognized even though they are much larger than in PWR designs where 80% perforations (a margin much less than the BWR) and 0.4% metal-water hydrogen (a margin of a factor of 13 in containment design) is calculated all on the basis of AEC approved calculation techniques. The Mark III design is capable of handling safety guide 3 requirements and more than adequate to accommodate PWR style margin on metal-water hydrogen without any additional features being added. However, to assure timely licensing review of the first applications utilizing Mark III design, GE is developing an added system to accommodate the safety guide 7 requirements. System details will be available by year end.

2. AEC notes that bypass leakage paths from the drywell are not considered in the GE report and that this leakage will be complicated by including provisions for atmosphere recirculation (this is Item 1 in their list). In discussions with the AEC, it was pointed out that Mark III has 20 times the bypass leakage capability of previous GE pressure suppression containments. The complication caused by atmospheric recirculation is indeed true, however, recirculation provisions are one and probably the most likely of the several possible solutions that would be used to accommodate the safety guide 7 requirements. This is precisely an example of the type of concern GE has raised in the past about arbitrary requirements dictating design features not in the best interests of safety. In the course of developing our design of a system to accommodate safety guide 7 as noted in 1 above, we will, of course, be paying close attention to attendant bypass leakage problems.
3. The AEC states that they will require further model tests of the pressure suppression capability of the Mark III containment concept. This is not surprising to us. The AEC notes that "no further tests are proposed by GE until they have received the results of our current review." The AEC was, in fact, informed that reduced scale testing was continuing. In addition, full-scale testing of the Mark III horizontal vent design has been an integral part of the continuing GE program and philosophy of systematic testing of improved designs. The details of this Mark III testing will be presented to the AEC in the course of their review of the first application utilizing the Mark III design.

GE will continue to work closely with the AEC Regulatory Staff and the ACRS to obtain reconsideration of the need to apply the current safety guide 3 and 7 requirements to the Mark III Containment. In

the meantime, action is being taken to assure that no BWR/6-Mark III project schedule will be adversely affected by this interim AEC action.

1.1.4.2 Review of G.E. MK-III Containment

Dr. Isbin informed the Committee that although the General Electric Company had requested disassociation of the Subcommittee review of the MK-III containment from considerations involving Safety Guides 3 and 7, it was the position of the Subcommittee Chairman that a meaningful review could only be conducted within the context of those Guides. In response to his request for guidance on this issue, the Committee concluded that the review of the MK-III containment should be made in the context of the requirements of Safety Guides 3 and 7.

[Note: Some of the Members (principally Mr. Etherington and Dr. Stratton) expressed the opinion that controversial matters related to the Safety Guides (particularly Safety Guide 7) should be resolved independently of and preferably prior to the MK-III review and that the General Electric Subcommittee should not function in the area of responsibility of the Safety Guide 7 Ad Hoc Working Group.]

# MARK III

## I. PURPOSE OF MEETING

A. FACILITATE ISSUE OF  
ACRS LETTER ON MARK III

B. CONCEPT ONLY  
NOT DETAIL DESIGN

C. INDUSTRY CONCERNS  
• CAN MARK III BE LICENSED?  
• SAFETY IMPROVEMENTS INVITED?

CONCLUSION:

ACRS GUIDANCE NEEDED

12/21/73

ACRS DOCUMENT - RETURN TO THE LIFE  
OF THE COMMITTEE - RETURN TO THE LIFE  
DATE

## II. HISTORY

### A. PRESSURE SUPPRESSION - WHY?

- LOWER CONTAINMENT PRESSURE
- RAPID PRESSURE REDUCTION
- F.R. HOLDUP IN DRYWELL
- F.R. RETENTION IN POOL

### B. MARK III VS. MARK II

- LOWER CONTAINMENT PRESSURE
- BETTER ACCESS FOR:
  - CONSTRUCTION
  - INSPECTION
  - MAINTENANCE
- IMPROVED SEISMIC CHARACTER
- PIPE WHIP PROTECTION
- NO INERTING - INSPECTABILITY
- FUEL HANDLING - SAFER
- F.R. HOLDUP ENHANCED

12/1/72

### C. RECENT EVENTS

- STAFF MEETINGS - FEB 1972
- NEDO 15071 - APR 1972
- STAFF MEETINGS - SUMMER 1972
- ACRS MEETINGS - MAR 1972
- STAFF REPORT - NOV 1972
- ACRS LETTER - JAN 1973

12/20/72

### III. CURRENT STATUS

#### A. STAFF CONCERNS

1. S.G. 7 and 3
2. Bypass
3. Test Program

#### B. PRESENT S.G. 7 & 3 SHOULD NOT APPLY TO MARK III

- NO M/W REACTION
- NO F.R. RELEASE

#### C. S.G. 7 & 3 TOO CONSERVATIVE

##### 1. STIFLES DEVELOPMENT

- WHY BETTER EGGS?
- WHY BETTER CONTAINMENT?

##### 2. STAFF LETTER

- CITES CURRENT EGGS UNCERTAIN
- FURTHER REVIEW OPEN

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D. FIRST MARK III APPLICANT

FORCED TO MEET S.G. 7 & 8

- SCHEDULE DELAY INTOLERABLE
- GE BELIEVES STAFF CONCERNS CAN BE RESOLVED

✓ SAFETY GUIDES

✓ BYPASS

✓ TESTING

E. GE POSITION UNCHANGED

- BWR/6 - SAFETY ENHANCED
- MARK III - SAFETY ENHANCED
- S.G. 7 & 8 TOO CONSERVATIVE

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#### IV. ACTION NEEDED

ACAS LETTER ON MARK II

- SCOPES: CONCEPT ONLY

- FINDINGS:

- "APPEARS TO BE IMPROVEMENT"

- "CAN BE ENGINEERED"

- DATE: JANUARY 1973

12/21/72

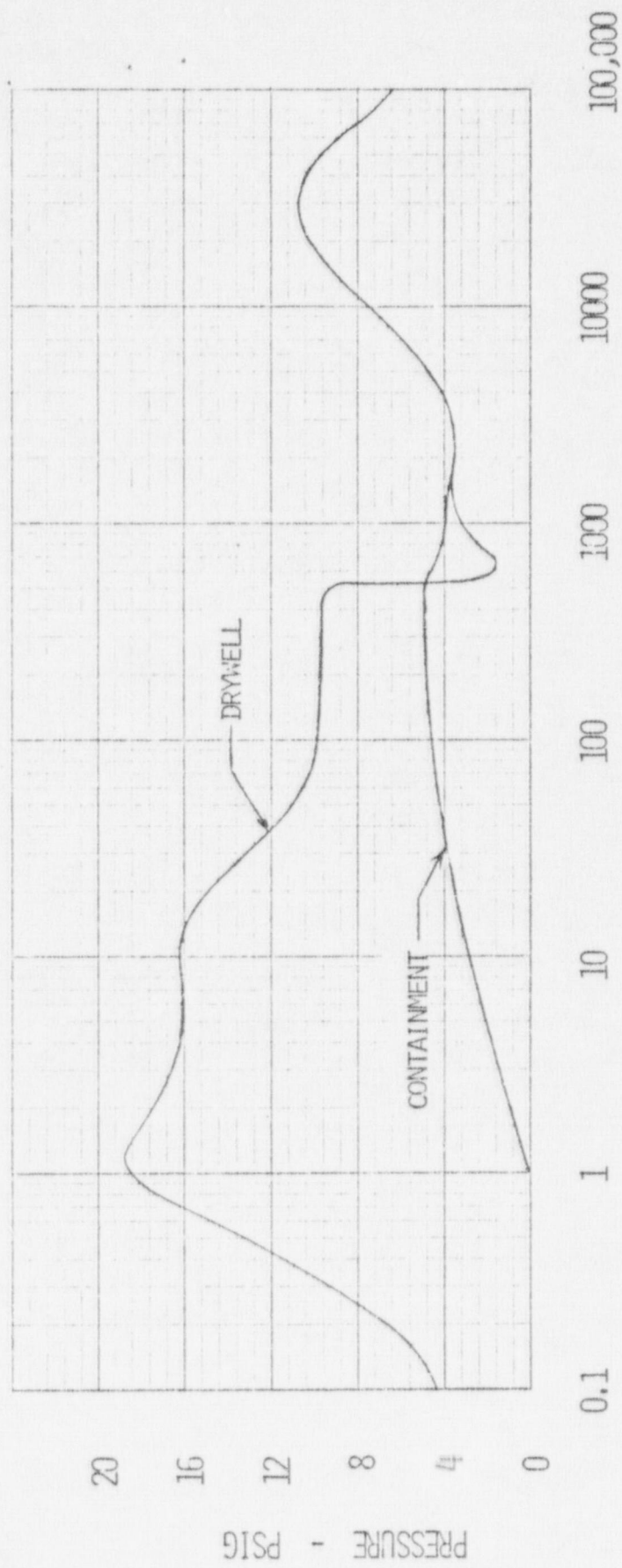
~~ATTACH. #1~~ 173  
EMBLEY'S  
SLIDES

## INTRODUCTION

- CONTAINMENT RESPONSE
- OPERATOR ACCIDENT EVALUATION
- BYPASS LEAKAGE
- TESTING
- SAFETY GUIDE 7 REQUIREMENTS

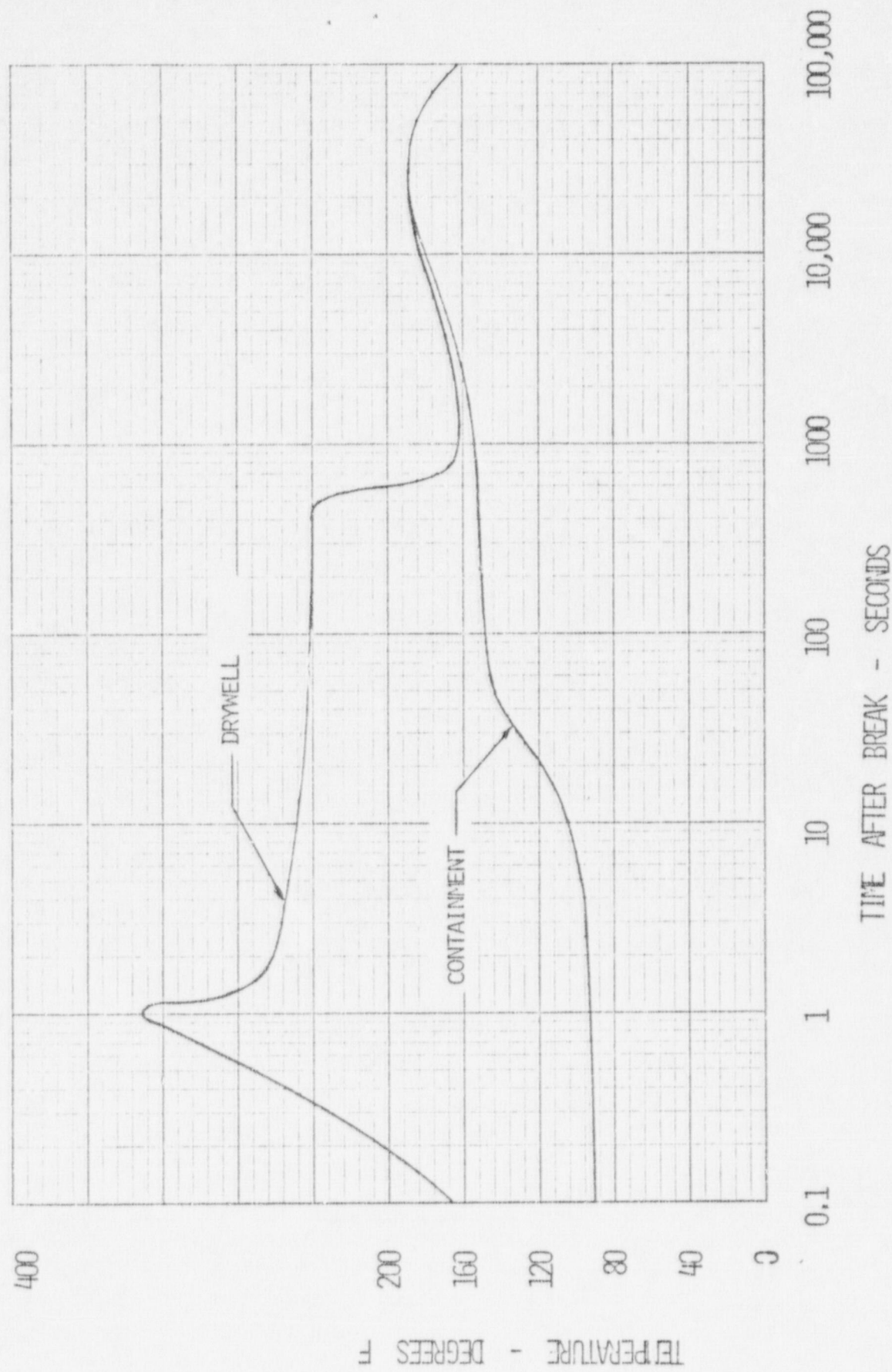
TYPICAL PRESSURE RESPONSE OF A  
MARK III CONTAINMENT AND DRYWELL

STEAM LINE BREAK  
238 INCH REACTOR PRESSURE VESSEL



TIME AFTER BREAK - SECONDS

TYPICAL TEMPERATURE RESPONSE OF A  
MARK III CONTAINMENT AND DRYWELL  
STEAM LINE BREAK  
238 INCH REACTOR PRESSURE VESSEL



POST LOCA MONITORING INSTRUMENTATION  
MARK III CONTAINMENT

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- CONTROL ROD INDICATION
- NEUTRON MONITORING INSTRUMENTATION
- REACTOR WATER LEVEL
- REACTOR PRESSURE
- E C C S OPERATION - FLOW AND PRESSURE
- ISOLATION VALVE STATUS
- DRYWELL PRESSURE AND TEMPERATURE
- CONTAINMENT PRESSURE AND TEMPERATURE
- SUPPRESSION POOL WATER LEVEL
- DRYWELL HYDROGEN AND RADIATION MONITORING
- CONTAINMENT HYDROGEN AND RADIATION MONITORING

# HORIZONTAL VENT TESTING

## 4 INCH DIAMETER VENTS

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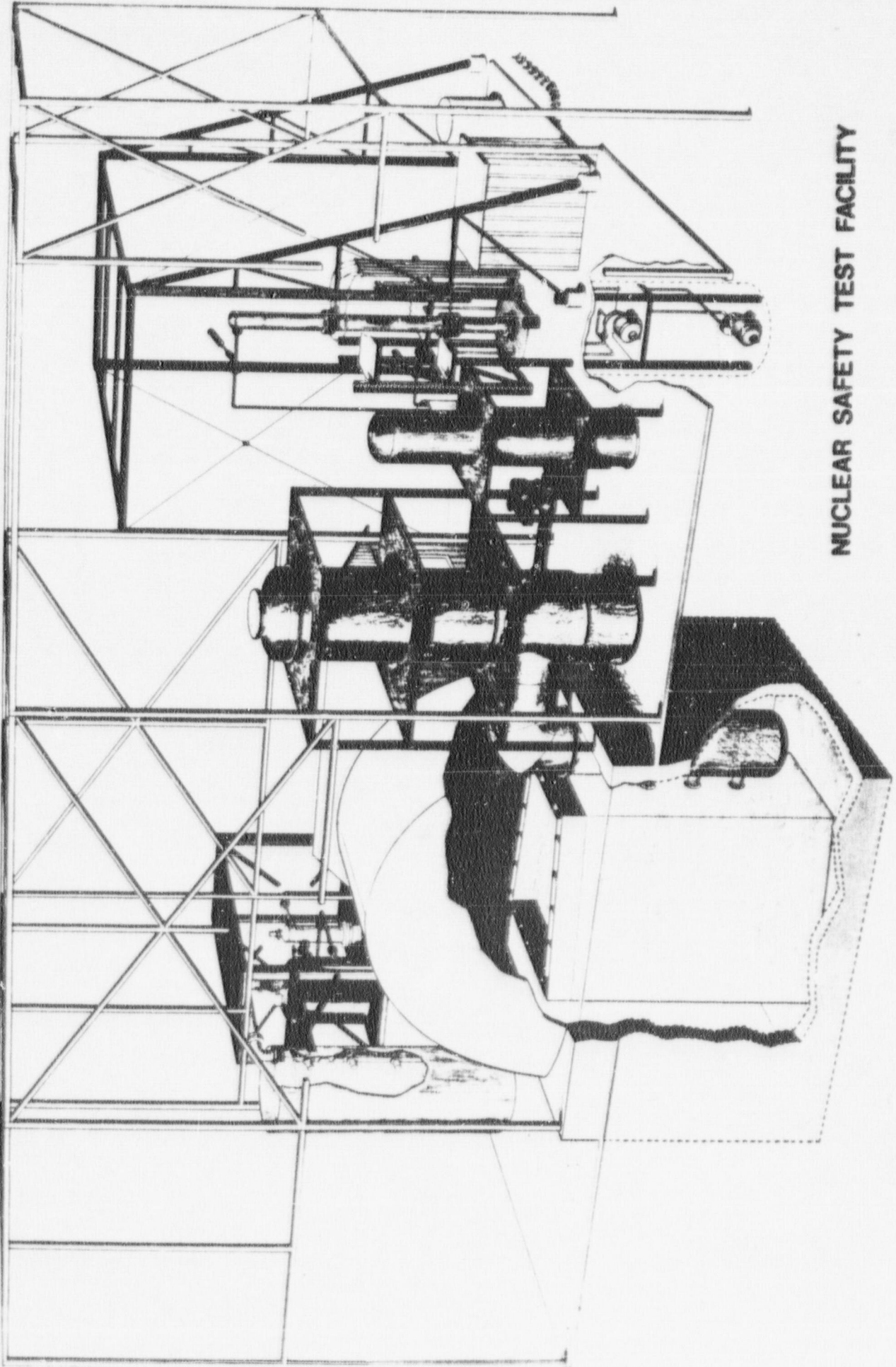
### CONCLUSIONS

1. STEAM COMPLETELY CONDENSED FOR SUBMERGENCE  
18 INCHES TO 13.5 FEET
2. GOOD POOL MIXING
3. PEAK DIFFERENTIAL PRESSURE OCCURS AS VENTS  
ARE CLEARED OF LIQUID
4. ANALYTICAL MODEL PREDICTS DATA

# TESTING OF HORIZONTAL VENT SYSTEM MARK III CONTAINMENT

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- TEST FACILITY NOW UNDER CONSTRUCTION
- TESTING OF TYPICAL SEGMENT OF HORIZONTAL VENT
- SUPPRESSION POOL ELECTRICALLY HEATED TO TEST  
VARIOUS POOL TEMPERATURES
- SCHEDULE PROVIDES FOR TESTING RESULTS BY END  
OF 1973.



NUCLEAR SAFETY TEST FACILITY

## MARK III CONTAINMENT - HYDROGEN

1. SAFETY GUIDE 7 EXTREMELY CONSERVATIVE  
CALLS FOR 5% METAL-WATER REACTION  
NOT TEMPERATURE DEPENDENT  
NOT TIME DEPENDENT
2. MARK III CONTAINMENT  
INERTING NOT POSSIBLE
3. AEC SAFETY EVALUATION: NEED SYSTEM  
GE CONSIDERED MANY SYSTEMS  
ONE SYSTEM APPROPRIATE: MIXING SYSTEM  
METAL-WATER REACTION PERIOD REQUIRED

# VALUES FOR METAL-WATER REACTION

CALCULATED METAL - WATER REACTION

( AEC APPROVED METHOD ) :

0.002%

- GE DATA OF 1967 ( APED 5458 )
- BWR FLECHT 1971 ( GEAP 13190 , 13112 )
- GE TTE TESTS ( TOPICAL REPORT IN PREPARATION )

GE PROPOSED CONSERVATIVE METAL - WATER :

0.02%

- NEDO 11013-77 ( MAY 1972 )

AEC ECCS INTERIM ACCEPTANCE CRITERIA LIMIT :

1%

SAFETY GUIDE 7 METAL - WATER ASSUMPTION :

5%

WHAT IS THE MARK III CONTAINMENT  
METAL - WATER HYDROGEN CAPABILITY ?

# MARK III CONTAINMENT

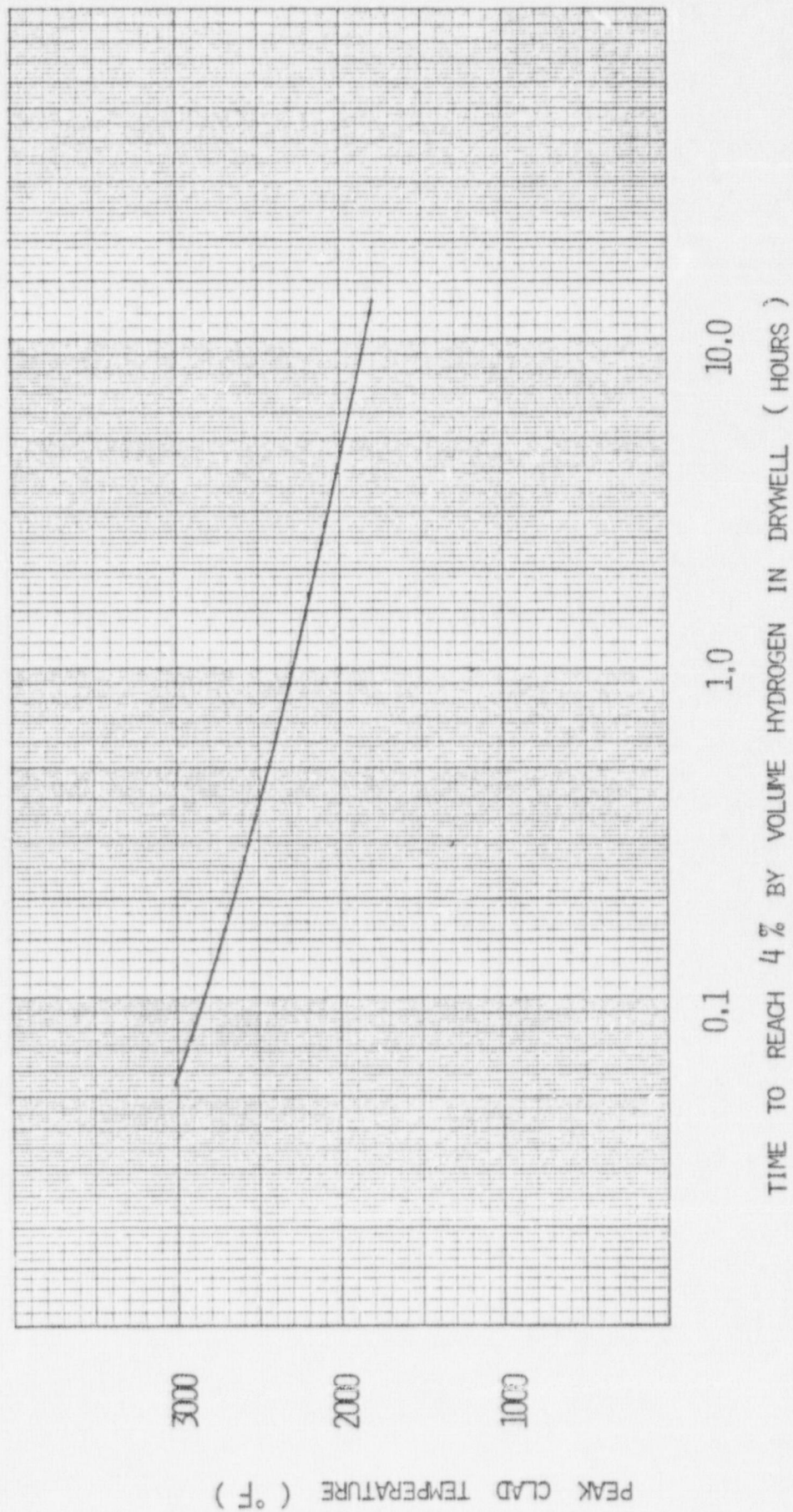
## HYDROGEN CONTROL CAPABILITY

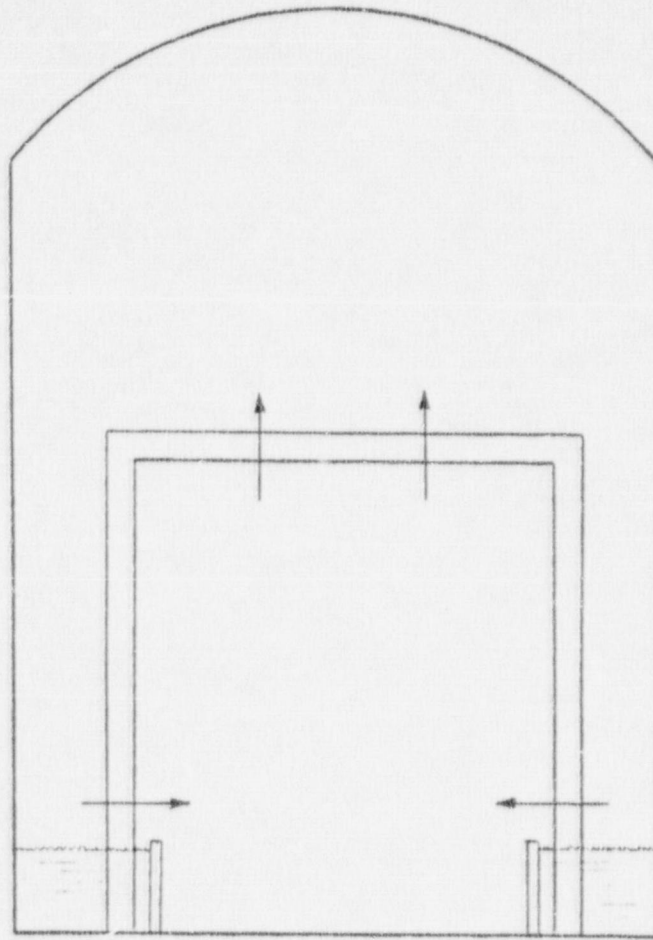
<u>ASSUMED METAL -WATER REACTION</u>	<u>TIME TO REACH FLAMMABLE LIMIT IN DRYWELL</u>	<u>TIME TO REACH FLAMMABLE LIMIT IN CONTAINMENT</u>
5 %	--	4 DAYS
1.7	0	12
1.0	19 HOURS	15
0.5	38	17
0.02	60	19

# TIME REQUIRED TO REACH 4 % BY VOLUME HYDROGEN IN DRYWELL VERSUS PEAK CLADDING TEMPERATURE

CONSERVATIVE TEMPERATURE DISTRIBUTION

( NEDO 11013 - 77 )





#### DRYWELL TO CONTAINMENT MIXING SYSTEM

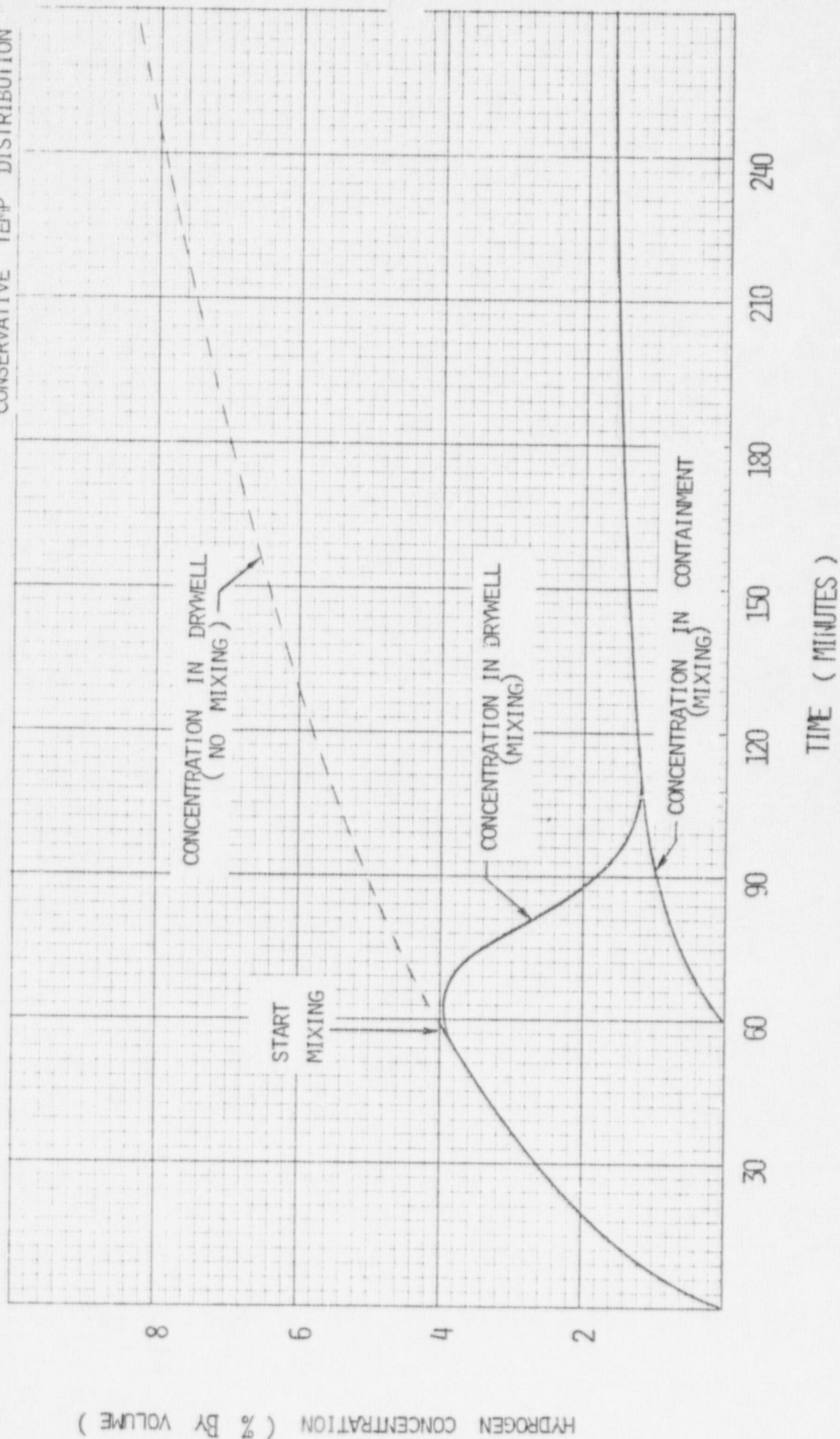
- REDUNDANT BLOWERS
- REDUNDANT VALVES ON EACH VENTILATION DUCT
- SAFETY GRADE DESIGN
- MANUAL INITIATION

#### HYDROGEN CONTROL SYSTEM

- RECOMBINER INSIDE CONTAINMENT
- SAFETY GRADE DESIGN
- MANUAL INITIATION

# HYDROGEN CONCENTRATION AS A FUNCTION OF TIME

Basis : BAKER - JUST RATE EQUATION  
 200°F PEAK CLAD TEMP  
 CONSERVATIVE TEMP DISTRIBUTION



## C O N C L U S I O N S

- SAFETY GUIDE 7 NOT APPLICABLE TO MARK III.
- HOWEVER, SYSTEM PROPOSED WITH HYDROGEN GENERATION PERIOD PROPOSED.
- TESTING FULL SCALE IMPLEMENTED.
- BYPASS LEAKAGE NO PROBLEM ON MARK III.
- MARK III CONTAINMENT OFFERS SUBSTANTIAL SAFETY IMPROVEMENT.

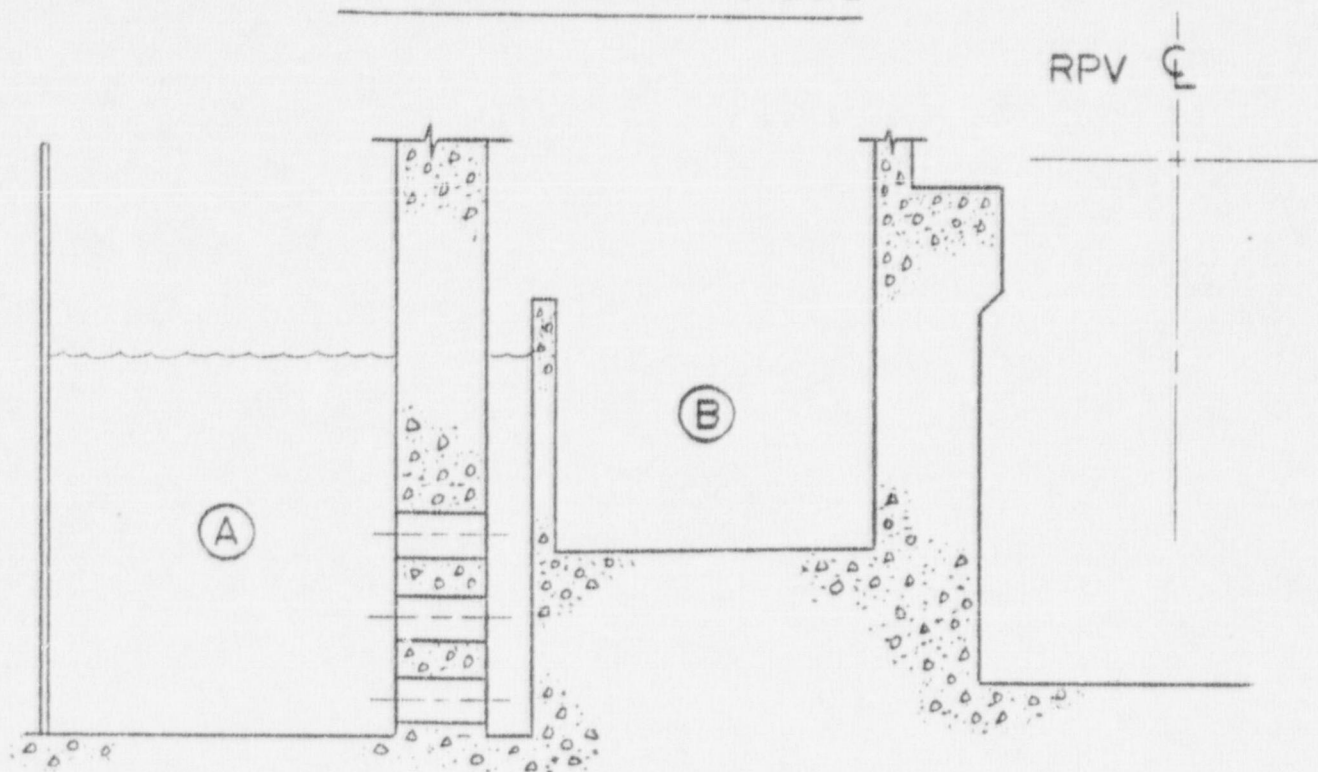
MARK III CONTAINMENT

CHANGES SINCE TOPICAL REPORT

- FULL SCALE HORIZONTAL VENT TEST PROGRAM COMMITTED
- INCREASE IN VENT AREA
- ELIMINATE UPPER POOL DUMP SYSTEM
  - • ADD DRYWELL FILL CONCRETE
  - • ADD WATER TO SUPPRESSION POOL
- RHR "C" & LPCS PUMPS MOVED
- PROVIDE VACUUM RELIEF FOR DRYWELL
- HORIZONTAL FUEL TRANSFER OPTION ADDED

# MARK III CONTAINMENT

## SUPPRESSION POOL



### SUPPRESSION POOL

### DRYWELL

#### NORMAL OPERATION

POOL DEPTH, FT  
VENT SUBMERGENCE, FT  
VOLUME, FT<sup>3</sup>

~ 21'      -0-  
9'-4"      -0-  
~ 136,000 (A)      -0-

#### POST LOCA DRAWDOWN

POOL DEPTH, FT  
VENT SUBMERGENCE, FT  
VOLUME, FT<sup>3</sup>

~ 14'-10"      TOP OF WEIR WALL  
~ 3'-2"      N.A.  
~ 96,000      ~ 40,000 (B)

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TOB

## MARK III CONTAINMENT

### WEIR WALL

- ° DESIGNED FOR RECIRC LOOP IMPACT & JET FORCES
- ° STEEL LINER ON WETTED SIDE  
THUS CRACKED CONCRETE NOT A PROBLEM
- ° POOL VOLUME VS DRYWELL VOLUME SUCH THAT:
  - 1. TOP DOWNCOMER NOT UNCOVERED
  - 2. ADEQUATE NPSH AVAILABLE FOR ECCS PUMPS

MARK III CONTAINMENT  
EQUIPMENT LOCATIONS

DRYWELL

ABOVE WEIR WALL

DISTANCE

RPV  
PENETRATIONS  
COOLING EQUIPMENT  
PIPING & VALVES

BELOW WEIR WALL

DISTANCE

SUMPS & SUMP PUMPS  
RECIRC PUMPS  
RECIRC VALVES & PIPING  
CONTROL ROD DRIVES  
IN-CORES

CONTAINMENT

ABOVE NORMAL POOL LEVEL

DISTANCE

PIPING, ELECT., C&I, ACCESS PENET.  
CRD MODULES  
CRD MASTER CONTROL  
RWCU SYSTEM  
RECIRC FLOW CONTROL MODULE  
STANDBY LIQUID CONTROL SYSTEM  
NON-ESSENTIAL PANELS  
CONTAINMENT COOLING EQUIPMENT  
PIPING & VALVES

BELOW NORMAL POOL LEVEL

DISTANCE

ECCS & RCIC SUCTION LINES & STRAINERS

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MARK III CONTAINMENT  
EQUIPMENT LOCATIONS

AUXILIARY BUILDING

ECCS PUMPS & HEAT EXCHANGERS  
RCIC PUMP & TURBINE  
STEAM TUNNEL  
HVAC EQUIPMENT  
PANELS & RACKS  
PIPING & VALVES

FUEL BUILDING

SPENT FUEL STORAGE  
NEW FUEL STORAGE  
CASK LOADING PIT  
FUEL POOL COOLING & CLEAN-UP SYS.  
STANDBY GAS TREATMENT SYS.  
HVAC EQUIPMENT  
FUEL HANDLING BRIDGE  
CASK HANDLING CRANE  
OVERHEAD BRIDGE CRANE  
FUEL TRANSFER SYSTEM  
CRD PUMPS

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## MARK III CONTAINMENT

### SINGLE BARRIER - DUAL BARRIER

- ° EQUAL REGARDING PRESSURE SUPPRESSION AND PRESSURE CAPABILITY
- ° SINGLE BARRIER MARK III LIKE DRY CONTAINMENT EXCEPT:
  - 1. LOWER PRESSURE
  - 2. F. P. HOLDUP IN DRYWELL
  - 3. F. P. RETENTION IN POOL
- ° COULD CONTROL OFF-SITE DOSES ON SINGLE BARRIER BY:
  - 1. ADD ENCLOSURE BUILDING, OR
  - 2. ADD FILTERS, OR
  - 3. ADD SPRAYS
- ° SELECTION BASED ON:
  - 1. ECONOMICS
  - 2. SITE CONSIDERATIONS
  - 3. LICENSING CONSIDERATION

## MARK III CONTAINMENT

### LEAK RATE TESTING

- MARK III SIMILAR TO DRY CONTAINMENT
- DESIGN BASIS LEAK RATE = 0.1% / DAY
- TECH SPEC LIMIT = ?
- TEST METHOD PER 10 CFR 50, APPENDIX  
J & ANS 7.60
- NO NEW PROBLEMS IDENTIFIED WITH MARK III  
VS. PREVIOUS DESIGNS

## MARK III CONTAINMENT

### VACUUM RELIEF

° DRYWELL & CONTAINMENT VACUUM RELIEF  
WILL BE PROVIDED

° DRYWELL

CHOOSE MOST RESTRICTIVE OF:

1. LIMIT DRYWELL NEGATIVE PRESSURE TO CAPABILITY, OR
2. PREVENT REVERSE POOL FLOW & FLOODING OF DRYWELL

### CONSIDERATIONS:

1. NORMAL HEAT-UP & COOL DOWN CYCLES
2. POST DBA FLOODING OF DRYWELL
3. SMALL LINE BREAKS IN CONTAINMENT
4. SMALL LINE BREAKS IN DRYWELL

## MARK III CONTAINMENT

### VACUUM RELIEF

#### CONTAINMENT

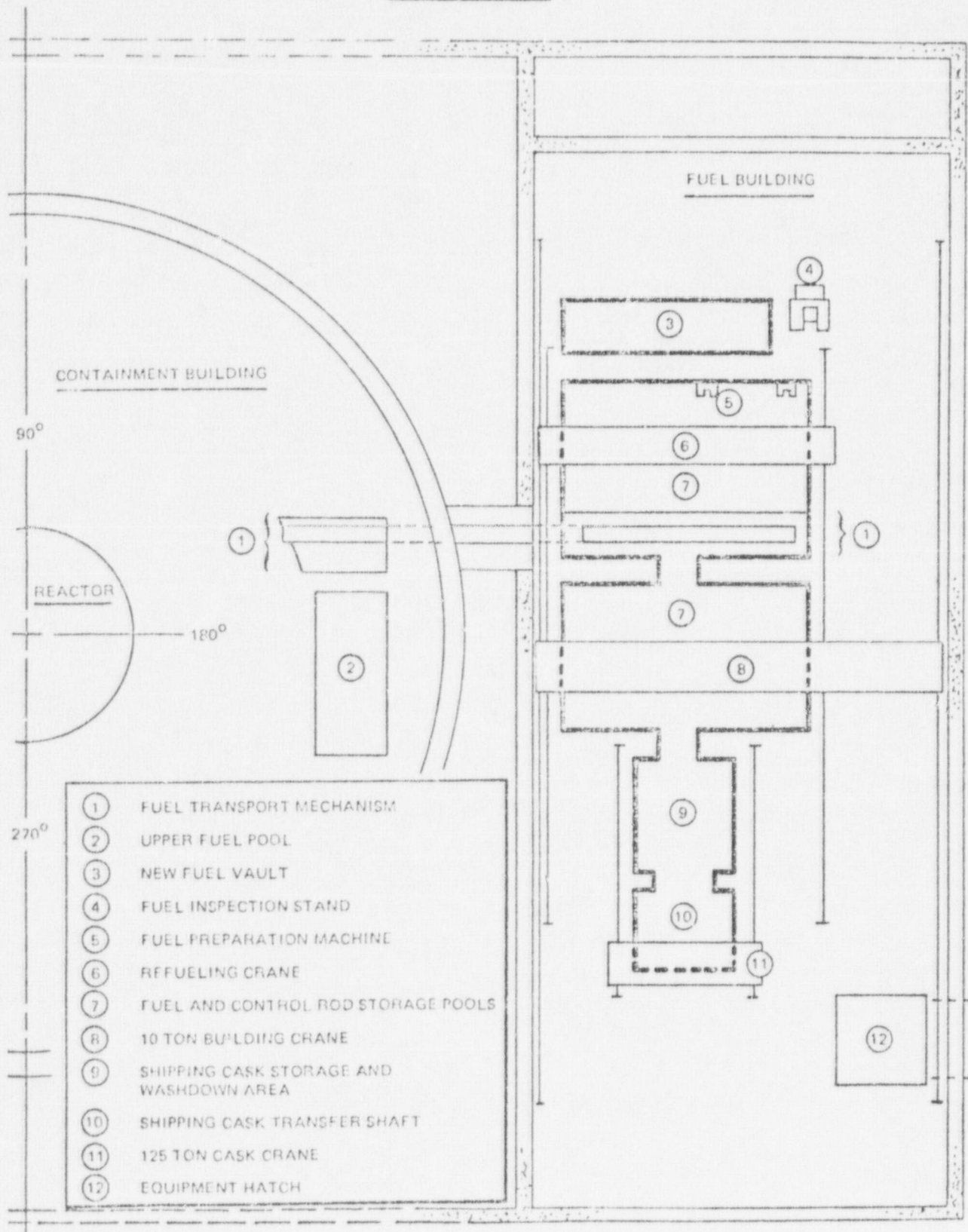
- REQUIRED TO LIMIT EXTERNAL  
PRESSURE ON CONTAINMENT SHELL

- CONSIDERATIONS:

1. CONTAINMENT ISOLATION &  
COOLDOWN.
2. INADVERTED ACTUATION OF  
SPRAYS (IF SPRAYS ARE USED.)

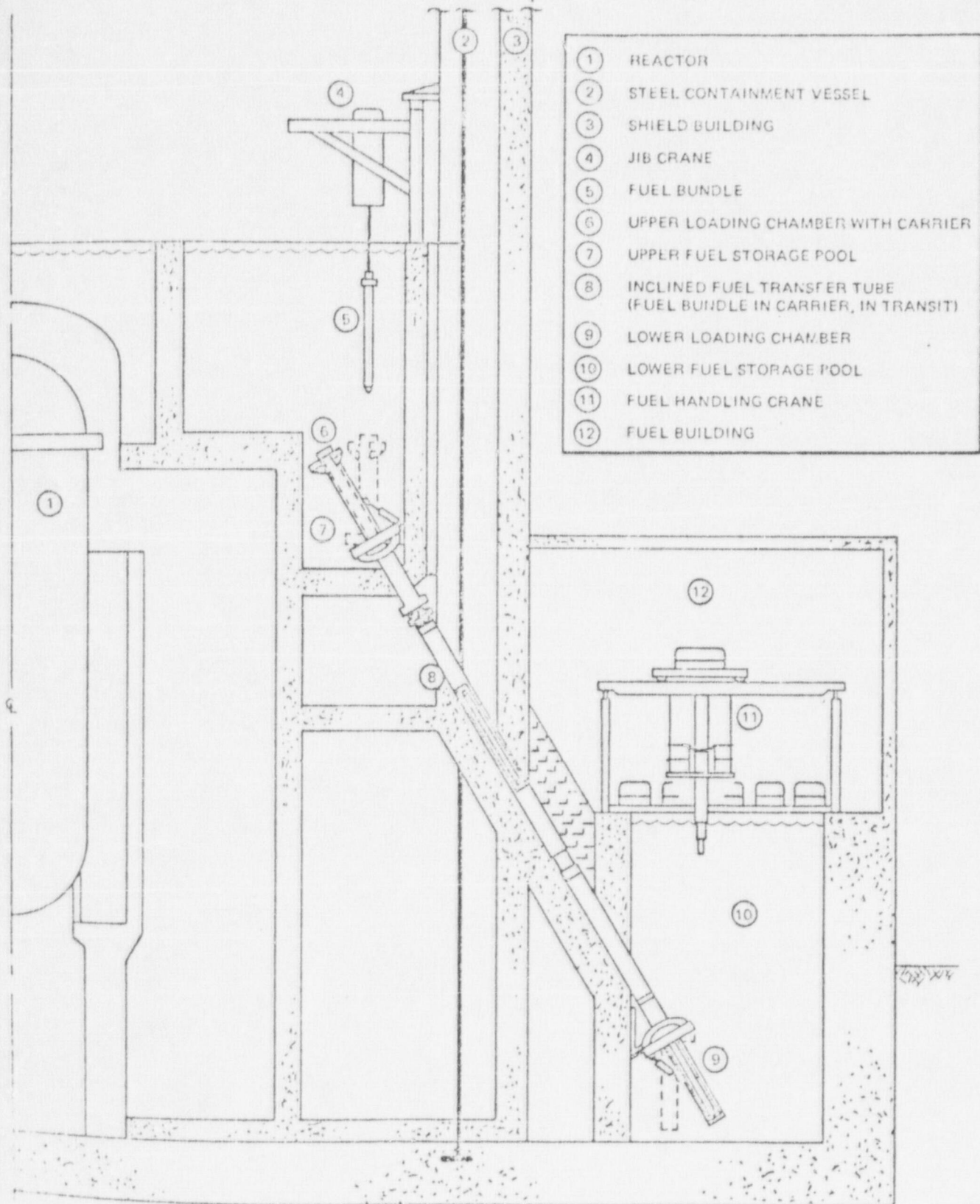
# MARK III CONTAINMENT

## FUEL HANDLING



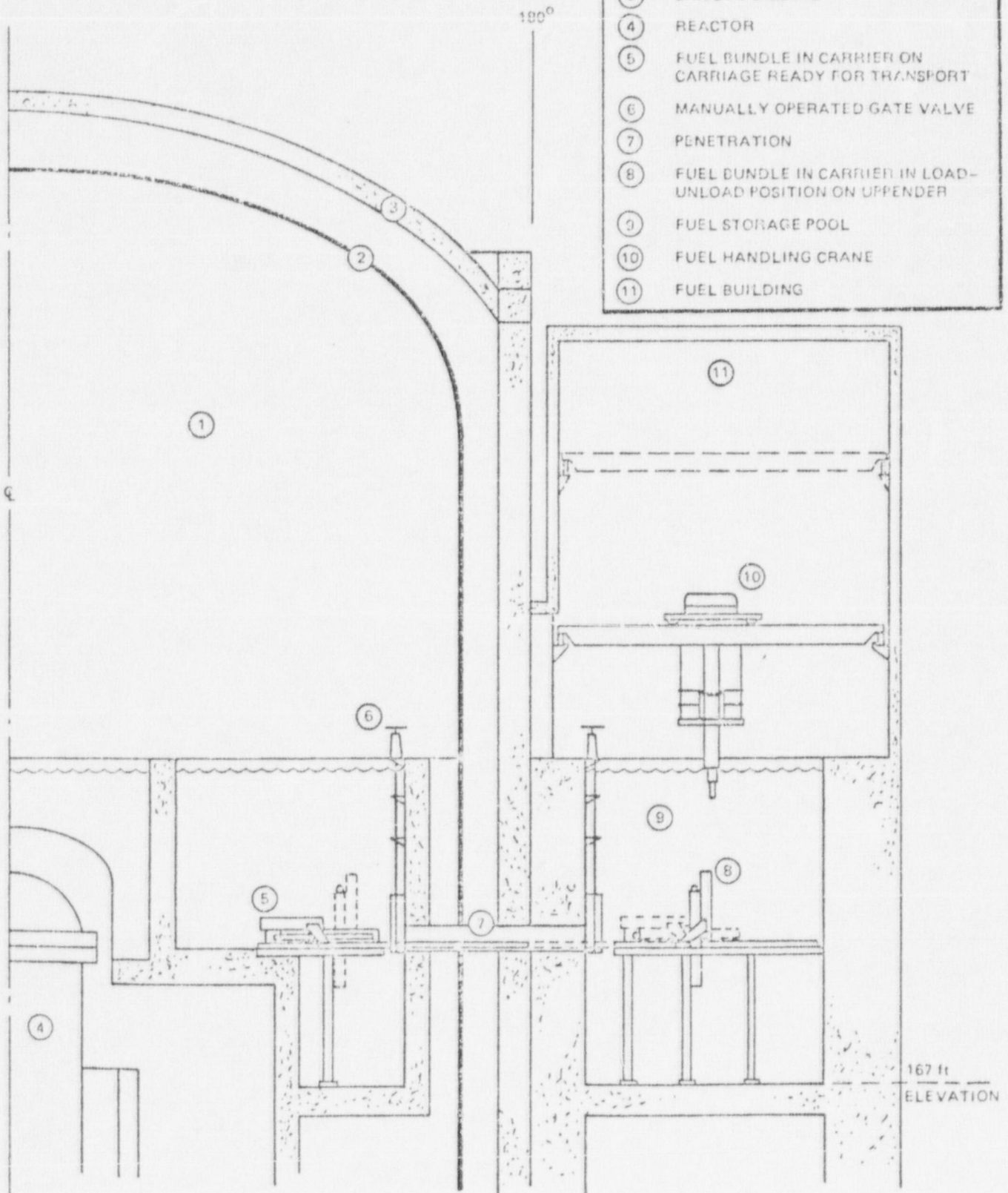
# MARK III CONTAINMENT FUEL HANDLING

180°



# MARK III CONTAINMENT

## FUEL HANDLING



## MARK III CONTAINMENT

### PROTECTION AGAINST PIPE WHIP & MISSILES

- ° WILL MEET PIPE WHIP GUIDE CURRENTLY  
BEING ESTABLISHED BY AEC/INDUSTRY  
RE: BREAK LOCATIONS
- ° LOADS DETERMINED BY DYNAMIC ANALYSIS  
--- REF. FERMI #2
- ° MARK III EASIER THAN PREVIOUS DESIGNS  
DUE TO:
  - °° MARK III LAYED OUT AND ENGINEERED WITH PIPE WHIP  
CONSIDERATIONS OF PRIME INTEREST
  - °° FERMI #2 WORK AS REFERENCE
  - °° F. P. BARRIER DOES NOT "SEE" HIGH PRESS.  
COMPONENTS
  - °° PIPE RUNS SIMPLER IN MARK III
  - °° MORE SPACE TO ROUTE LINE & INSTALL RESTRAINTS

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MARK III CONTAINMENT

REACTOR SHIELD WALL

- SIMILAR TO PREVIOUS DESIGNS
- WILL MEET CURRENT CRITERIA RE:  
PRESSURE DUE TO PIPE RUPTURE
- INCREASE ANNULUS RESULTS IN RE-  
DUCED PRESSURE BUILD-UP.

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MARK III CONTAINMENT

RPV INSPECTIBILITY

- ° WILL MEET ASME IN-SERVICE  
INSPECTION REQUIREMENTS
- ° INCREASE ANNULUS PERMITS  
FULL COMPLIANCE

TOP-  
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## MARK III CONTAINMENT

- INTRODUCTION
- CHANGES SINCE TOPICAL REPORT
- AGENDA ITEMS
  - SUPPRESSION POOL
  - EQUIPMENT LOCATIONS
  - DUAL VS SINGLE BARRIER
  - CONTAINMENT LEAK RATE TESTING
  - VACUUM RELIEF PROVISIONS
  - FUEL HANDLING
  - PIPE WHIP & MISSILES
  - REACTOR SHIELD WALL
  - RPV INSPECTABILITY
- SUMMARY & CONCLUSIONS

# MARK III CONTAINMENT

## SUMMARY & CONCLUSIONS

- MORE MAN YEARS APPLIED TO MARK III THAN PREVIOUS CONCEPTS

BY GENERAL ELECTRIC

BY UTILITIES

BY AE'S

- MARK III CONCEPT HAS BEEN WELL RECEIVED BY UTILITIES & AE'S

- STILL SOME CONCERN ABOUT MARK III LICENSABILITY

•• THE ACRS LETTER IS NEEDED

SPECIFIC PROBLEM AREAS  
IN SAFETY GUIDE 7

- 5 % METAL-WATER TOO HIGH
- METAL-WATER RATE UNSPECIFIED
- INCORRECT TECHNICAL BASIS  
FOR METAL-WATER
  - PENALIZES THICK CLAD
  - IGNORES ECCS, FUEL SURFACE  
AREA, TIME
- RADIOLYSIS RATES TOO HIGH

## WHY REEVALUATION OF SAFETY GUIDE 7 NECESSARY

- NOT IN BEST INTERESTS  
OF SAFETY
  - SOLUTIONS CAUSE  
UNNECESSARY PROBLEMS
    - ROUTINE INSPECTION  
PRECLUDED
    - HAZARDOUS TO PERSONNEL
    - DISCOURAGES SHUTDOWN  
FOR INSPECTION
    - BYPASS PROBLEMS AGGRAVATE
    - CONTAINMENT PRESSURIZE  
• EARLY VENTING RESULTS IN HIGHER DOSE
  - BEST SOLUTIONS TO REAL  
PROBLEM PRECLUDED

## WHY REEVALUATION OF SAFETY GUIDE 7 NECESSARY (CONT)

- NEW INFORMATION AVAILABLE
  - IMPROVED ECCS
  - IAC CRITERIA-HEARING  
CONFIRMS
  - REALISTIC ECCS PERFORMANCE  
QUANTIFIES MARGIN
  - LOW PROBABILITY OF HIGH  
% MW CONFIRMED
  - NEW CONSERVATIVE MW MODE
  - FLECHT PROGRAM
  - CONSERVATISM OF BAKER-JUS  
MW MODEL CONFIRMED  
BY TESTS
  - NEW TESTS ON H<sub>2</sub> BURNING  
AND FLAMMABILITY
- CONCLUSIONS
  - SAFETY GUIDE 7 OUT OF DAT
  - REEVALUATION NECESSARY

NOT IN BEST INTERESTS  
OF SAFETY

- INERTING

- DANGEROUS TO PERSONNEL  
(MOST RECENT FATALITY  
AT TARAPUR)

- ROUTINE INSPECTION  
PRECLUDED

- DISCOURAGES SHUTDOWN  
FOR INSPECTION

∴ POTENTIAL FOR DBA  
INCREASED

NOT IN BEST INTERESTS  
OF SAFETY

• MIXING SYSTEMS

- BYPASS FISSION PRODUCT ABSORBER (SUPPRESSION POOL)
- INCREASED POTENTIAL FOR BYPASS LEAKAGE
- MAY MEAN CORROSIVE SPRAY SOLUTION, AGGRAVATING  $H_2$  PROBLEM

NOT IN BEST INTERESTS  
OF SAFETY

• DILUTION SYSTEMS

- PRESSURIZE CONTAINMENT
- PERSONNEL HAZARD  
*in press Mark II*
- DIFFICULT TO CONTROL  
(MARK III)

NOT IN BEST INTERESTS  
OF SAFETY

- REALISTIC AND SAFE SOLUTIONS PRECLUDED
  - VENTING
  - MIXING SYSTEM WITHOUT BYPASS
  - RECOMBINERS WITHOUT INERTING
  - COUPLE WITH ECCS PERFORMANCE

TE -  
marks  
in 2 place

## NEW INFORMATION AVAILABLE

- NEW TESTS ON  $H_2$  BURNING AND FLAMMABILITY

- REALISTIC GEOMETRY

- REALISTIC CONDITIONS

- OVER 70 TESTS PERFORMED

- NO DETONATIONS OBSERVED

- BURNING AND FLAMMABILITY IMPROVED BY WATER VAPOR

- INITIATION OF BURNING DIFFICULT AT POST-LOCA CONDITIONS

## NEW INFORMATION AVAILABLE

### • FLECHT PROGRAM

- SHOWED HIGHER TEMPERATURES CONTROLLABLE
- SHOWED M-W REACTIONS LESS THAN PREDICTED BY FACTOR OF 2
- ELIMINATED CONCERNS OVER ABILITY TO COOL ZIRCALOY AT HIGH TEMPERATURES

## NEW INFORMATION AVAILABLE

- LOW PROBABILITY OF HIGH % MW CONFIRMED

- PROBABILITY OF NO ECCS  $< 10^{-10}$

- PROBABILITY OF ONLY ONE PUMP  $< 10^{-9}$

(ASME PAPER 72-WA/NE-9)

- NEW CONSERVATIVE METAL-WATER MODEL

- FACTOR OF 5 HIGHER THAN IAC MODEL

- FACTOR OF 10 HIGHER THAN FLECHT INDICATES

- FACTOR OF  $> 1000$  HIGHER THAN MOST PROBABLE

calculate  
n 9 and

## NEW INFORMATION AVAILABLE

- IMPROVED ECCS
    - PCT < 1500°F USING IAC MODELS
    - MW < 0.004% USING IAC MODELS
    - NO FUEL ROD PERFORATION
  - IAC-ECCS HEARING CONFIRMS
    - BWR ECCS MEET IAC
    - CRITERIA VERY CONSERVATIVE
    - UPPER LIMIT ON METAL-WATER OF 1%
  - REALISTIC ECCS PERFORMANCE QUANTIFIES MARGINS
    - MOST PROBABLE PCT < 900°
    - PROBABILITY OF EXCEEDING IAC LIMIT <  $10^{-9}$
- (ASME PAPER 72-WA/HT-48)

# REEVALUATION OF SAFETY GUIDE 7

1. GE MEET WITH ACRS  
SUBCOMMITTEE (12/21/72)
2. ACRS SUBCOMMITTEE  
AREAS NEEDING DOCUMENTATION
3. GE SUBMIT DOCUMENTATION
4. GE MEET WITH ACRS  
SUBCOMMITTEE AGAIN
5. GE MEET WITH FULL ACRS
6. ACRS RECOMMEND  
APPROPRIATE REVISION  
OF SAFETY GUIDE 7

## WHAT CAN BE DONE

- MAKE SAFETY GUIDE 7  
CONSISTENT WITH IAC
- RECOGNIZE ECCS PERFORMANC
  - PROVIDE INCENTIVES  
FOR IMPROVEMENT
  - ESTABLISH STANDARD/  
CONSERVATIVE METHODS-  
GE TOPICAL
- ENCOURAGE REALISTIC  
SOLUTIONS / WITH MARGINS
- IDENTIFY AREAS NEEDING  
DOCUMENTATION

## EXCERPT FROM THE

116th ACRS SUMMARY 12/11-13/69

2. Shoreham Nuclear Power Station Unit 1 - The Committee completed its review of the application by Long Island Lighting Company (LILCO) for authorization to construct the Shoreham Nuclear Power Station Unit 1, a 2436 MWt GE-BWR.

Items discussed during the review included:

- a. \*\* Steam Line Inspection - LILCO stated they had no significantly different position than was stated in the Duane Arnold review.

The DRL Staff and ACRS positions were the same as noted in the Duane Arnold review.

- b. \*\* Main Steam Line Isolation Valve - LILCO stated in Amendment 10 that they recognize the main steam isolation valve leakage valve problem and will work to assure that, at the operating license stage, the valves will either be tight, be made tight, or resolved in some other way.

GE does not believe the radiation source (dose) from a steam line failure would be significantly different for plutonium fuels than for uranium fuels.

\* Item discussed with Shoreham observer present.

\*\* Item discussed with Duane Arnold observer present.

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Summary, 116th ACRS Meeting

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- c. \*Instrument Lines Through Containment - LILCO stated that they will fasten the instrument lines to the concrete wall and under the concrete floors of the reactor building. This will provide a degree of mechanical protection.

The DRL Staff and ACRS positions were the same as noted in the Duane Arnold review.

- d. Flood Protection - LILCO stated that they were reviewing the peak storm surge water level and will protect the plant to the recalculated level.

The DRL Staff believes the review will show a higher flood level to be possible, but it will be below the level for which the plant is presently being designed.

The Committee noted that the applicant agreed to provide flooding protection to a higher level if the calculations show this to be necessary.

- e. Containment Structure Rebar - LILCO agreed to provide for diagonal reinforcing steel until they can demonstrate that such reinforcement is not required.

The Committee decided that the diagonal rebar should be provided unless convincing evidence is presented to show that the rebar is not needed.

- f. Primary Containment Downcomer Pipes - Several questions were asked of Stone & Webster as to the degree of conservatism used in analyzing the blowdown and potential dynamic loads on the drywell vent pipes during a LOCA and as to the conservatism of design in the structural restraints at the bottom end of these pipes. Stone & Webster believes the slip flow model to be conservative even though the homogeneous flow model is more conservative. The applicant expressed his intent to evaluate forces on the drywell vent pipes and to provide conservatively designed structural restraints.

The DRL Staff is basically satisfied that the applicant has conservative design values as determined by their independent calculations.

The Committee's report proposed that the applicant perform additional parametric analyses in a manner satisfactory to the regulatory staff.

- g. Airport Criteria - DRL described the bases for their conclusion that Shoreham does not require any special protective measures against an aircraft crash. The Staff is satisfied that the Shoreham site is not significantly more vulnerable to aircraft crashes, due to the presence of an airport, than would be found at northeastern U. S. sites which are considered to meet the "background" values. They believe the risk to Three Mile Island is worse by a factor of 5 to 10 than it is to Shoreham

\* Item discussed with Duane Arnold observer present.

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116th ACRS SUMMARY 12/11-13/69

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and this is a significant factor.

The Committee concurred in the conclusion that no special protective measures against an aircraft crash are required for the Shoreham Plant.

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Meeting with the Division of Reactor Development and Technology

Request to Revise Ground Rules Regarding RDT Attendees at ACRS Meetings - Mr. Shaw requested the ACRS to permit him to send "high level personnel" to ACRS reviews of commercial LWRs as substitutes for himself and one Assistant Director, RDT. He finds it difficult for himself or his assistant to attend all such meetings, but he would like to obtain the "sense" of the reviews so that he can better interpret what the ACRS means in its reports to the Commission.

Mr. Shaw also requested that the ACRS permit him to have a reasonable number (five) of RDT contractor personnel attend ACRS reviews of advanced reactors, e.g., LMFBF, HTGR.

(He intended the requests, above, to include RDT attendance at Subcommittee meetings.)

Mr. Shaw does not ask at present to be permitted to sit in ACRS Executive or Regulatory Staff sessions unless it is determined acceptable by the ACRS.

Mr. Shaw was asked whether there are better ways to communicate between the ACRS and RDT than by having RDT representatives attend ACRS meetings as observers, e.g., Subcommittee meetings to discuss the most current issues. He was also asked whether he would expect written or oral reports from his Staff members who attended ACRS meetings.

The Committee did not have time to make a decision on Mr. Shaw's requests. (This has tentatively been scheduled for the 117th ACRS meeting in January, 1970.)

Executive Session

Chairman's Report

a. Subpoena of AEC/ACRS Documents on the N. S. SAVANNAH - Dr. Hanauer reported that the AEC has been subpoenaed to provide documents on the N. S. SAVANNAH due to an ensuing lawsuit. Three categories of ACRS documents have been identified: (1) documents already in the public domain; (2) documents originated by others (e.g., DRL) (release is up to the originator); (3) all remaining ACRS documents. The Commission has been asked to request an exemption from subpoena of documents in the last category under provisions of executive privilege.

✓ b. Attendance at ACRS Reviews by Applicants as "Observers" - Dr. Hanauer reported that Shoreham and Duane Arnold wish to have representatives of each attend each others reviews due to the number of common problems. Shoreham also requested a representative of the Power Authority of New York State be permitted to attend their review because Shoreham is similar to the FitzPatrick Station. The Committee decided that observers from Shoreham can attend the Duane Arnold review and vice versa, but only during discussion of items common to Shoreham and Duane Arnold. The Committee's attitude was that observers from the Power Authority of New York State should not be allowed for the Shoreham review.

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