"TMI EVALUATION EFFORT-REVIEW

OF BWR HYDROGEN ACCOMMODATION CAPABILITY"

VU-GRAPHS USED IN THE

GENERAL ELECTRIC PRESENTATION

TO

DR. MATTSON

OCTOBER 12, 1979

795 Enclosure 5

8007160

MEETING PURPOSE

- IMPROVE UNDERSTANDING OF STAFF OBJECTIVES
- IDENTIFY BWR HYDROGEN GENERATION PREVENTION CAPABILITIES
- PROVIDE BWR HYDROGEN ACCOMMODATION EVALUATION RESULTS
- DISCUSS APPROACH TO ESTABLISH HYDROGEN ACCOMMODATION REQUIREMENTS
- GAIN UNDERSTANDING OF NEAR-TERM STAFF ACTIONS

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10/12/79

ENCLOSURE 5

SUMMARY OBSERVATIONS

- LEVEL OF SAFETY = f(PREVENTION, MITIGATION)

- MANY METHODS OF PREVENTION AND MITIGATION INHERENT IN BWR DESIGN

- METAL-WATER REACTION CONSIDERATIONS ...
  - 100% COMPARABLE TO DBA
  - NOT GOOD YARDSTICK
  - NO MITIGATION SYSTEM CAN ACCOMMODATE 100% RAPIDLY RELEASED

- USE PROBABLISTIC/MECHANISTIC APPROACH TO ESTABLISH DESIGN BASIS ...
  - FOCUSES ATTENTION, I.E. LOSS OF FEEDWATER
  - ESTABLISHES A UNIFORM LEVEL OF SAFETY
  - UTILIZES INFORMATION ALREADY REQUESTED

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10/12/79

TMI EVALUATION EFFORT

REVIEW OF BWR HYDROGEN ACCOMMODATION CAPABILITY

GENERAL ELECTRIC COMPANY

OCTOBER 12, 1979
BETHESDA, MD.

INTRODUCTION

- MEETING PURPOSE
- DAY'S AGENDA
- SUMMARY OBSERVATIONS

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REVIEW OF HYDROGEN ACCOMMODATION CAPABILITY
MEETING AGENDA .... OCTOBER 12, 1979

0900 BUCHHOLZ	INTRODUCTION
0915 STAFF	NRC OBJECTIVES
0930 FIDRYCH	HYDROGEN GENERATION EVALUATION RESULTS - BWR SENSITIVITY INFORMATION - BWR ACCOMMODATION METHODS
1000 DUNCAN	BWR HYDROGEN PREVENTION CAPABILITY
1030 ALL	SUMMARY/OPEN DISCUSSION
1100 BUCHHOLZ	MEETING CLOSE

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IMPACT OF LARGER METAL WATER REACTION AND HYDROGEN DESIGN BASIS ON BWR'S

PRELIMINARY ASSESSMENT

- SENSITIVITY INFORMATION
- ACCOMMODATION METHODS
  - INERT
  - BURN
  - RECOMBINERS
  - VENTING
  - OTHERS
- CONCLUSIONS

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MARK III PRESENT BASIS AND CAPABILITY

- DESIGN BASIS PER R.G. 1.7 AND 1.3
  - * MW REACTION ~0.8%
  - * RADIOLYTIC O_2
- CONTAINMENT CAPABILITY - MW REACTION
  - * BASIS - DRY-WELL H_2 SOURCE
    PRESENT 500 SCFM
    DRYWELL TO WETWELL MIXER
  - * SHORT TERM - ~1.2% (MINUTES)
  - * LONGER TERM - ~3 TO 4% IN 24 HOURS
  - * FURTHER INCREASE UP TO ~ 8%
    LIMITED BY MIXING AND HEAT REMOVAL
- RECOMBINER CAPABILITY
  - * 100 SCFM - (AIR - MAX 4% H_2)
  - * RADIOLYTIC O_2 RECOMBINATION
    (EQUIV. TO ~1/30% MWR/HR)

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PRELIMINARY H_2 CAPABILITY EVALUATION

CONTAINMENT PARAMETER	MARK I (DRESDEN 2)	MARK II (HANFORD)	MARK III TVA-STRIDE	TMI PWR DRY CONTAINMENT
DESIGN PRESSURE P_D (PSIG)	62	45	15	55
TOTAL AIR VOLUME (FT^3)	275,000	347,000	1,400,000	2,000,000
DRY-WELL VOLUME (FT^3)	160,000	200,000	275,000	N/A
% H_2 AT 100% MW	72%	67%	33%	17%
MW % TO REACH 4% H_2 (FLAMMABILITY LIMIT)*	1.6	1.6	8	20
H_2 PRESSURE RISE (INERT) FROM 100% ADIABATIC COMPRESSION OF RELEASED H_2*Δ	73 PSI	55 PSI	11 PSI	5 PSI
% MW TO BURN H_2 TO STAY $<P_D$	2%	2%	8%	60%

*REQUIRES UNIFORM MIXING INCLUDING DRY-WELL TO WET-WELL. ΔOTHER MECHANISMS OF PRESSURE RISE (E.G. BLOWDOWN AND DECAY HEAT) NOT INCLUDED.

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(13)

KEY PARAMETERS

	BWR STRIDE	PWR TMI
• ZIRC - CLAD, LBS % TOTAL	90,000 55%	~50,000 ~ 80%
• H^2 (SCF) 100% MW (CLAD)	700,000	400,000
• HEAT, OF REACTION 10^6 BTU ZR - WATER	250	140
• HEAT, OF COMBUSTION 10^6 BTU $H^2 + O^2$	200	110
• LOCAL, BLOWDOWN 10^6 BTU	~400	~400
• DECAY HEAT, INTEGRATED 4 HRS, 10^6 BTU	~700	~700
• SUPPRESSION POOL HEAT CAPACITY (TO 185°F) 10^6 BTU	600	NA
• RHR HEAT REMOVAL CAPABILITY (10^6 BTU/HR)	186	

∴ 100% MWR HEAT LOAD COMPARABLE TO DESIGN BASIS LOCA

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INERTING

CONCEPT

- INERT CONTAINMENT VOLUME TO INHIBIT H_2 COMBUSTION

TECHNICAL ASSESSMENT

- NOT SUFFICIENT FOR 100% MW REACTION
  - * H_2 PRESSURE ALONE CLOSE TO OR ABOVE DESIGN
  - * DESIGN PRESSURE EXCEEDED WHEN OTHER PRESSURE SOURCES INCLUDED, I.E. LOCA BLOWDOWN, DECAY HEAT, EXOTHERMAL REACTION

- ADDITIONAL MIXING SYSTEMS REQUIRED
- LOSS OF AVAILABILITY - PURGING AND MIX TIMES
- LOSS OF ACCESS DURING PLANT OPERATION
  - * WHILE INERTED EMERGENCY ACCESS ONLY WITH SCBA (SAFETY CONCERN)
- PRECLUDED BY EQUIPMENT ACCESS REQUIREMENTS IN MARK III, EXAMPLES
  - * DAILY INSPECTIONS
    - CONTROL ROD DRIVE HYDRAULIC UNITS
    - FLOW CONTROL VALVE HYDRAULIC UNITS
  - * WEEKLY OPERATIONS
    - REACTOR WATER CLEANUP
    - FILTER DEMINERALIZERS LOADING
  - * MONTHLY OPERATIONS
    - STANDBY LIQUID CONTROL SYSTEM TESTS
  - * NON-SCHEDULED REPAIRS
    - SUMP PUMPS
    - ELECTRICAL DISTRIBUTION CABINETS

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EQUIPMENT WITHIN REACTOR BUILDING

EXTERNAL TO DRYWELL MARK III

KEY:	NSSS	BOP	
1.	A	B	EQUIPMENT REQUIRES ATTENDANCE DURING PLANT OPERATION.
2.	A	B	EQUIPMENT COULD BE MAINTAINED EITHER DURING SHUTDOWN, OR DURING PLANT OPERATION.
3.	A	B	EQUIPMENT NOT NORMALLY REQUIRING MAINTENANCE. FAILURE COULD RESULT IN FORCED OUTAGE, IF NOT REPAIRED DURING PLANT OPERATION.

-6 FT LEVEL

3B,A	O	FOUR SUMP PUMPS, CONTROL + INSTRUM
3A	O	4 TO 6 TIP DRIVES
2B	X	TWO TRACTION MOTORS FOR HATCH PLUGS

+11 FT LEVEL

1A	RM	145 TO 205 CRD HCU
1A	RM	TWO CRD MASTER CONTROL AREA PANELS
3B	O	ONE SLC COLLECTING TANK
1A	RM	4 MAIN STEAM FLOW LOCAL PANELS - CALIBRATE
1A	RM	TWO JET PUMP LOCAL PANELS - CALIBRATE
1A	RM	TWO RECIRC PUMP LOCAL PANELS - CALIBRATE
1A	RM	4 RX VESSEL LEVEL AND PRESSURE LOCAL PANELS - CALIBRATE
3B	O	ONE PERSONNEL LOCK DOOR

+28 FT LEVEL (INCL 26 FT LEVEL)

1A	RM	TWO RECIRC HYDRAULIC POWER UNITS
1A	RM	ONE SLC STORAGE TANK - CHECK LEVEL
1A	RM	ONE SLC TEST TANK - TEST
1A	RM	TWO SLC PUMPS - TEST
---	NA	ONE RWCS BACKWASH RECEIVING TANK (NOT ACCESSIBLE)
2B	X	ONE TRACTION MOTOR FOR IFTS ACCESS HATCH PLUG
1A	RM	ONE SLC LOCAL PANEL - TEST
1A	RM	ONE LDS SAMPLE PANEL - TAKE SAMPLES
3A	O	TWO ROD POSITION MUX CABINETS
3B	O	TWO DISTRIBUTION CABINETS
3B	O	ONE RWCS DRAIN SUMP PUMP

KEY:

RM = ROUTINE ATTENTION OR MAINTENANCE REQUIRED DURING PLANT OPERATION

NA = NOT ACCESSIBLE

X = NOT OPERATED DURING PLANT OPERATION

O = USED DURING PLANT OPERATION, AND CONSEQUENTLY MAY REQUIRE MAINTENANCE

+50 FT LEVEL (INCL. 48 FT LEVEL)

1B	RM	TWO HYDROGEN MIXING BLOWERS - TEST? HOW?
1A	RM	ONE RWCS PRECOAT PUMP
1A	RM	TWO RWCS PRECOAT AND RESIN TANKS
--	NA	TWO RWCS FILTER/DEMINERALIZERS (NOT ACCESSIBLE)
--	NA	TWO RWCS HOLDING PUMPS (NOT ACCESSIBLE)
--	NA	ONE FILTER/DEMINERALIZER DRAIN VALVE COMPLEX (NOT ACCESSIBLE)
--	NA	TWO RWCS ROOM COOLING UNIT (NOT ACCESSIBLE)
--	NA	TWO RWCS HEAT EXCHANGERS (NOT ACCESSIBLE)
1B	RM	SIX CONTAINMENT AIR CONDITIONING UNITS - INSPECT
2A	X	ONE FUEL TRANSFER UPENDING MECHANISM
1A	RM	THREE RWCS LOCAL AND INSTRUMENTATION PANELS
1A	RM	TWO RWCS SMAPLE COOLER AND SAMPLING PANELS

+84 FT LEVEL (INCL. 141 FT LEVEL)

2A	X	ENTIRE REFUELING AREA AND EQUIPMENT
1B	RM	TWO DOME RECIRC FANS - INSPECT
3B	O	ONE PERSONNEL LOCK DOOR
?		SIX RWCS MANUAL VALVE EXTENSIONS
2A	X	ONE REFUELING PLATFORM
2A	X	ONE AUXILIARY PLATFORM
2B	X	ONE POLAR CRANE
2A	X	ONE ENCODER CABINET
2A	X	TWO FUEL TRANSFER CONTROL PANEL AND CABINET
2A	X	ONE FUEL TRANSFER POWER WINCH

INERTING

- NOT SUFFICIENT FOR 100 MW REACTION
- MARK III
  * LOSS OF ACCESS SIGNIFICANT TO OPERABILITY AND SAFETY
  * EXTENSIVE RE-DESIGN REQUIRED

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BURNING

CONCEPT

BURN H_2 AS FORMED TO MAINTAIN PRESSURE BELOW DESIGN

TECHNICAL ASSESSMENT

- DIFFICULT TO ENSURE PROMPT IGNITION AT ALL H_2 SOURCES
- MAJOR PROBLEM TO REMOVE HEAT OF COMBUSTION
  - TOTAL HEAT OF COMBUSTION ~50% OF DBA BLOWDOWN ENERGY
  - HEAT ADDED TO AIR NOT SUPPRESSION POOL
  - DELAYED BURN PRESSURIZES MARK III CONTAINMENT OVER DESIGN PRESSURE (IGNITION AT SOURCE IMPORTANT)
- ESCALATION OF EQUIPMENT ENVIRONMENTAL CONDITIONS
  - HIGHER TEMPERATURES
    - MUCH GREATER THAN PRESENT ENVIRONMENTAL LIMITS
  - LOCAL FLAME FRONTS EVEN HIGHER
  - INADVERTENT FIRE POSSIBILITY
- PROBABLE RELOCATION OF EQUIPMENT TO LESS SEVERE ENVIRONMENTAL LOCATIONS

IMPRACTICAL FOR
SIGNIFICANT RATES
AND ALL SOURCES

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HYDROGEN RECOMBINERS

CONCEPT

RECOMBINE H_2 AS FORMED TO MAINTAIN CONCENTRATION BELOW 4% BY VOLUME

TECHNICAL ASSESSMENT

	PRESENT SYSTEM	"BIGGER SYSTEM"
SIZING BASIS:	RADIOLYSIS	RADIOLYSIS & METAL WATER
CAPACITY:	1/30% MW/HR EQUIVALENT	5% MW/HR (ASSUMPTION)
ELECTRICAL HEAT INPUT:	40 KW	6000 Kw
HEAT REMOVAL:	800,000 BTU/HR	12×10^6 BTU/HR
FLOW CFM:	100	15000
DIMENSIONS:	4'x5'x9'	?
COST:	$\$(0.2-05.) \times 10^6$	$\sim\$75 \times 10^6$

IMPRACTICAL FOR SIGNIFICANT RATES

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VENTING

CONCEPT

IMPLEMENT CONTROLLED, FILTERED VENTING OF H_2 FROM CONTAINMENT

TECHNICAL ASSESSMENT

REQUIRES DEFINITION OF EVENT TO ASSESS BENEFIT VS. OTHER METHODS

* REQUIRED RATE
* REQUIRED PROCESS
  - H_2, FISSION PRODUCT REMOVAL

EXAMPLES

- 5%/HR M-W REACTION RESULTS IN ~12,000 SCFM TOTAL GAS FLOW VS.

* NORMAL OFF-GAS TREATMENT (NOBLE GASES)	~30 SCFM (AFTER RECOMBINER)
* STANDBY GAS TREATMENT (IODINE)	~6,000 SCFM
* RECOMBINERS (H_2)	~100 SCFM

IMPRACTICAL FOR SIGNIFICANT RATES
OPERATING FEASIBILITY QUESTIONABLE

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OTHER METHODS

- CHEMICAL H_2 GETTERS
- H_2 SEPARATION
- ABSORBER
- SOLID ELECTROLYTE RECOMBINER
- CONTAINMENT SPRAY$^{\Delta}$

NOT CONSIDERED PROMISING • REQUIRE DEVELOPMENT Δ• SMALL BENEFIT

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SIGNIFICANT CONCLUSIONS

- INCREASE ABOVE PRESENT BASIS REQUIRES MAJOR DESIGN CHANGES

- METAL WATER REACTION APPROACHING 100% NOT A PRACTICAL DESIGN BASIS

- EVENT DEFINITION REQUIRED FOR MECHANISTIC EVALUATION OF CONTAINMENT AND SYSTEMS DESIGN
  - AMOUNT
  - RATE
  - H_2 SOURCE LOCATION
  - H_2 SOURCE MIXTURE
  - FISSION PRODUCT CONTENT

- FURTHER CONSIDERATIONS OF WELL DEFINED BASIS, POTENTIAL IMPACT ON OTHER AREAS, E.G.
  - CONTAINMENT LOADS
  - EQUIPMENT QUALIFICATION
  - ATWS

- ACCOMMODATION METHOD SELECTION MUST CONSIDER
  - IMPACT ON PRESENT SAFETY FEATURES
  - IMPACT ON NON-SAFETY SYSTEMS
  - TRADE-OFF ON MITIGATION VS. PREVENTION

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1A

BWR ECCS PROTECTION AGAINST H_2 GENERATION

- BWR REVIEW
  - * BASIC FEATURES
  - * EVENT SIMILAR TO TMI
- RELATIVE POTENTIAL FOR GENERATING SIGNIFICANT AMOUNTS OF H_2
  - * LOSS OF FEEDWATER
  - * LOCA
- AMOUNT OF H_2 AND GENERATION RATE
  - * LOSS OF FEEDWATER
  - * LOCA
- CURRENT ACTIONS RELATIVE TO H_2 ASSESSMENTS
  - * OPERATOR GUIDELINES
  - * FAULT TREE

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- CONCLUSIONS
  - * LOW ABSOLUTE RISK
  - * MOST RISK IN MORE REALISTIC LOSS OF FEEDWATER
    SLOWER RATES
    SMALLER AMOUNTS
  - * BASIC APPROACH SHOULD BE TO QUANTIFY RISK AND
    IMPROVE IF UNACCEPTABLE

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BWR FEATURES WHICH WOULD PREVENT OR MITIGATE TMI TYPE ACCIDENT

- LARGE PASSIVE HEAT SINK INSIDE CONTAINMENT
  ** CAN RUN LONGER "BOTTLED UP"
- DESIGNED TO HANDLE STUCK OPEN RELIEF VALVE
- DIRECT MEASUREMENT OF VESSEL WATER LEVEL
- VESSEL VENTED THROUGH STEAM LINES AND TOP HEAD
- BOILING MODE OPERATION ROUTINE
- STRONG NATURAL CIRCULATION
- ABILITY TO RAPIDLY DEPRESSURIZE
- CORE SPRAY COOLING OF UNCOVERED CORE
- WATER-STEAM SEPARATION OF FISSION PRODUCTS
- SCRUBBING OF FISSION PRODUCT RELEASES BY SUPPRESSION POOL
- SECONDARY CONTAINMENT AND FILTERED OFFSITE RELEASE

BWR ≠ TMI. TMI TYPE ACCIDENT MUCH LESS LIKELY AND MUCH LESS SEVERE IN BWR

DRW
8/21/79

TYPICAL BWR/6 "SIMILAR EVENTS" ANALYSIS

RESPONSE TO LOSS OF FEEDWATER PLUS MULTIPLE SUBSEQUENT FAILURES

FAILURES (CUMULATIVE)	BWR RESPONSE (BEST ESTIMATE): MINIMUM WATER LEVEL (FT ABOVE CORE)	DURATION OF CORE UNCOVERY	PEAK CLAD TEMP (F)	METAL WATER REACTION (%)
• LOSS OF FEEDWATER	+12	NONE	T_{SAT}	0
+				
• LOSS OF CRD FLOW	+12	NONE	T_{SAT}	0
+				
• RCIC FAILURE	+12	NONE	T_{SAT}	0
+				
• HPCS FAILURE WITH NOMINAL MANUAL ADS (AT 7 MIN.)	+1.6	NONE	T_{SAT}	0
• HPCS FAILURE WITH DELAYED MANUAL ADS + STUCK OPEN RELIEF VALVE				
10 MINUTE	+0.7	NONE	T_{SAT}	0
13 MINUTE	-0.9	20 SEC	700	<0.001
16 MINUTE	-4.6	3.5 MIN	1350	<0.01

NO SIGNIFICANT ADVERSE CONSEQUENCES

DRW
8/21/79

RELATIVE POTENTIAL FOR GENERATING SIGNIFICANT AMOUNTS OF H_2

- BASIS - IDENTIFY POTENTIAL PATHS TO SIGNIFICANT H_2
  - ORDER OF MAGNITUDE JUDGEMENTS

CASE	FAILURES	KEY DIFFERENCES RELATIVE TO PROCEEDING CASE
TMI Loss of Feed	Auxiliary Feed High Pressure Injection Relief Valve	
BWR Loss of Feed	HPCS RCIC Relief Valve Manual ADS	Manual ADS Simple Action Direct Level Indication Operator Training Potential to Regain Feed
BWR Small Break	HPCS RCIC Automatic ADS	Break Probability Automatic ADS
BWR Large Break	Off Site Power 2 - 3 Divisions	Off Site Power, Diesel Reliability

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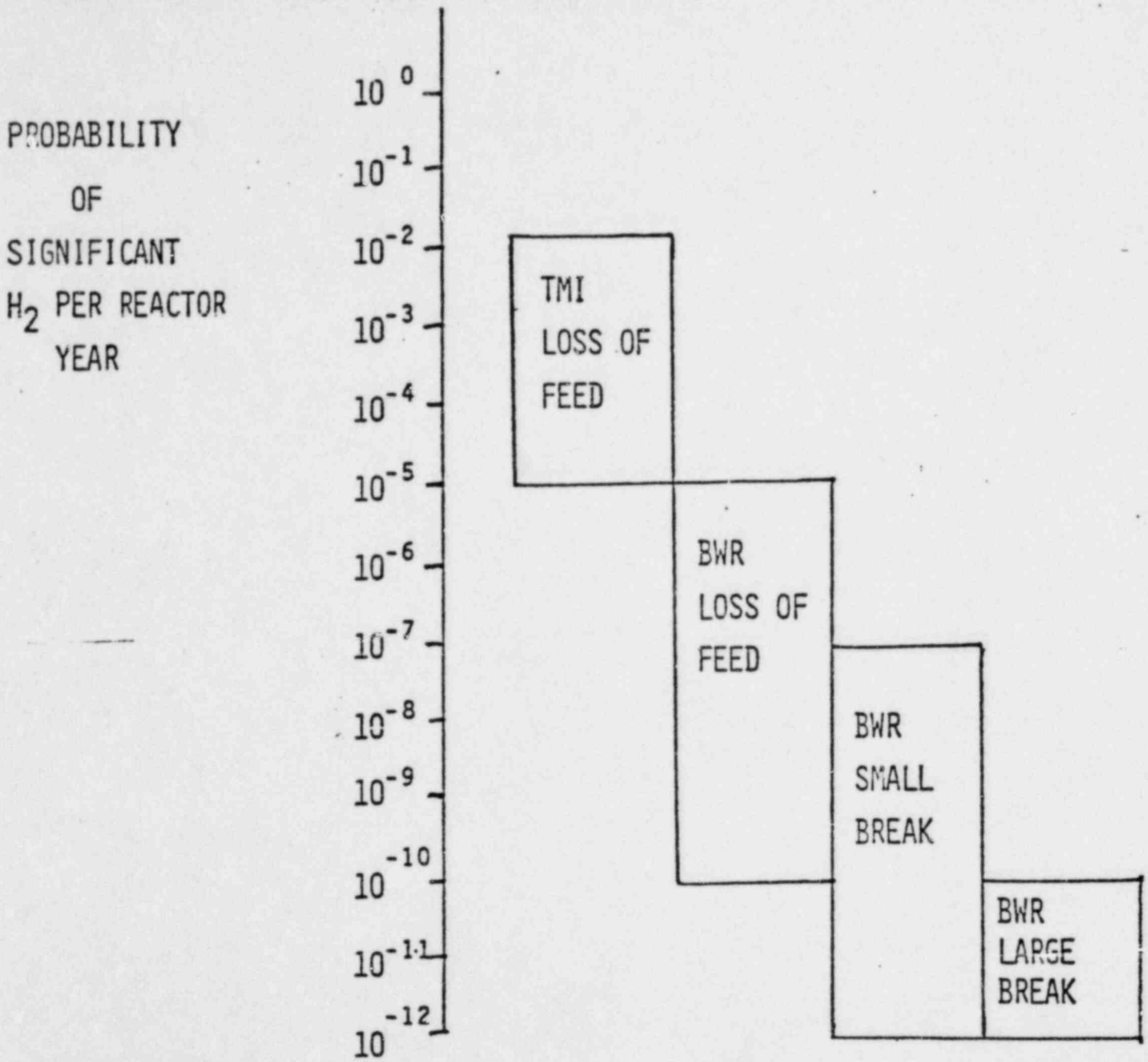
RESULTING ROUGH JUDGEMENTS



- CONCLUSIONS
  - BWR BETTER THAN TMI
  - MORE PRECISE QUANTIFICATION APPROPRIATE, BUT:
  - MOST OF BWR RISK IS IN LOSS OF FEEDWATER EVENT

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RELATIVE ASSESSMENT OF HYDROGEN GENERATION

- MAGNITUDE AND RATE DEPEND ON TRANSIENT, COURSE OF EVENTS

	LOSS OF FEEDWATER	LARGE BREAK
PROBABILITY	SMALL	VERY SMALL
OPERATOR ERROR POTENTIAL	SMALL	VERY SMALL
POTENTIAL FOR OPERATOR TO IMPROVE ON DEGRADED CASE	LARGE (MORE TIME)	SMALL (SHORT TIME)
RATE OF GENERATION	SLOW (10's OF MINUTES)	FAST (MINUTES)
AMOUNT OF GENERATION IN DEGRADED CASE	SMALLER	LARGER

CONCLUSION - MORE REALISTIC LOSS OF FEEDWATER CASE LEADS TO SMALLER H_2 GENERATION, SLOWER RATE

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CURRENT ACTIONS THAT ARE CONTRIBUTING TO ASSESSMENT/REDUCTION OF HYDROGEN GENERATION POTENTIAL

- BULLETINS AND ORDERS/OWNERS' GROUP REPORTS
- OPERATOR GUIDELINES

SMALL LOCA	DONE
INADEQUATE CORE COOLING	DUE IN NOV.
LOSS OF FEEDWATER	DUE IN JAN.
STUCK OPEN RELIEF VALVE	DUE IN JAN.

* BASIC DIRECTION

MONITOR COURSE OF EVENTS

DEPRESSURIZE TO GET LOW PRESSURE SYSTEM ON IF HIGH PRESSURE SYSTEMS INSUFFICIENT

SIMPLE

- FAULT TREE ANALYSIS - DUE IN JAN.

PATHS TO CORE UNCOVERY (SMALL BREAK)

RELIABILITY OF INJECTION SYSTEMS

CONCLUSION - SIMPLICITY OF OPERATOR ACTIONS AND FAULT TREE RESULTS ARE IMPORTANT INPUTS TO H_2 GENERATION AND MITIGATION CONSIDERATIONS

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CONCLUSIONS

- LOW ABSOLUTE RISK OF GENERATING SIGNIFICANT AMOUNTS OF H_2 IN BWR
- MOST OF RISK IN LOSS OF FEEDWATER, WHERE GENERATION RATES TEND TO BE LOWER, ABSOLUTE AMOUNTS TEND TO BE LOWER
- COMMITTED ACTIONS CONTRIBUTE TO H_2 ASSESSMENT
- THEREFORE RECOMMEND
  - * MORE REALISTIC APPROACH OVER ARBITRARY ASSUMPTION
  - * CONSIDER RESULTS OF CURRENT BULLETINS AND ORDERS
  - * BASIC APPROACH SHOULD BE:
    - QUANTITATIVE RISK ASSESSMENT
    - IF UNACCEPTABLE, IMPROVE PREVENTION AND/OR MITIGATION

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"THE BWR PERSPECTIVE

ON

INTERIM HYDROGEN CONTROL MEASURES"

VU-GRAPHS USED IN THE

GENERAL ELECTRIC PRESENTATION

TO

THE COMMISSION

MARCH 19, 1980

Enclosure 6

GENERAL ELECTRIC

NUCLEAR ENERGY

PROJECTS DIVISION

RAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125

August 3, 1979

MFN-199-79

U. S. Nuclear Regulatory Commission
Office of Nuclear Regulation
Washington, D.C. 20555

Attention: Harold R. Denton, Director

SUBJECT: INERTING OF BWR MARK I & II CONTAINMENTS

Gentlemen:

This letter is to appeal the proposed ruling for inerting BWR Mark I and II containments contained in the NRC Lessons Learned Task Force, NUREG-0578. We believe that inerting will not add to the safety of the Mark I and II containments.

General Electric recognizes the NRC must take action to reduce and remove the uncertainties related to the TMI accident; however, we believe that the proposed ruling on inerting in the BWR Mark I and II is counter productive to safety, and does not logically follow from the observations of the TMI incident. The reasons for our appeal are as follow:

- The sequence of events at TMI, including operator action, led to a cessation of core flow. This apparently caused stagnant voiding of the core, elevated zirconium temperatures, and hydrogen was generated by the chemical reaction between zirconium and steam. For the operating BWR's there is no known sequence of events, including operator actions, that can cause a cessation of core flow when water inventory is available. Core flow is greatest in the jet-pump type of BWR, but even in the BWR 2, core flow is more than adequate to prevent fuel damage. This was demonstrated during the Oyster Creek transient of May 2, 1979. Therefore, the probability of core damage of the magnitude of TMI is highly unlikely for any of our BWR's.

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ENCLOSURE 7

GENERAL ELECTRIC LETTER OF

MARCH 7, 1980

FROM A. PHILLIP BRAY

TO CHAIRMAN AHEARNE

Enclosure 8

GENERAL ELECTRIC
GENERAL ELECTRIC COMPANY
NUCLEAR POWER SYSTEMS DIVISION
175 CURTNER AVENUE
SAN JOSE, CALIFORNIA 95125

A. PHILIP BRAY
VICE PRESIDENT AND GENERAL MANAGER

March 7, 1980

Honorable John F. Ahearne
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Ahearne:

SUBJECT: BWR MARK I & II CONTAINMENT INERTING

I am writing to raise a serious objection by the General Electric Company to the proposed order for inerting Boiling Water Reactor (BWR) Mark I and II containments. As it now stands, inerting has been recommended by the NRC staff in advance of the accident prevention and mitigation rulemaking process.

We believe there is no basis for inerting Mark I and Mark II when the inherent design of the BWR and the arguments against inerting are considered. Moreover, such a ruling would be inconsistent with the Lessons Learned Task Force Final Report recommendation to conduct rulemaking to address hydrogen control resulting from core damage. It is General Electric's belief that inerting is counterproductive to safety of the Mark I and II containments as we explain herein.

Recognizing that the NRC must take action to reduce and remove the uncertainties related to the TMI accident, General Electric and the BWR Owners Group have been working closely with the USNRC since the accident to accomplish that goal. However, the NRC staff has apparently decided to recommend inerting before the accident studies are begun and the merits of inerting, in terms of risk reduction, quantified. We believe the proposed order is inappropriate in light of the following arguments:

1. The NRC staff proposal for containment inerting fails to recognize the BWR's proven inherent accident prevention features. The capabilities for the direct and redundant water level measurement and the multiplicity of Emergency Core Cooling Systems - including diverse core spray capability, a variety of cooling water sources and the ability to automatically depressurize - are expressly provided in the GE BWR to prevent the occurrence of a core uncovery event. In addition to these accident prevention systems the BWR

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possesses a unique capability to operate under conditions of natural circulation in cases of extreme degradation.

2. The sequence of events at TMI including operator action, led to a cessation of core flow, core uncovery and the formation of a noncondensible hydrogen bubble. For the BWR's there is no known sequence of events that can cause a cessation of core flow or formation of a hydrogen bubble when water inventory is available. Core flow is greatest in the jet-pump type of BWR, but even in the BWR 2, core flow is more than adequate to prevent fuel damage. This was demonstrated during the Oyster Creek transient of May 2, 1979. Thus the probability of core damage of the magnitude of TMI is highly unlikely for the BWR.

3. Inerting of Mark I and II containments fails to recognize the grave safety hazards to plant personnel. One death in a foreign BWR containment occurred in 1970 when it was thought that the previously inerted containment had been purged. In addition, there have been instances of plant personnel losing consciousness during containment entry for inspection into an inerted atmosphere. In testimony to the Atomic Safety and Licensing Appeal Board in 1974, witnesses for the Vermont Yankee Nuclear Power Corporation testified that the hazards to plant personnel resulting from entries into an inerted containment with the assistance of self-contained breathing apparatus are so great that such entries would not be made except in the most extraordinary circumstances.

   The ASLAB Memorandum and Order of July 11, 1974 indicated that the Board members were also very concerned about the reduced inspection capability resulting from operation with an inerted containment. Instances were cited by Vermont Yankee witnesses in which mechanical defects were discovered by virtue of routine inspections. These inspections would not have taken place had the containment been inerted. In at least one of these cases, plant personnel were able to discover a defect and call for its repair. Had it gone undiscovered, it might have led to a situation of concern.

4. The costs to the utilities to provide for containment inerting are not insignificant. The resources to put equipment in place in BWR Mark II's have been estimated to be as high as two million dollars per plant. The costs to maintain nitrogen purity for an inerting system are estimated to be approximately $20,000 per month. In addition, the lost power production time associated with the inerting and purging process has been estimated by utilities to cost as much as $200,000 - $500,000 in replacement power per year.

5. General Electric perceives the NRC proposed order to inert BWR Mark I and II containments to be an arbitrary decision. We believe that the proper way to assess the need for BWR modifications is for the NRC to first establish the criteria. Then industry analyses could be performed which consider this criteria, invoking both the capability of accident prevention in concert with mitigation. Such evaluations when complete should form the bases for requiring plant changes such as inerting, if needed. The proposed inerting action discriminates against the BWR.

In summary, General Electric believes that inerting BWR Mark I and Mark II containments is unnecessary, and is counterproductive to BWR safety. Such a proposed ruling appears discriminatory in singling out the BWR particularly in neglecting the BWR's proven inherent accident prevention and mitigation features. In essence it appears to be a simplistic reaction to TMI without evaluation of the safety implications.

I urge that these comments receive consideration by the NRC. General Electric stands ready to assist the NRC in properly investigating the total safety implication of potential hydrogen generation.

Sincerely,

Phil Bray

A. Philip Bray

cc: Commissioner Bradford
Commissioner Gilinsky
Commissioner Hendrie
Commissioner Kennedy
M. W. Carbon
H. R. Denton
R. J. Mattson