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June 18, 1980

9:00 a.m. I. Introductory Remarks
- A. NRC
- B. Utilities

9:15 a.m. II. Accident Sequence Selection - Utility Presentation
- A. Overview
- B. Accident Sequence Event Trees & Probability Estimates
  1. Sequence Event Trees for Z/IP
  2. Data Sources (WASH-1400 & Others)
  3. Initiating Event Probabilities
  4. Mitigating Systems, Success Criteria & Probability of Failure on Demand
- C. Containment Failure Modes and Fission Product Release
  1. Identification of Modes and Bases for Failure Probability Estimates
  2. Overall Accident Sequence Probabilities
  3. Basis for Assignment of Overall Failure Sequences to Release Categories
  4. Overall Accident Sequence Listing by Release Category
- D. Risk Estimates
  1. Short-Term Risk Tabulation by Release Category
  2. Long-Term Risk Tabulation by Release Category
- E. Results
  1. Comparison of Zion, Indian Point & WASH-1400 PWR Risk Estimates
  2. Comparison of Sequences to WASH-1400 PWR
     - a. Sequences Added and Eliminated re WASH-1400
     - b. Principal Design ~~Design~~ Differences re Dominant Sequences
  3. Estimates of Risk Reduction Resulting from Interim Measures
  4. Accident Sequence Ranking Relative to Risk
- F. Conclusions
  1. Methodology for Sequence Selection
  2. Accident Sequence Ranking
  3. Sequence Mitigation
  4. Recommendations for Future Analysis

12:15 p.m. LUNCH

1:15 p.m. III. Long-Term Utility Probabilistic Risk Assessment - Utility Presentation
- A. Scope of Study
- B. Status
- C. Schedule for Completion; Type of Results & Their Significance

2:15 p.m. IV NRC Comments and Discussion of Dominant Accident Sequence Selection

4:00 p.m. V. Adjournment

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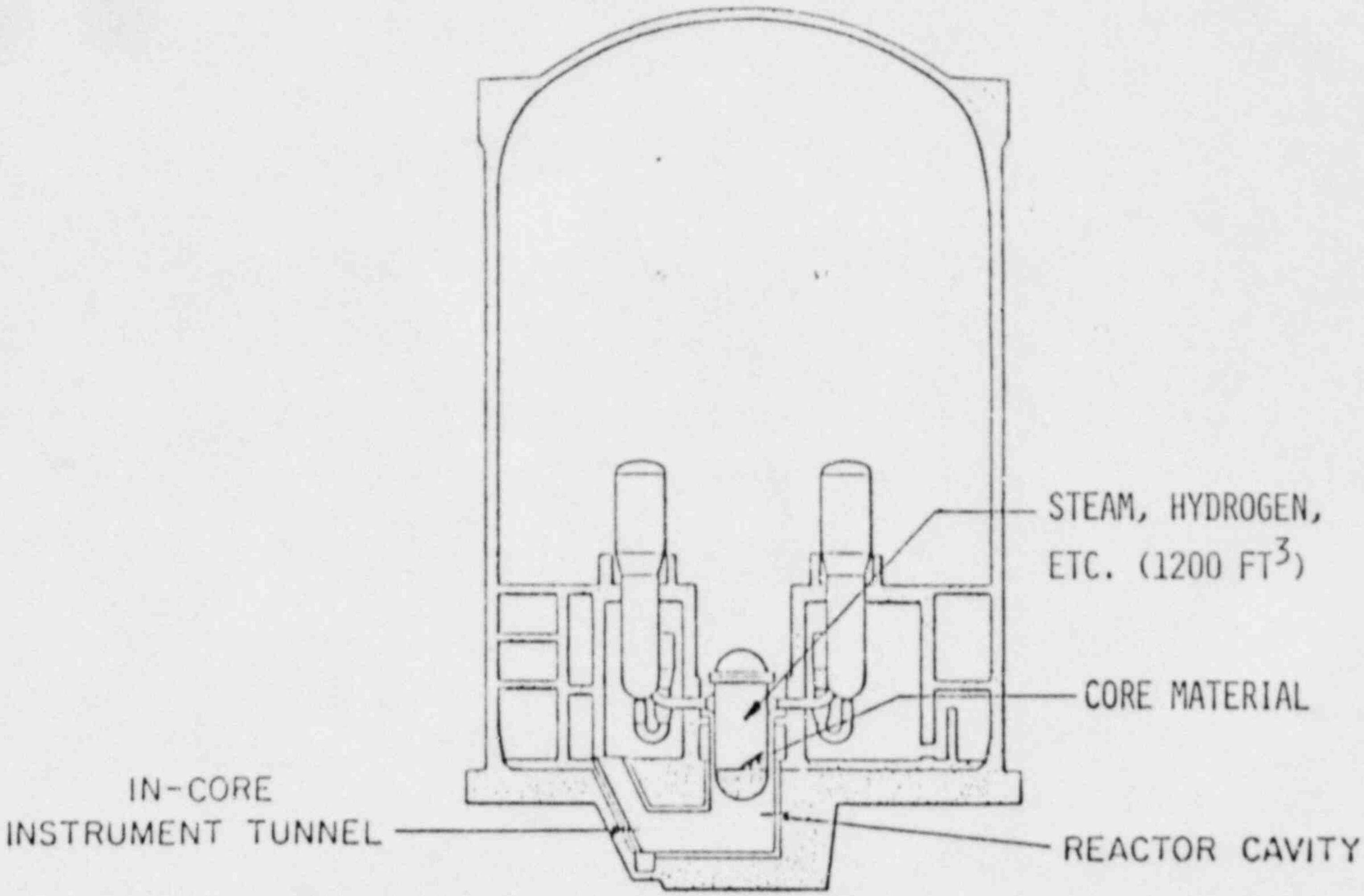
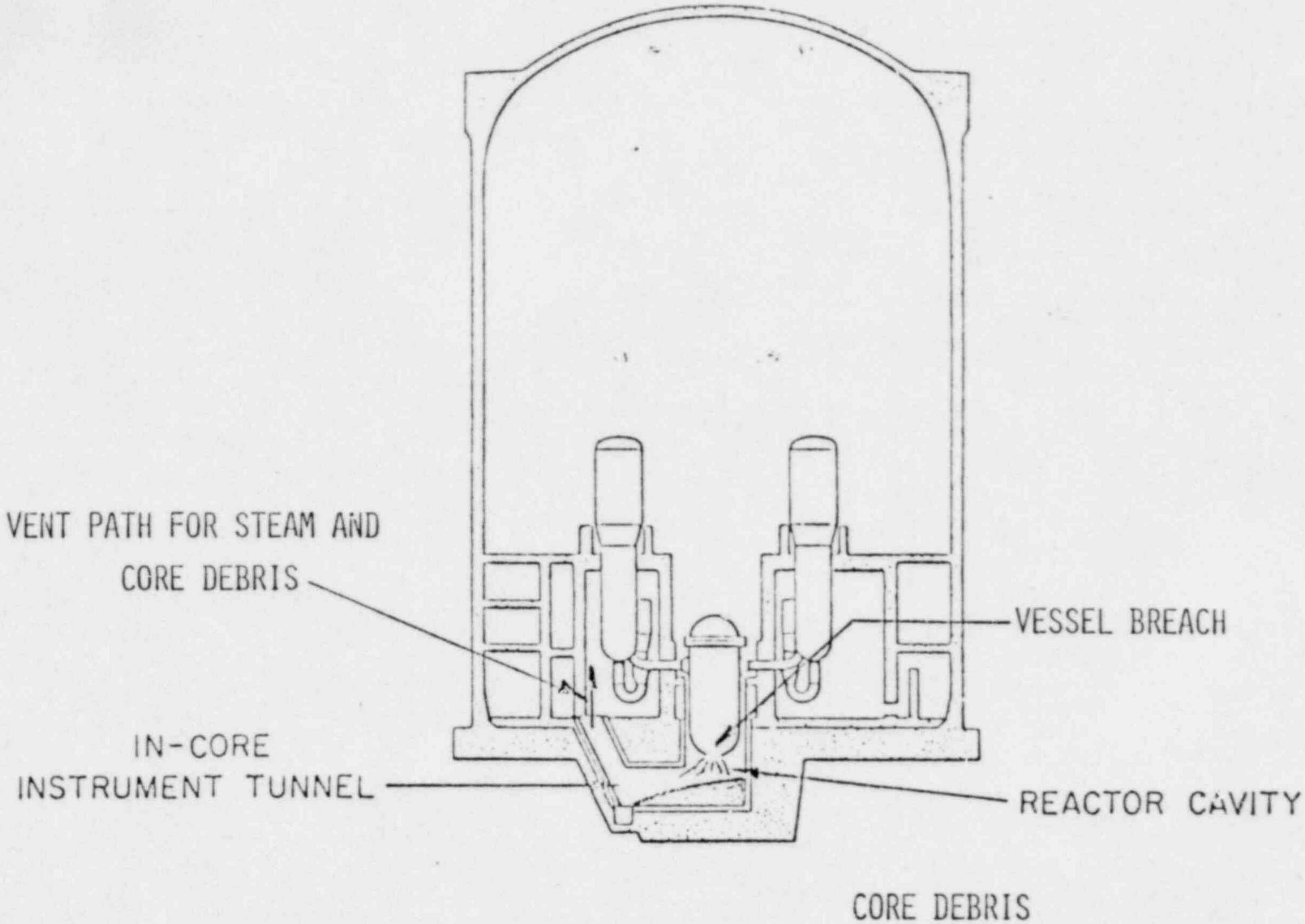
Slides presented by R. Henry - June 10, 1980

MECHANICAL DISPERSION
of
CORE MATERIAL

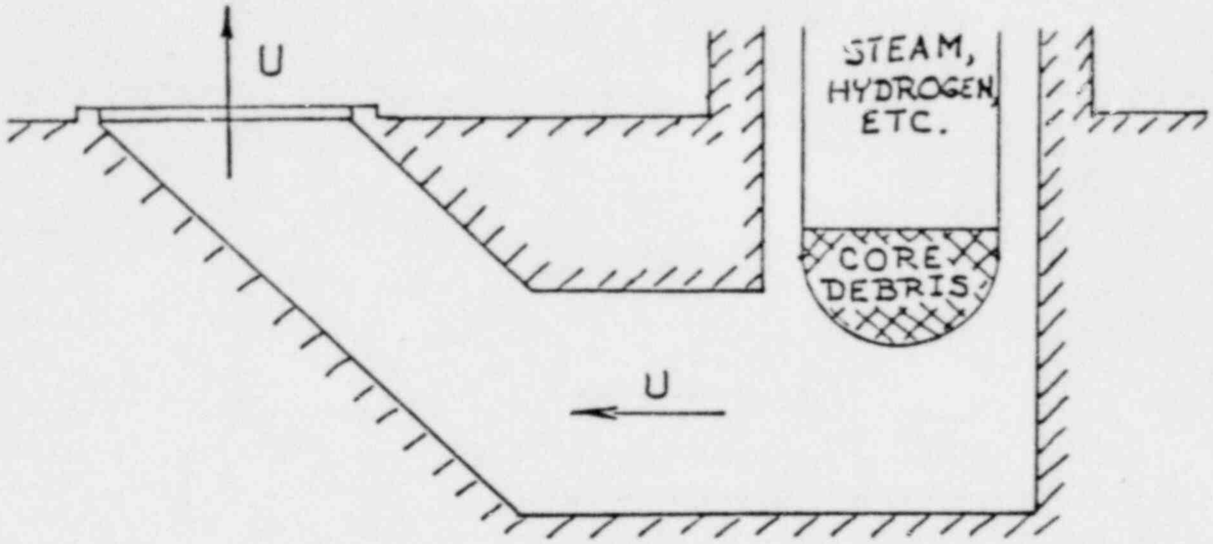


REACTOR BUILDING



REACTOR BUILDING

DISPERSAL CALCULATIONS



$$U = \frac{3\sqrt[4]{g\sigma(\rho_F - \rho_G)}}{\rho_G}$$

$$w = \rho_G A_T U$$

$$G = \eta P_o/\sqrt{RT}$$

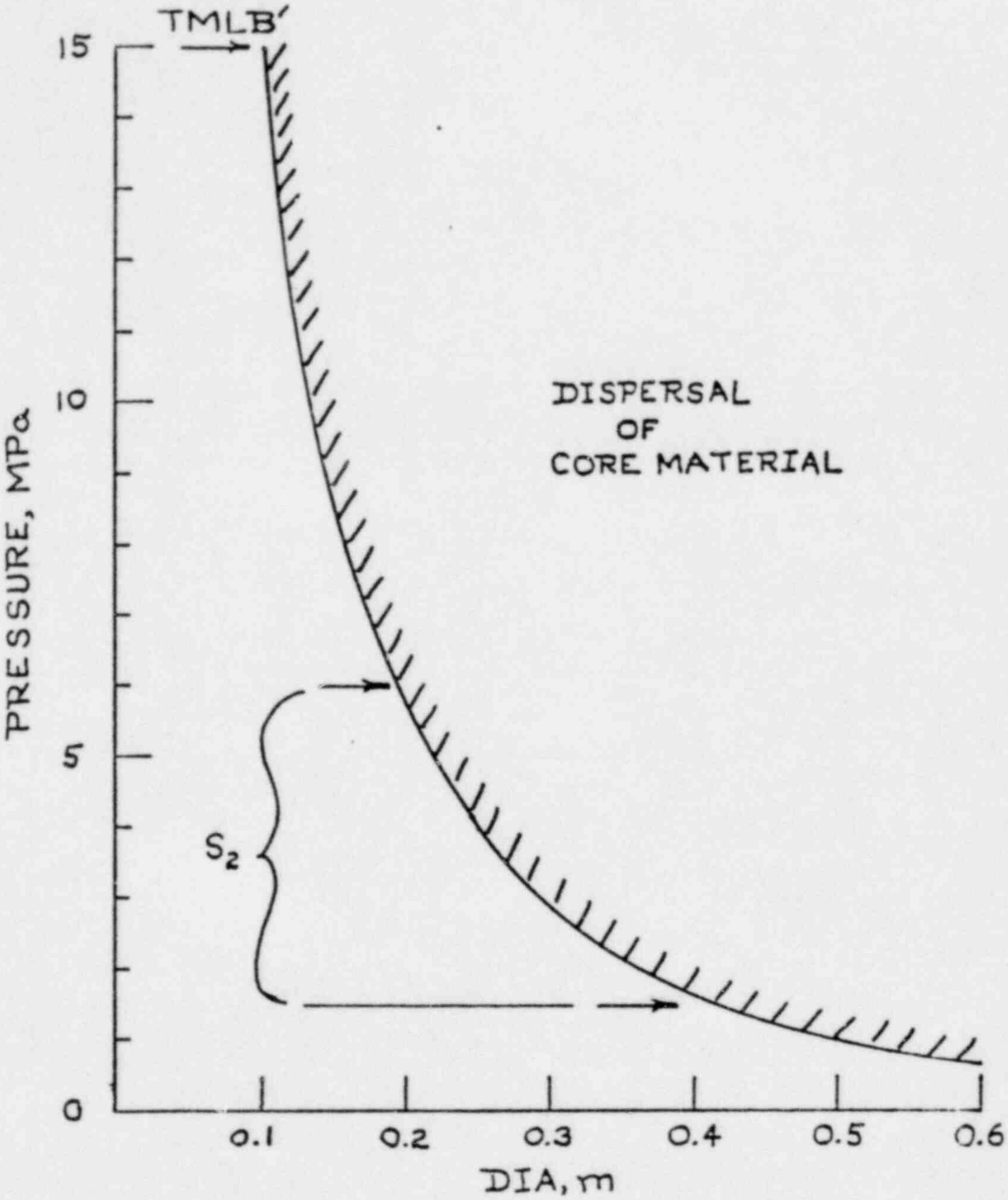
$$A_V = W/G$$

$$D_F = \frac{3}{8}\,\frac{\rho_G U^2}{\rho_F G}$$

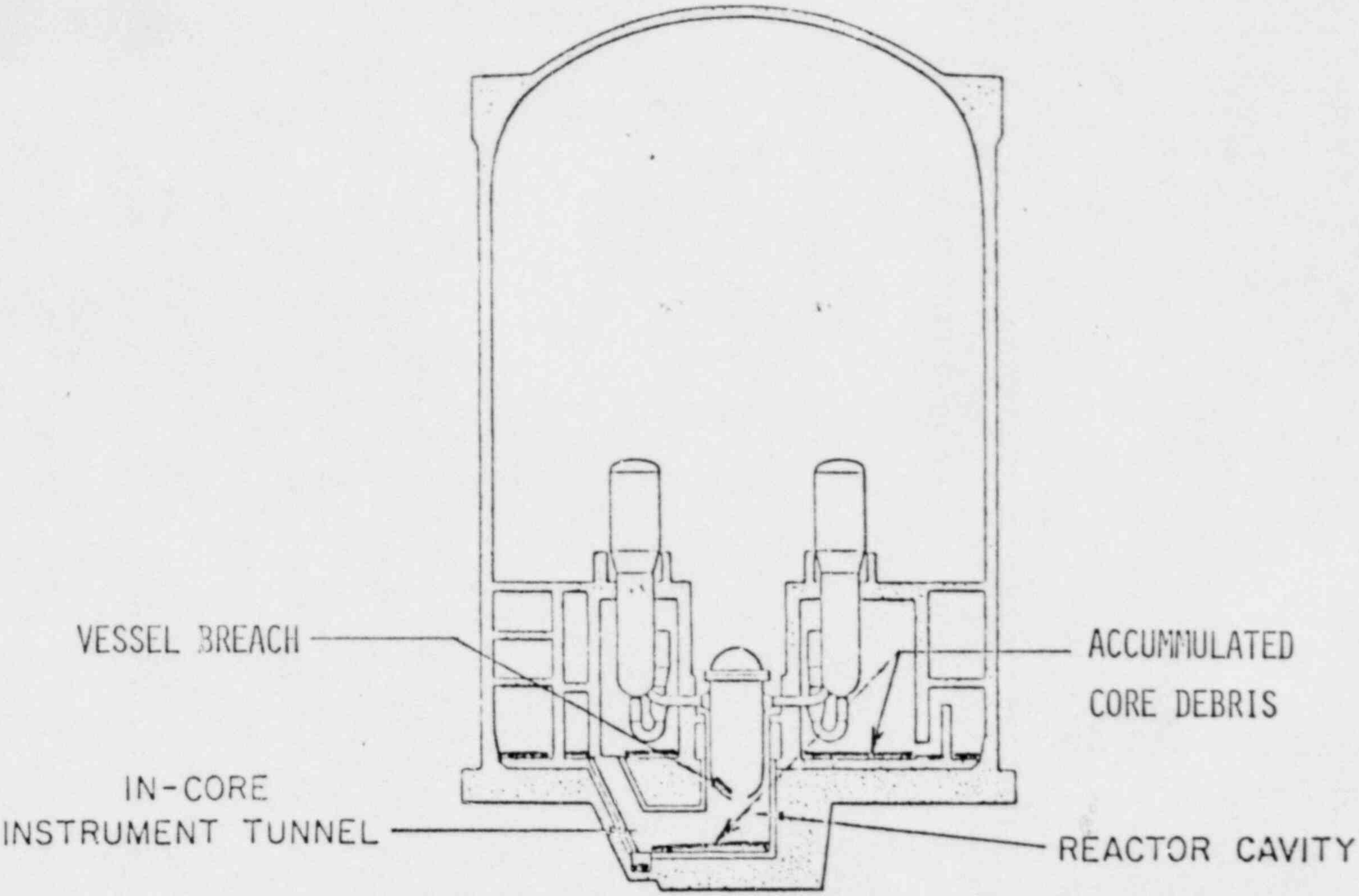
$$v_o = \frac{RT}{P_o}$$

$$M_o = \frac{V_V}{v_o}$$

$$\Delta\theta = \frac{M_o}{W}$$



DISPERSAL POTENTIAL VERSE VESSEL BREACH DIAMETER



REACTOR BUILDING

DISPERSED CONDITIONS

- AVAILABLE SURFACE AREA ~ 800 m^2
- AMOUNT OF CORE DEBRIS ~ 100,000 kg
- BED POROSITY $\epsilon \sim 0.5$
- BED DEPTH ~ 3 cm

CONCLUSIONS

- MECHANICAL DISPERSIVE POTENTIAL IS LARGE AND PROBABLY DICTATES THE FINAL CORE DEPOSITION
- WATER IS AVAILABLE ON A CONTINUOUS BASIS ON ALL SURFACES WHERE SIGNIFICANT FUEL ACCUMULATION CAN OCCUR
- DISPERSED CORE IS COOLABLE AND NO SIGNIFICANT ATTACK OF THE CONCRETE OCCURS

Slides presented by Dee Walker, June 18, 1980

APPENDIX B: SYMBOLOGY

System Identification Symbol	System	System Failure Symbol
CSRS	Containment Spray Recirculation System	F
ECI(S)	Emergency Coolant Injection (System)	D
ECR(S)	Emergency Coolant Recirculation (System)	H
AFWS	Auxiliary Feedwater System	L
LPRS	Low Pressure Recirculation System	
HPIS	High Pressure Injection System	
LPIS	Low Pressure Injection System	
ACCS	Accumulator System	
RCS	Reactor Coolant System	
RHR	Residual Heat Removal System	
HPRS	High pressure recirculation system	
RWST	Refueling water storage tank	

SYMBOLOGY

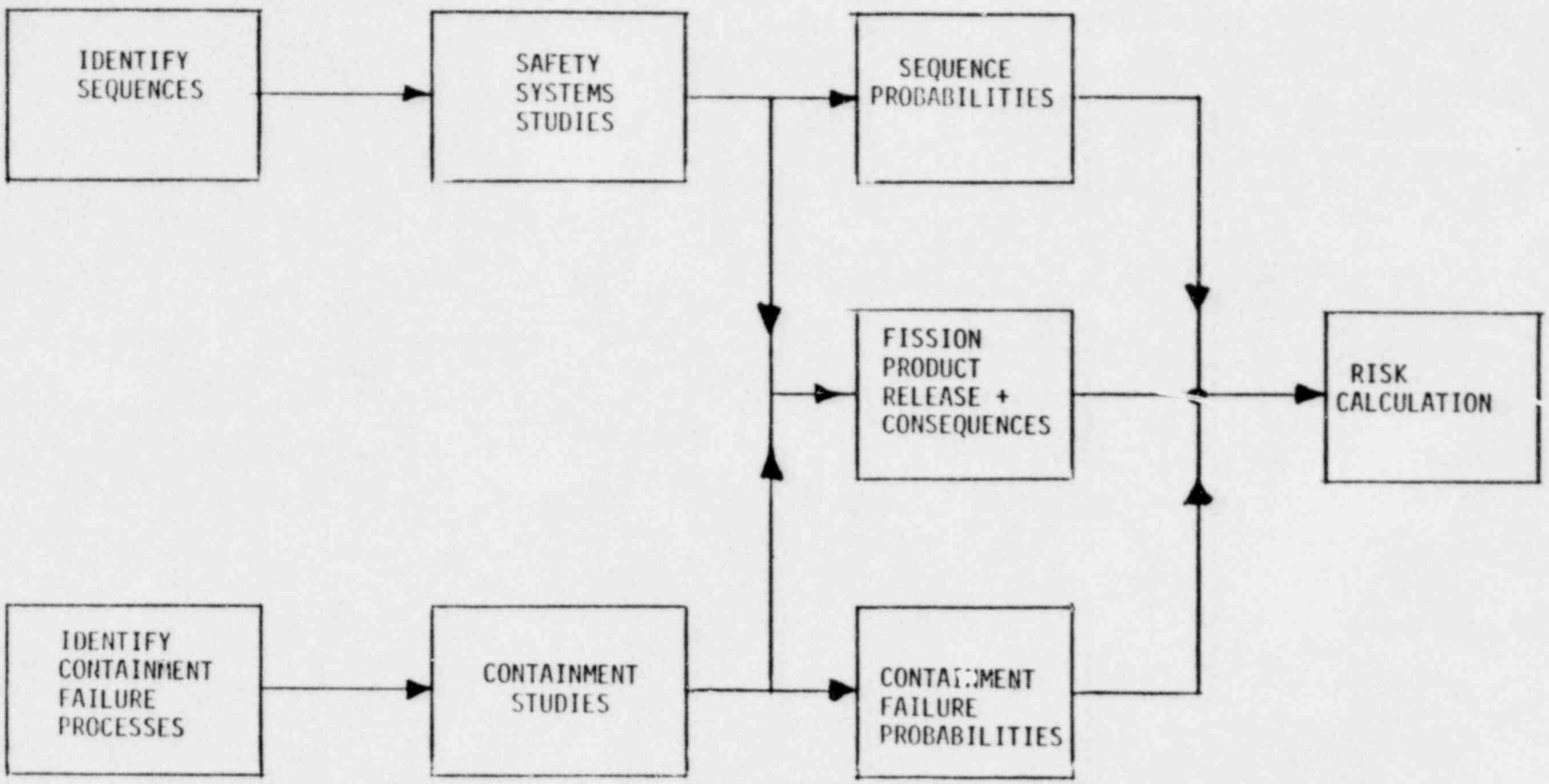
Initiating Events	Symbol
Large pipe break (6")	A
Small pipe break (2"-6")	S_1
Small pipe break (1/2"-2")	S_2
Interfacing check valve failure (To LPIS/LPRS) with blowdown outside containment	V
Transient (Loss of offsite AC power)	T

Loss of AC Power Events	Symbol
Non-recovery of off-site power for about 1 hr	M
Loss of Onsite AC power for about 1 hr.	B
Non-recovery of any AC power for about 3 hrs.	B'
Successful recovery of some AC power within 3 hrs.	B"

Containment Failure Modes	Symbol
Steam explosion in Reactor Vessel	α
Isolation leakage	β
Overpressure from Hydrogen burning	γ
Overpressure - generally (less hydrogen)	δ
Containment melt-through	ϵ

SHORT-TERM CORE MELT STUDY

PROCESS OVERVIEW



PRESENTATION OUTLINE

- IDENTIFICATION OF SEQUENCES
- PROBABILITY ESTIMATES
- FISSION PRODUCT RELEASES AND CONSEQUENCE CALCULATIONS
- RESULTS

ACCIDENT SEQUENCE IDENTIFICATION

- STARTING POINT

  WASH-1400, APPENDIX 5, TABLE 3-14

  CUTOFF PROBABILITY OF 1 X 10^{-6} / YEAR

- SEQUENCES ADDED

  AHF

  S_1HF

  S_2HF

- SEQUENCES DELETED

  S_2C

  TML

  TKQ

  TKQM

ACCIDENT SEQUENCE SUMMARY

SEQUENCE	INITIATING EVENT	FAILED FUNCTIONS
AD	LARGE LOCA (A)	ECCS INJECTION (D)
AH	LARGE LOCA (A)	ECCS RECIRCULATION (H)
AHF	LARGE LOCA (A)	ECCS RECIRCULATION (H) + SPRAY RECIRCULATION (F)
S_1D	INTERMEDIATE LOCA (S_1)	ECCS INJECTION (D)
S_1H	INTERMEDIATE LOCA (S_1)	ECCS RECIRCULATION (H)
S_1HF	INTERMEDIATE LOCA (S_1)	ECCS RECIRCULATION (H) + SPRAY RECIRCULATION (F)
S_2D	SMALL LOCA (S_2)	ECCS INJECTION (D)
S_2H	SMALL LOCA (S_2)	ECCS RECIRCULATION (H)
S_2HF	SMALL LOCA (S_2)	ECCS RECIRCULATION (H) + SPRAY RECIRCULATION (F)
V	INTERFACING CHECK VALVE FAILURE (V)	
TMLBB'	TRANSIENT LOSS OF OFFSITE POWER (T)	ONSITE AC POWER + AUXILIARY FEEDWATER + LONG-TERM NON RECOVERY OF POWER
TMLBB"	TRANSIENT LOSS OF OFFSITE POWER (T)	ONSITE AC POWER + AUXILIARY FEEDWATER + RECOVERY OF SOME POWER

PROBABILITY TOPICS

- KEY DIFFERENCES FROM WASH-1400
- INITIATING EVENT PROBABILITIES
- COMPONENT FAILURE DATA
- SYSTEM FAILURE CALCULATION

SUMMARY OF WASH-1400 DIFFERENCES

1. CONTAINMENT FAILURE FROM STEAM EXPLOSION

   - REDUCED BY 10 FOR "A" SEQUENCES
   - REDUCED BY 100 FOR "S_1", "S_2", "TMLB" SEQUENCES

2. OPERATOR ERROR PROBABILITIES

   - ELIMINATE FAILURE TO SHIFT TO HOT LEG RECIRCULATION
   - REDUCE INJECTION-TO-RECIRCULATION ERROR PROBABILITY BY 10 FOR S_1HF AND S_2HF

3. INTERFACING CHECK VALVE CALCULATION

4. LOSS OF OFFSITE POWER PROBABILITY (ZION)

5. CONTAINMENT OVERPRESSURE FAILURE PROBABILITY

   - USED 0.1 FOR ALL SEQUENCES EXCEPT TMLB

6. DIESEL-GENERATOR COMMON MODE FAILURE

   - REDUCED PROBABILITY BY 100

INITIATING EVENT SUMMARY

INITIATING EVENT	PROBABILITY
LARGE LOCA (A)	1×10^{-4}/YEAR
INTERMEDIATE LOCA (S_1)	3×10^{-4}/YEAR
SMALL LOCA (S_2)	1×10^{-3}/YEAR
LOSS OF OFFSITE POWER (T)	0.04/YEAR (IP-2) 0.2/YEAR (ZION)
INTERFACING CHECK VALVE FAILURE (V)	2.8×10^{-10}/YEAR (IP-2) 7.2×10^{-8}/YEAR (ZION) 5.2×10^{-8}/YEAR (IP-3)

SOURCES OF COMPONENT FAILURE RATE DATA

- WASH-1400 GENERALLY
- EXCEPTIONS
    - DIESEL GENERATORS
    - GAS TURBINES (IP ONLY)
    - AUX FEEDWATER TURBINE (ZION)
- DETAILED DERIVATIONS IN APPENDIX A

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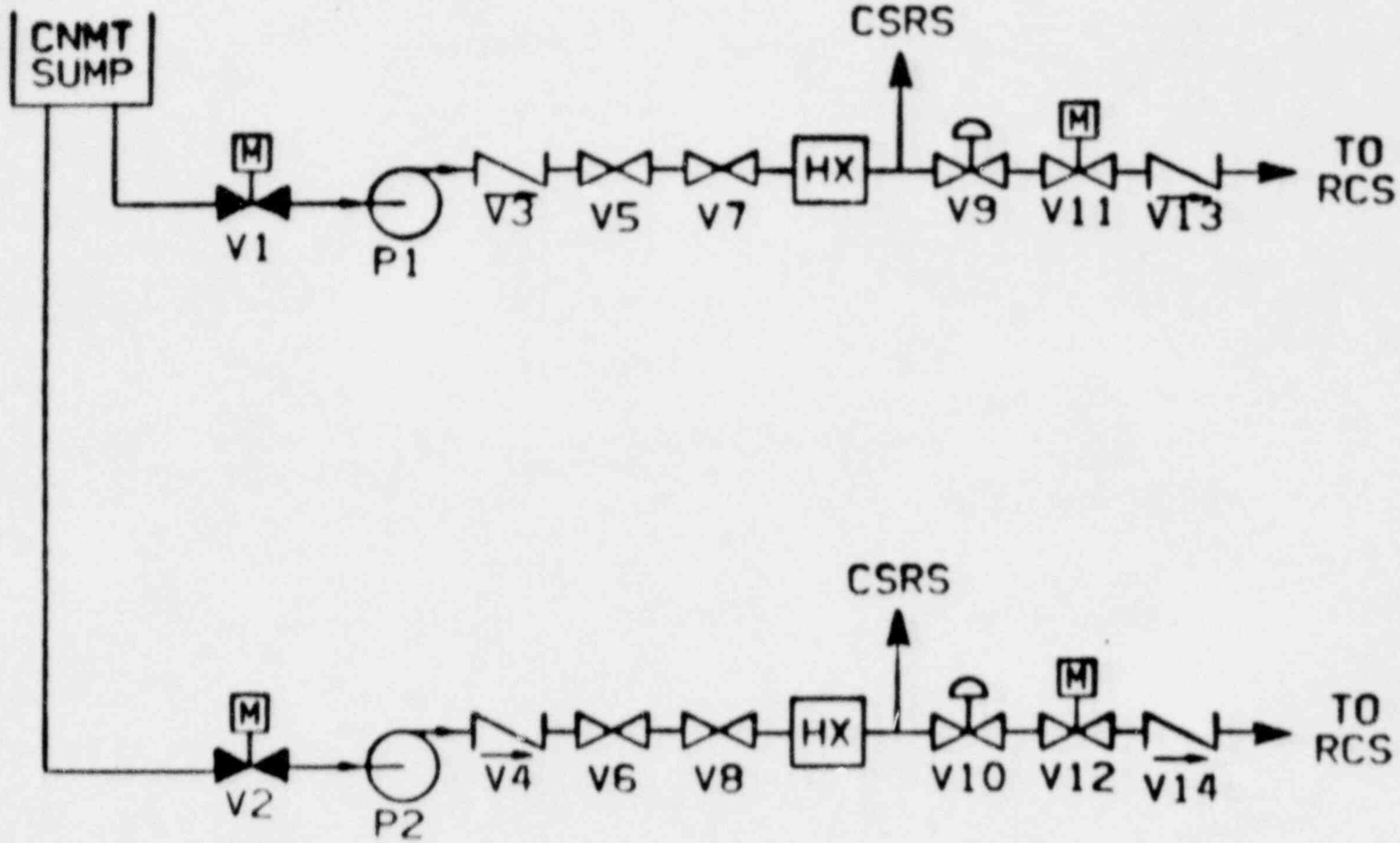
MITIGATING SYSTEMS AND RELATED SEQUENCES

SYSTEM	SEQUENCES
LPIS	AD
ACCUMULATORS	AD, S_1D
HPIS	S_1D, S_2D
LPRS	AH, AHF
HPRS	S_1H, S_1HF, S_2H, S_2HF
CHECK VALVES	V
AFW	TMLB
ONSITE AC POWER	TMLB

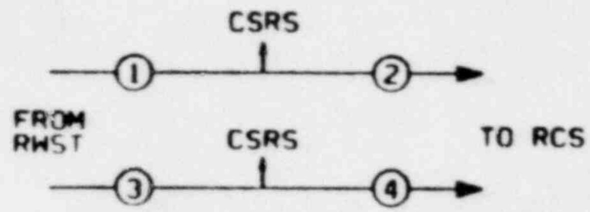
FLUID SYSTEM UNAVAILABILITY ANALYSIS PROCEDURE

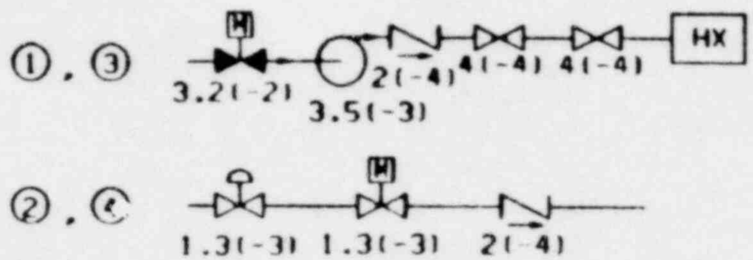
- PRODUCE SIMPLIFIED FLOW DIAGRAM
- ARRANGE COMPONENTS INTO GROUPS OR "BLOCKS"
- CONVERT FLOW DIAGRAM INTO A BLOCK DIAGRAM
- COMPUTE FAILURE PROBABILITY WITHIN EACH BLOCK
- DETERMINE THE COMBINATIONS OF BLOCK FAILURES WHICH RESULT IN SYSTEM FAILURE
- COMBINE BLOCK FAILURE PROBABILITIES TO ARRIVE AT SYSTEM FAILURE PROBABILITY



LPRS FLOW DIAGRAM

#11





P① = P③ = 3.6×10^{-2}

P② = P④ = 2.8×10^{-3}

COMBINATION OF BLOCKS	PROBABILITY FORMULATION	RESULT: CSRS ALSO FAILS	RESULT: CSRS DOES NOT FAIL
① AND ③	3.6(-2)X3.6(-2)	1.3×10^{-3}	
① AND ④	3.6(-2)X2.8(-3)		1×10^{-4}
② AND ③	2.8(-3)X3.6(-2)		1×10^{-4}
② AND ④	2.8(-3)X2.8(-3)		7.8×10^{-6}
	P(LPRS AND CSRS) =	1.3×10^{-3}	
	P(LPRS) =		2×10^{-4}

LPRS BLOCK DIAGRAM & FAILURE COMBINATIONS

EXAMPLE SEQUENCE PROBABILITY CALCULATIONS

SEQUENCE AH

$p\binom{\text{LPRS}}{\text{FAILURE}} = p(\text{EVENT H}) = 2 \times 10^{-4}$

$p\binom{\text{LARGE}}{\text{LOCA}} = p(\text{EVENT A}) = 1 \times 10^{-4}$

$p(\text{SEQUENCE AH}) = 2 \times 10^{-8}$

SEQUENCE AHF

$p(\text{LPRS + CSRS FAILURE}) = 1.3 \times 10^{-3}$

$p(\text{OPERATOR ERROR}) = 3 \times 10^{-3}$

$p(\text{EVENT HF}) = 4.3 \times 10^{-3}$

$p\binom{\text{LARGE}}{\text{LOCA}} = p(\text{EVENT A}) = 1 \times 10^{-4}$

$p(\text{SEQUENCE AHF}) = 4.3 \times 10^{-7}$

COMPARISON OF CHECK VALVE FEATURES

PLANT FEATURE	ZION	IP-2	IP-3	WASH-1400
CHECK VALVE TEST CONNECTIONS PROVIDED?	YES	YES	YES	NO
PERIODIC TEST INTERVAL	NOT DONE(*)	15 MOS. (*)	9 MOS. (*)	—
LOW PRESSURE SYSTEM PIPING INSIDE CONTAINMENT?	NO	YES	YES	NO
CHECK VALVES ISOLATED BY NORMALLY CLOSED VALVE?	NO	YES	NO	NO
NUMBER OF PATHS TO LOW PRESSURE PIPING ISOLATED BY CHECK VALVES	4	4	4	3
NUMBER OF CHECK VALVES IN EACH PATH	3	2	2	2

(*)TESTING IS PRESENTLY PERFORMED AT EACH RCS PRESSURIZATION.

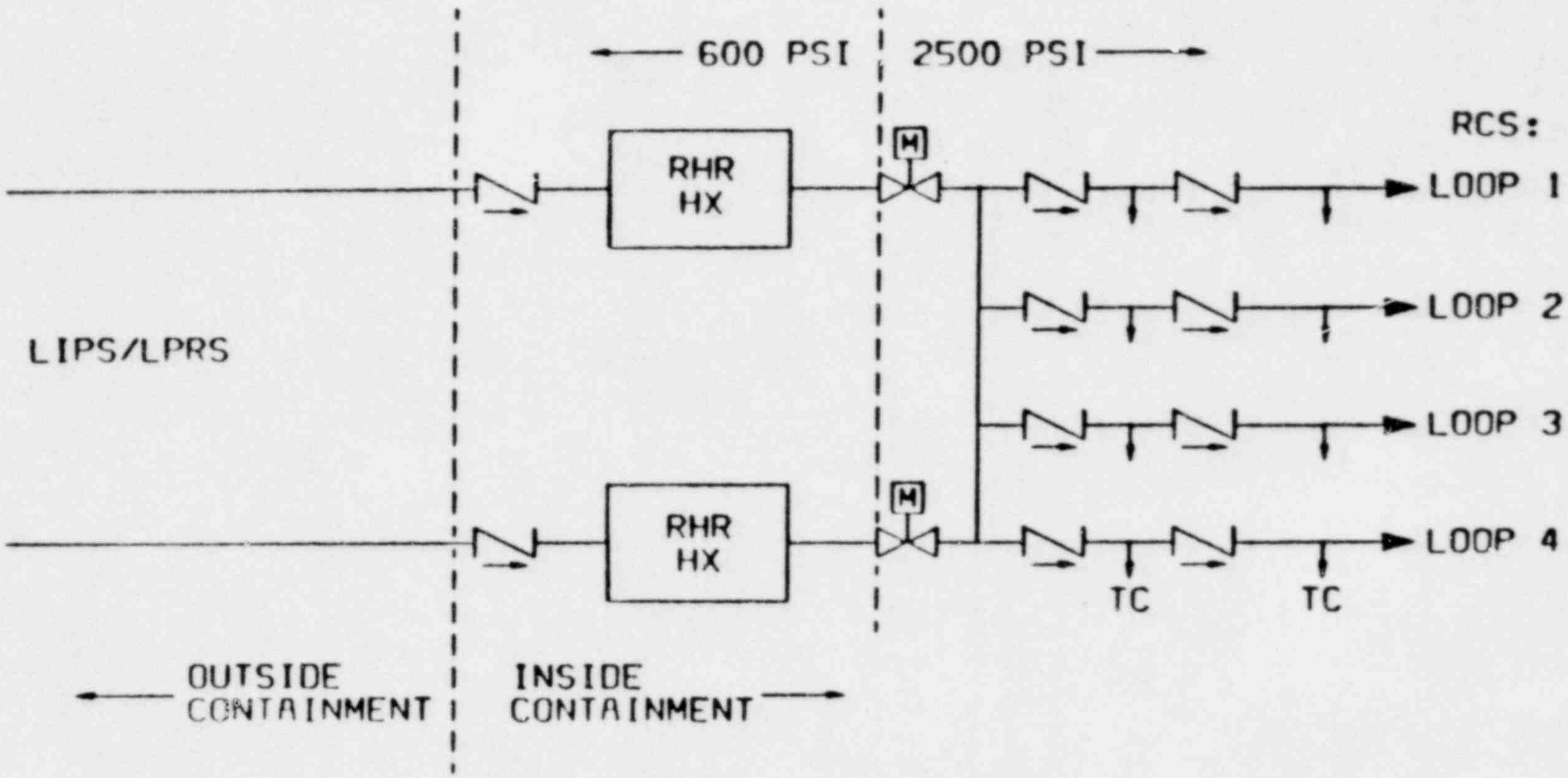


DIAGRAM OF INTERFACING CHECK VALVES

INTERFACING CHECK VALVE FAILURE PROBABILITY CALCULATION

The following calculation is based on the model and failure rates given in WASH-1400, Appendix V, Section 4.4, pp. V-43 and V-44.

Q_o = Failure of one check valve pair, one ordered double $= \frac{1}{2} \lambda_R \lambda_L t^2$

Q_1 = Failure of one check valve pair, two ordered doubles $= 2Q_o = \lambda_R \lambda_L t^2$

Q = Failure of any one of four check valve pairs $= 4Q_1 = 4\lambda_R \lambda_L t^2$

V = Failure of any one of four check valve pairs with blowdown outside containment $= 0.1Q = 0.4\lambda_R \lambda_L t^2$

λ_L = Failure rate from gross leakage $= 2.6 \times 10^{-3}$/yr

λ_R = failure rate from internal rupture $= 8.8 \times 10^{-5}$/yr

t = test interval = 9 mos = .75 yr.

$p(V) = 0.4(2.6 \times 10^{-3})(8.8 \times 10^{-5})(.75)^2 = 5.2 \times 10^{-8}$

CONTAINMENT FAILURE MODES

FAILURE MODE	THIS STUDY	WASH-1400
IN-VESSEL STEAM EXPLOSION (ALPHA)	10^{-3}, LARGE BREAKS 10^{-4}, SMALL BREAKS & TRANSIENTS	10^{-2}
FAILURE OF CONTAINMENT ISOLATION (BETA)	2×10^{-3}	2×10^{-3}
OVERPRESSURE FAILURE (GAMMA + DELTA)	0.1	0.1 TO 0.2 FOR NO SPRAY CASES 0.8 FOR TMLB $< 10^{-2}$ OTHER CASES
MELT THRU (EPSILON)	CASE 1: RESIDUAL ASSUMING TOTAL FAILURE PROBABILITY OF 1.0 CASE 2: 10^{-2}	RESIDUAL ASSUMING TOTAL FAILURE PROBABILITY OF 1.0

CATEGORIZATION OF SEQUENCES INTO RELEASE CATEGORIES

1a	1b	2	3	5	6	7
STEAM EXPLOSION + NO SPRAY						
LOW PRESSURE	HIGH PRESSURE	OVERPRESSURE NO SPRAY	STEAM EXPLO. WITH SPRAY	OVERPRESSURE WITH SPRAY	MELT-THRU NO SPRAY	MELT-THRU WITH SPRAY
AHF	S_1HF	AHF	AD	AD	AHF	AD
	S_2HF	S_1HF	AH	AH	S_1HF	AH
	TMLBB'(IP)	S_2HF	S_1D	S_1D	S_2HF	S_1D
		V	S_2D	S_2D	TMLBB'(IP)	S_2D
		TMLBB'(IP)	S_1H	S_1H		S_1H
			S_2H	S_2H		S_2H
			TMLBB'(ZION)	TMLBB'(ZION)		TMLBB' (ZION)
			TMLBB"	TMLBB"		TMLBB"

COMPARISON OF ACCIDENT SEQUENCE PROBABILITIES

SEQUENCE	PROBABILITY (PER YEAR)			
	ZION	IP-2	IP-3	WASH-1400
AD	5 X 10^{-7}	6 X 10^{-7}	5 X 10^{-7}	2 X 10^{-6}
AH	2 X 10^{-8}	1 X 10^{-7}	2 X 10^{-9}	1 X 10^{-6}
AHF	4 X 10^{-7}	3 X 10^{-7}	3 X 10^{-7}	1 X 10^{-10}
S_1D	5 X 10^{-7}	2 X 10^{-6}	1 X 10^{-6}	3 X 10^{-6}
S_1H	1 X 10^{-6}	1 X 10^{-6}	1 X 10^{-6}	3 X 10^{-6}
S_1HF	5 X 10^{-7}	1 X 10^{-7}	1 X 10^{-7}	4 X 10^{-10}
S_2D	5 X 10^{-7}	5 X 10^{-6}	4 X 10^{-6}	9 X 10^{-6}
S_2H	4 X 10^{-6}	4 X 10^{-6}	4 X 10^{-6}	6 X 10^{-6}
S_2HF	2 X 10^{-6}	4 X 10^{-7}	4 X 10^{-7}	1 X 10^{-9}
S_2C	N/A	N/A	N/A	2 X 10^{-6}
V	7 X 10^{-8}	3 X 10^{-10}	5 X 10^{-8}	4 X 10^{-6}
TMLBB'	1 X 10^{-8}	8 X 10^{-9}	8 X 10^{-9}	3 X 10^{-6}
TMLBB"	1 X 10^{-8}	8 X 10^{-9}	8 X 10^{-9}	3 X 10^{-6}

TABLE 3-1
CONTAINMENT FAILURE MODE PROBABILITIES AND RELEASE CATEGORIES FOR THE DOMINANT ACCIDENT SEQUENCES

SEQUENCE	CONTAINMENT FAILURE PROBABILITY AND (RELEASE CATEGORY)					
	α	β	γ	δ	ϵ (NOTE 1)	
					CASE 1	CASE 2
AD	10^{-3}(3)	2×10^{-3}(5)	0.1(5)	0	0.9(7)	.01(7)
AH	10^{-3}(3)	3×10^{-3}(5)	0.1(5)	0	0.9(7)	.01(7)
AHF	10^{-3}(1)	3×10^{-3}(5)	0.1(2)	0	0.9(6)	.01(6)
S_1D	10^{-4}(3)	2×10^{-3}(5)	0.1(5)	0	0.9(7)	.01(7)
S_1H	10^{-4}(3)	1.67×10^{-3}(5)	0.1(5)	0	0.9(7)	.01(7)
S_1HF	10^{-4}(1)	1.67×10^{-3}(5)	0.1(2)	0	0.9(6)	.01(6)
S_2D	10^{-4}(3)	2.2×10^{-3}(5)	0.1(5)	0	0.9(7)	.01(7)
S_2H	10^{-4}(3)	1.67×10^{-3}(5)	0.1(5)	0	0.9(7)	.01(7)
S_2HF	10^{-4}(1)	1.67×10^{-3}(5)	0.1(2)	0	0.9(6)	.01(6)
V						
TMLBB	10^{-4}(3)		.24(5)	0	.76(7)	.76(7)
TMLBB' (Zion)	10^{-4}(3)		.24(5)	.56(5)	.2 (7)	.2 (7)
TMLBB' (I.Point)	10^{-4}(1)		.24(2)	.56(2)	.2 (6)	.2 (6)

Note (1)

Case 1: $P(\epsilon) = 1 - \sum P(\text{Others})$

Case 2: $P(\epsilon) = .01$, except for TMLB sequences. For TMLB sequences, P(E) is the same as in Case 1.

SUMMARY OF PROBABILITY ESTIMATES: INDIAN POINT - 3

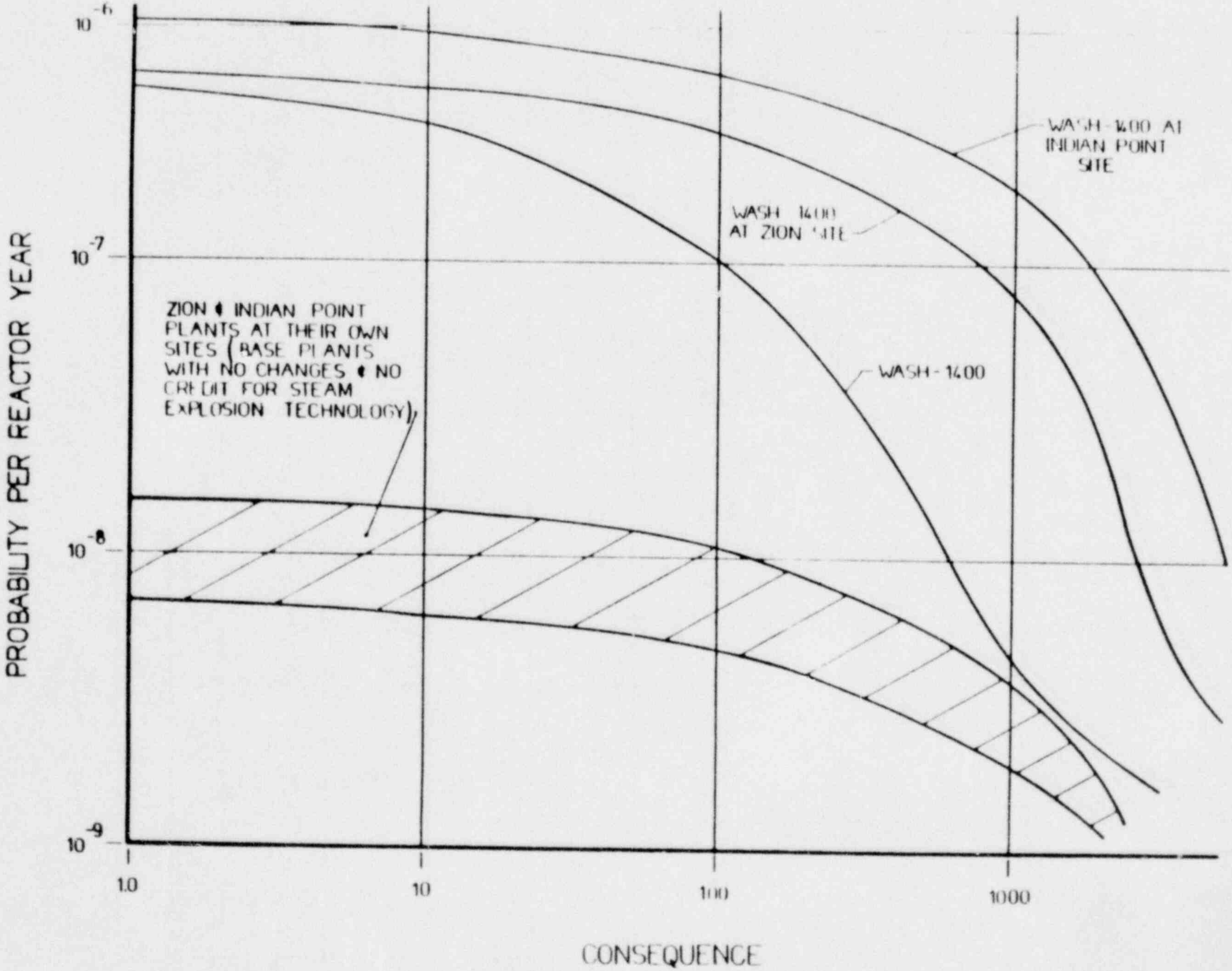
Sequence \ Release Category	1	2	3	4	5	6	7
AD			5.4(-10)α		1.1(- 9)β 5.4(- 8)γ		4.9(- 7)ε
AH			1.6(-12)α		4.8(-12)β 1.6(-10)γ		1.4(- 9)ε
AHF	3.0(-10)α	3.0(- 8)γ			9.0(-10)β	2.7(- 7)ε	
S_1D			1.4(-10)α		2.8(- 9)β 1.4(- 7)γ		1.3(- 6)ε
S_1H			1.2(-10)α		2.0(- 9)β 1.2(- 7)γ		1.1(- 6)ε
S_1HF	1.1(-11)α	1.1(- 8)γ			1.8(-10)β	1.0(- 7)ε	
S_2D			3.6(-10)α		7.9(- 9)β 3.6(- 7)γ		3.2(- 6)ε
S_2H			4.0(-10)α		6.7(- 9)β 4.0(- 7)γ		3.6(- 6)ε
S_2HF	3.6(-11)α	3.6(- 8)γ			6.0(-10)β	3.2(- 7)ε	
V		5.2(- 8)					
TMLBB'			8.0(-13)α		1.9(- 9)γ		6.1(- 9)ε
TMLBB'	8.0(-13)α	1.9(- 9)γ 4.5(- 9)δ				1.6(- 9)ε	
Total Category Probability	3.5(-10)	1.4(- 7)	1.6(- 9)		1.1(- 6)	6.9(- 7)	9.7(- 6)

SUMMARY OF RELEASE CATEGORY
PROBABILITY ESTIMATES (FOR CASE 1)

PLANT \ RELEASE CATEGORY	1	2	3	4	5	6	7
INDIAN POINT - 2	3.5(-10)	8.5(-8)	1.9(-9)	-	1.3(-6)	7.0(-7)	1.1(-5)
INDIAN POINT - 3	3.5(-10)	1.4(-7)	1.6(-9)	-	1.1(-6)	6.9(-7)	9.7(-6)
ZION	6.4(-10)	3.2(-7)	1.2(-9)	-	6.8(-7)	2.2(-6)	6.1(-6)
WASH-1400 PWR	2.8(-8)	4.6(-6)	2.3(-6)	-	3.8(-8)	1.4(-7)	2.9(-5)

PRINCIPAL DESIGN DIFFERENCES
IMPORTANT IN THE DOMINANT SEQUENCES

DESIGN FEATURE	PLANT APPLICABILITY			
	ZION	IP-2	IP-3	WASH-1400 PWR
DIESEL SPRAY PUMP	X			
CONTAINMENT FAN COOLERS	X	X	X	
PARALLEL LOW PRESSURE RECIRC. SUBSYSTEMS		X	X	
THREE VS TWO DIESELS	X	X	X	
GAS TURBINES		X	X	
CHECK VALVE TEST CONNECTIONS	X	X	X	
CTMT. SPRAY RECIRC. SEPARATE FROM ECCS RECIRC.				X



PROBABILITY PER REACTOR YEAR
10^{-6}
10^{-7}
10^{-8}
10^{-9}
1.0
10
100
1000
CONSEQUENCE
WASH-1400 AT INDIAN POINT SITE
WASH 1400 AT ZION SITE
WASH-1400
ZION & INDIAN POINT PLANTS AT THEIR OWN SITES (BASE PLANTS WITH NO CHANGES & NO CREDIT FOR STEAM EXPLOSION TECHNOLOGY)

SUMMARY OF MAN-REM CONSEQUENCE
AND RISK RESULTS BY RELEASE CATEGORY

		1a	1b	2	3	5	6	7
INDIAN PT.2	Consequence Per Event	4.8(7)	2.1(7)	2.9(7)	3.0(7)	2.9(6)	2.7(5)	4.4(3)
	Risk Per Year	1.4(-2)	1.1(-3)	2.5	5.7(-2)	3.8	1.9(-1)	4.8(-2)
INDIAN PT.3	Consequence Per Event	4.8(7)	2.1(7)	2.9(7)	3.0(7)	2.9(6)	2.7(5)	4.4(3)
	Risk Per Year	1.4(-2)	1.0(-3)	4.1	4.8(-2)	3.2	1.9(-1)	4.3(-2)
ZION	Consequence Per Event	1.8(7)	1.2(7)	1.6(7)	1.9(7)	2.6(6)	3.2(5)	5.9(3)
	Risk Per Year	7.7(-3)	2.5(-3)	5.1	2.3(-2)	1.8	0.7	3.6(-2)
WASH-1400	Consequence Per Event	2.8(6)		3.1(6)	1.4(6)	7.0(4)	7.5(3)	1.3(2)
	Risk Per Year	7.8(2)		1.4(1)	3.2	2.7(-3)	1.1(-3)	3.8(-3)

SUMMARY

IMPORTANT CONTRIBUTORS TO RISK FOR INDIAN POINT & ZION

	TYPE OF SEQUENCE - CONTAINMENT FAILURE MODE CONTRIBUTION	REPRESENTATIVE SEQUENCES
MAJOR	CONTAINMENT OVERPRESSURE FAILURE WITHOUT SPRAYS. FAILURE RESULTING FROM PRESSURE SPIKES (HYDROGEN BURN OR RAPID STEAM GENERATION)	AHF-GAMMA S_1HF-GAMMA
INTERMEDIATE	CONTAINMENT OVERPESSURE FAILURES WITH SPRAYS INTERFACING CHECK VALUE FAILURES (PERHAPS) TMLB' WITH OVERPRESSURE FAILURE (PERHAPS)	AH-GAMMA AD-GAMMA S_1D-GAMMA S_2D-GAMMA V(?) TMLB(?)
MINOR	INTERFACING CHECK VALVE FAILURES (PERHAPS) TMLB' WITH OVERPRESSURE FAILURE (PERHAPS) ALL STEAM EXPLOSION SEQUENCES ALL CONTAINMENT ISOLATION FAILURE	V(?) TMLB(?) ALPHA MODE ALPHA MODE

NRC SEQUENCES FOR Z/IP MITIGATING SYSTEMS DESIGN

SEQUENCE		
AB-BURN	LARGE BREAK, LOSS OF AC POWER EARLY AND RAPID HYDROGEN BURN	o LOW PROBABILITY o UNNECESSARILY HIGH AMBIENT PRESSURE AT TIME OF BURN o UNNESSARILY CONSERVATIVE DESIGN CONDITIONS
S_2D-BURN	SMALL BREAK, LOSS OF INJECTION, RAPID HYDROGEN BURN	o REALISTIC SEQUENCE o S_2HF SHOULD ALSO BE CONSIDERED
S_2C	SMALL BREAK, LOSS OF CONTAINMENT SPRAY INJECTION	o NOT AN APPRPROPRIATE SEQUENCE FOR IP AND ZION
A-VENT	LARGE BREAK, LOSS OF CONTAINMENT INTEGRITY	o NOT A CORE MELT SEQUENCE
TMLB' TMLB"	LOSS OF AC POWER, LOSS OF HEAT SINK, LONG-TERM POWER LOSS (B') OR SOME POWER RECOVERY (B'')	o INTERMEDIATE - LOW RISK CONTRIBUTION o BOTH PROBABILITY AND MITIGATION SHOULD BE CONSIDERED. o UTILIZED IN PRESENT SYSTEM EFFECTIVENESS EVALUATIONS

SUGGESTED SEQUENCES FOR DESIGN

LARGE BREAK	AD OR AHF
SMALL BREAK	S_1D OR S_2D
	S_1H OR S_1HF
TRANSIENTS	DO NOT UTILIZE AS PART OF DESIGN BASIS BECAUSE OF SMALL RISK CONTRIBUTION

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