Enclosure 2

VIEWGRAPHS PRESENTED BY PAS

TO THE

ACRS SUBCOMMITTEE ON TMI-2

OCTOBER 3, 1979

8007110490

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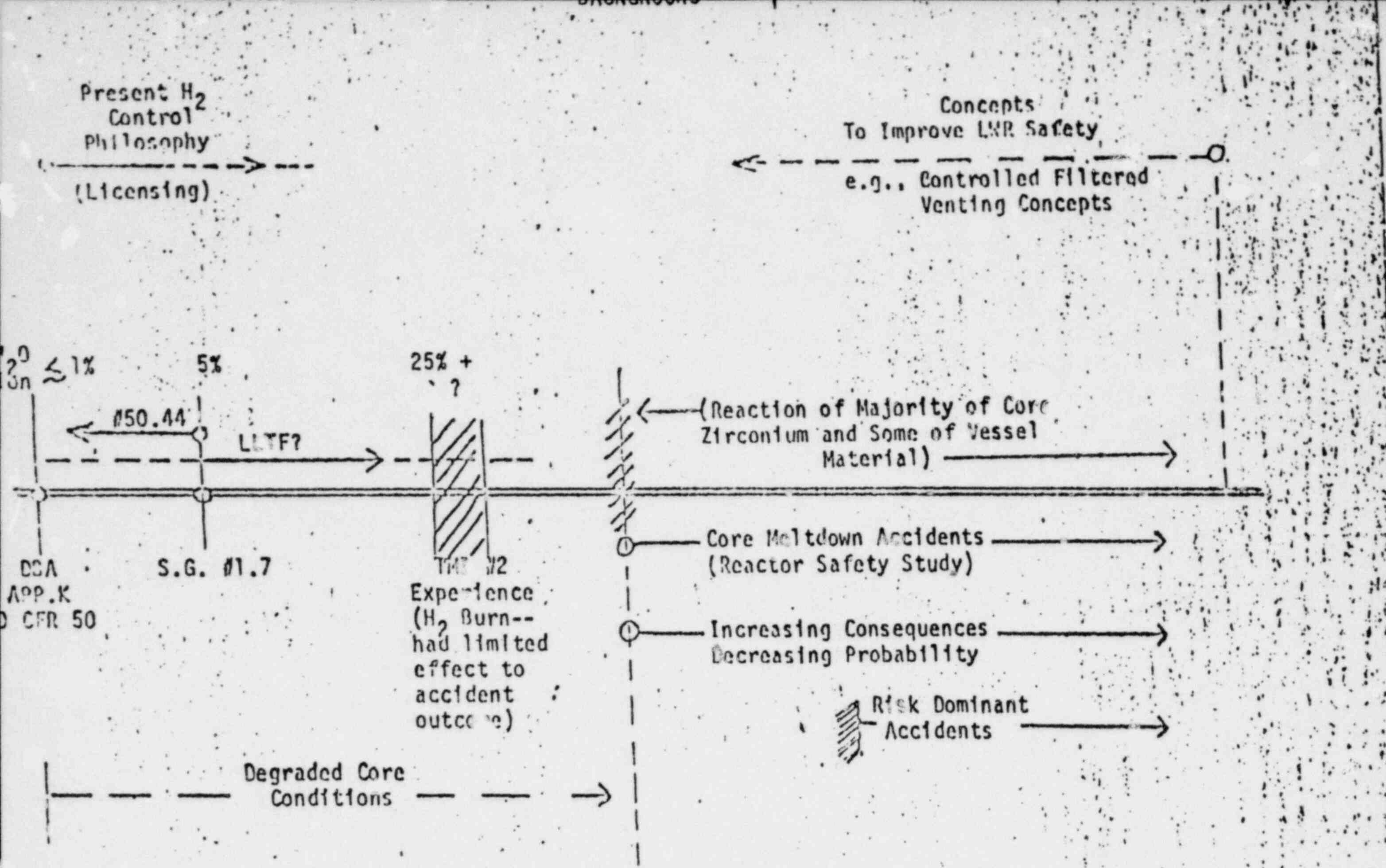
PRESENTATIONS TO ACRS SUBCOMMITTEE ON TMI #2

✓ o RISK-BASED INSIGHTS ABOUT POST-ACCIDENT HYDROGEN AND CONTAINMENT FAILURE MODES	PAS/RES
o RECENT WORK/ANALYSES ON STEAM EXPLOSIONS AND HYDROGEN	BCL
o STATUS OF RESEARCH PROGRAM ON CONTROLLED FILTERED VENTING OF CONTAINMENT	PAS/RES

#1

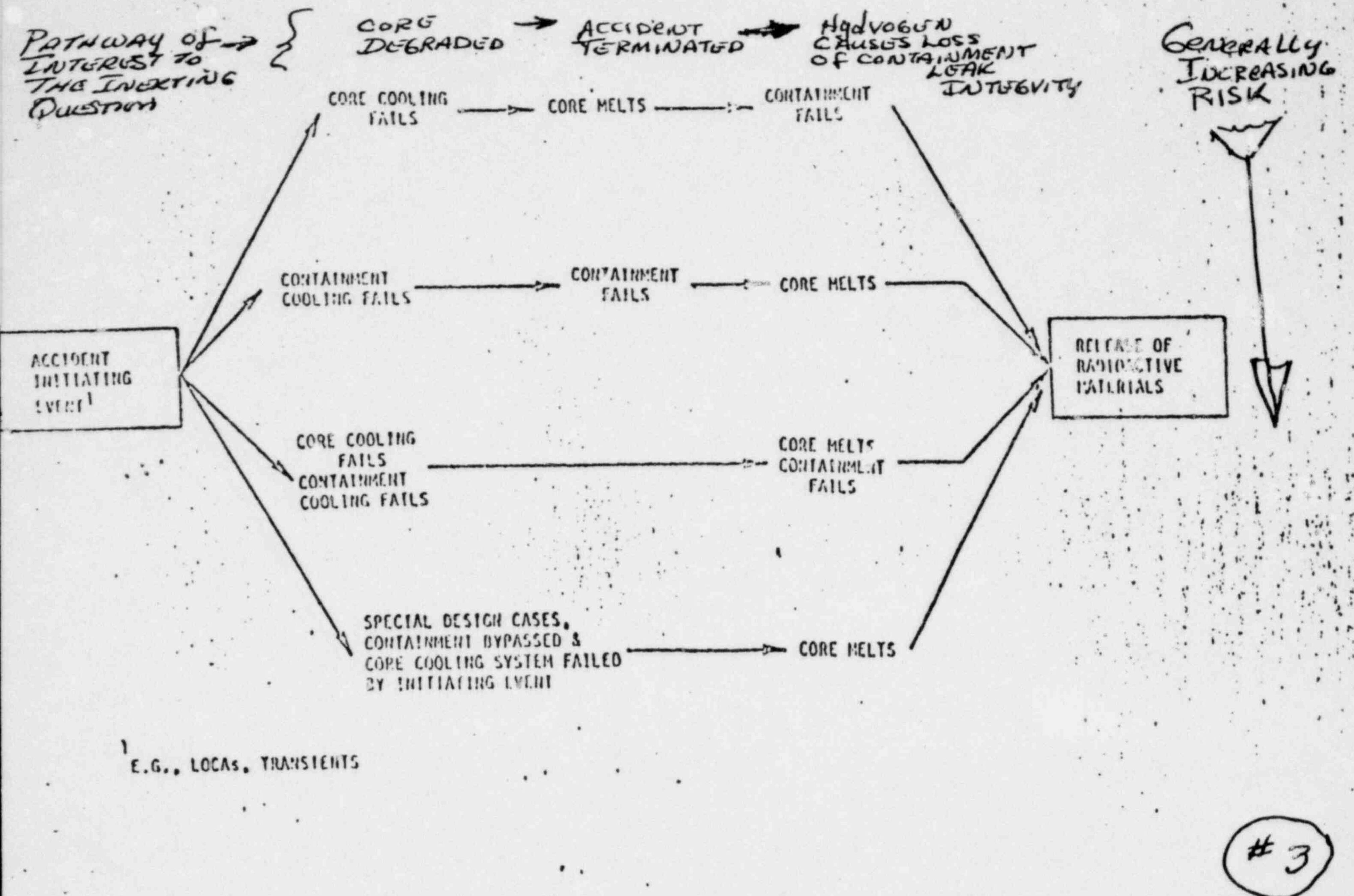


Reactor Safety Study Insights Can Be Useful to H_2 Control Questions.

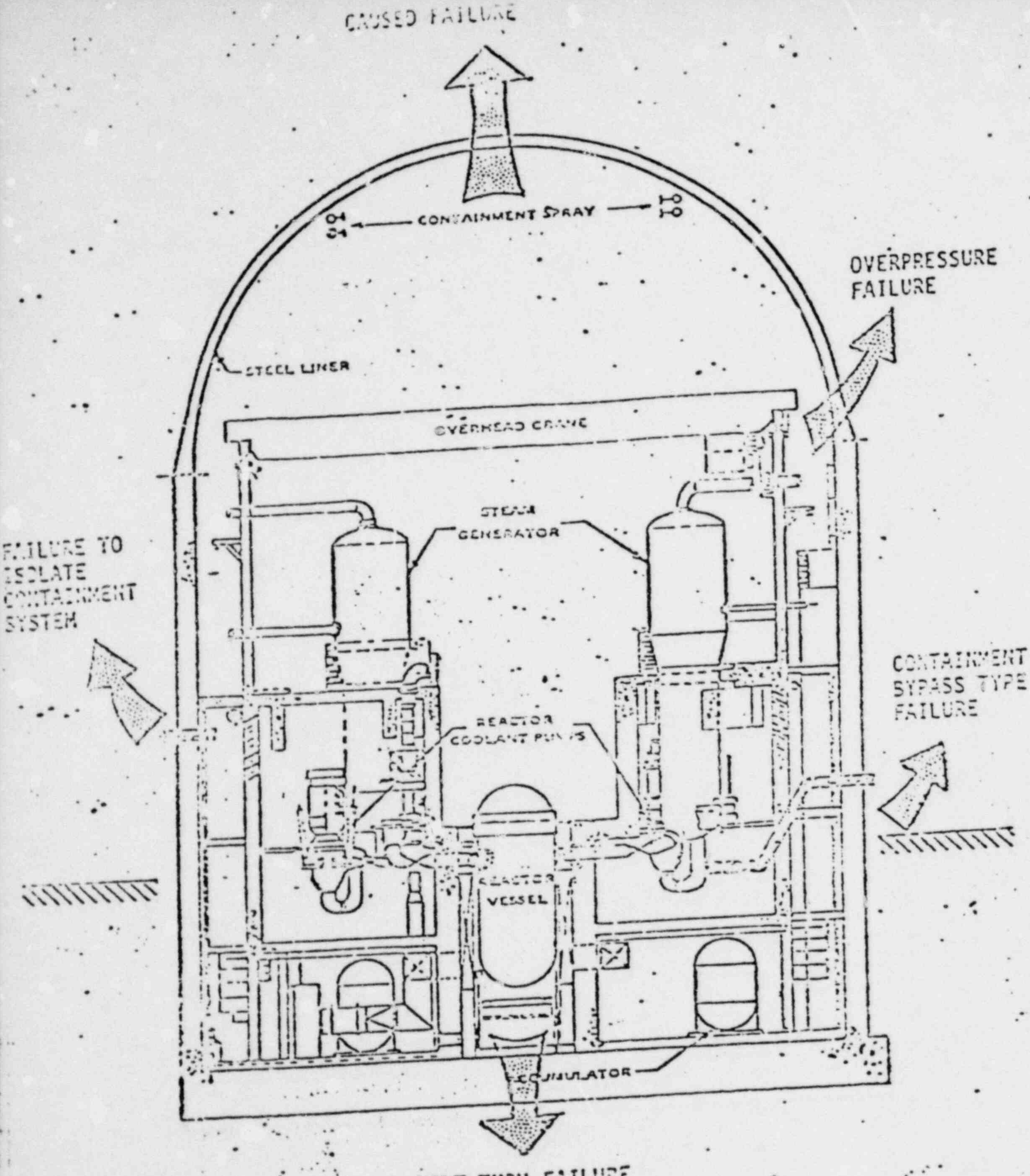
- Core Melt Accidents Most Likely to Occur from Transient and Small LOCA initiated Events.
- H_2 is But One Pathway to Containment Failure and Decisions on H_2 Control Should Be Considered in Suc Context.

#2

PRINCIPAL ACCIDENT SEQUENCES

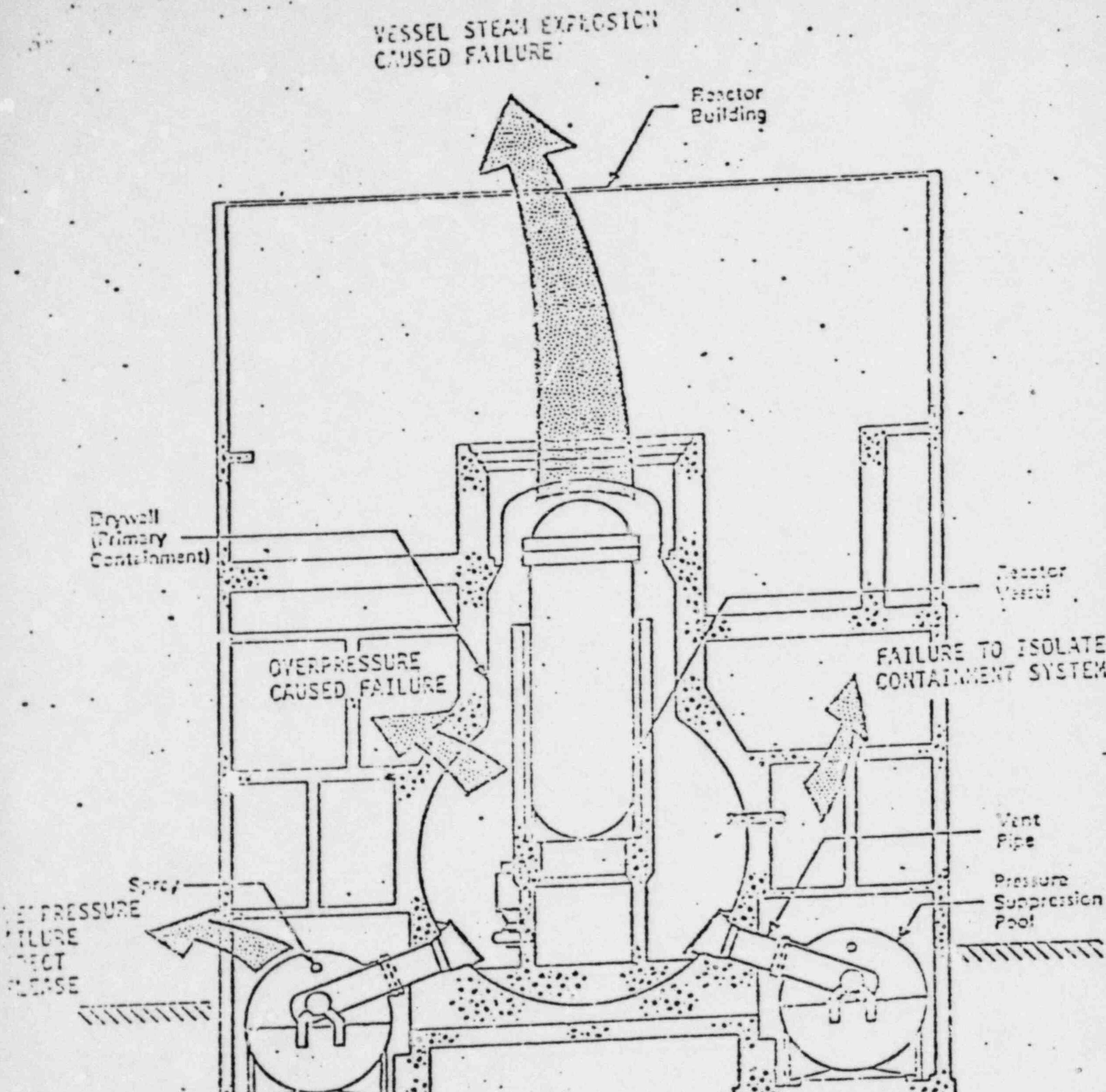


[1] E.G., LOCAs, TRANSIENTS



PWR CONTAINMENT

(#4)



TYPICAL BWR CONTAINMENT

RISK CONTRIBUTIONS FROM CORE-MELT ACCIDENTS

RELEASE CATEGORIES		APPROX. RISK CONTRIBUTION % EARLY DEATHS	APPROX. RISK CONTRIBUTION % LATENT DEATHS
CORE MELT	PWR 1	35	9
	PWR 2	40	46
	PWR 3	24	39
		(~100)	(~94)
	PWR 4		
	PWR 5		
	PWR 6		
	PWR 7		
	PWR 8		
	PWR 9		
CORE MELT	BWR 1	93	9
	BWR 2	7	32
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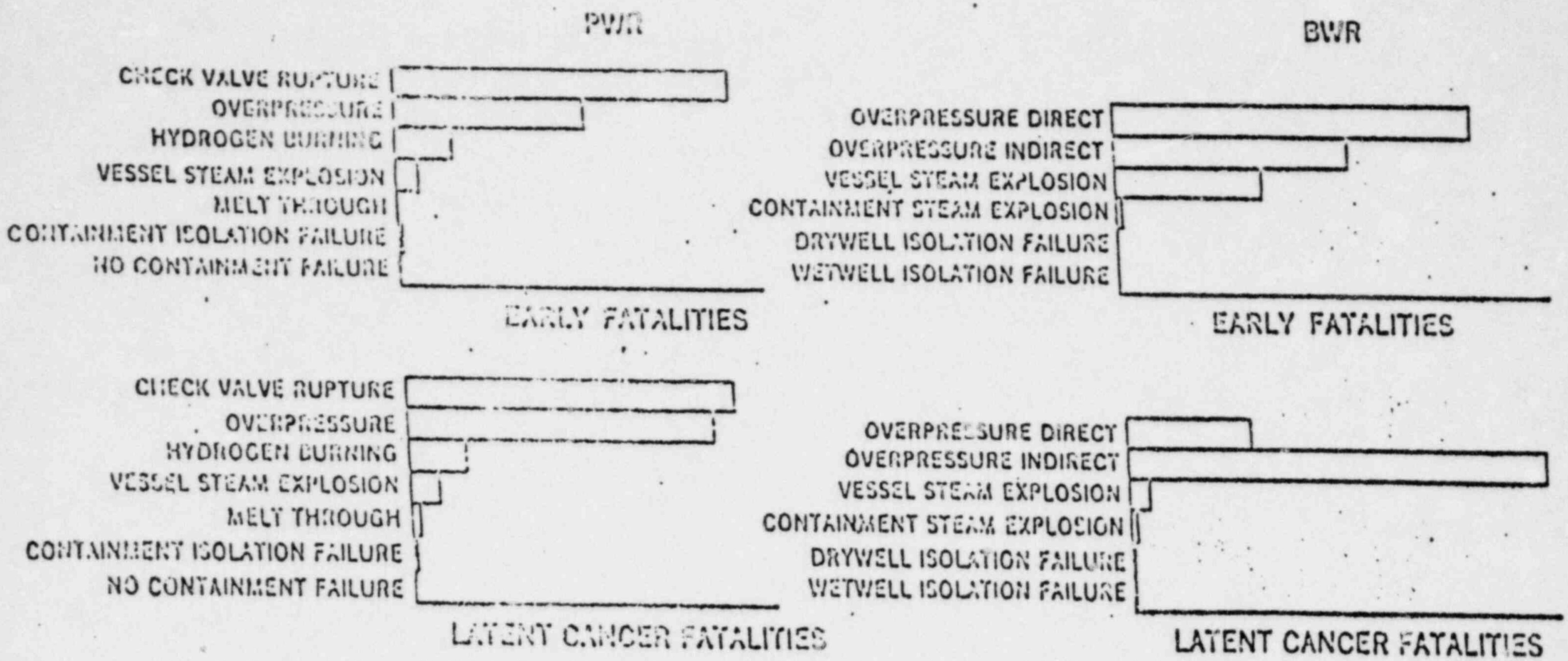
		(~100)	(~100)
	BWR 4		
	BWR 5		

BASIS: LWR DESIGNS IN WASH-1400

#6

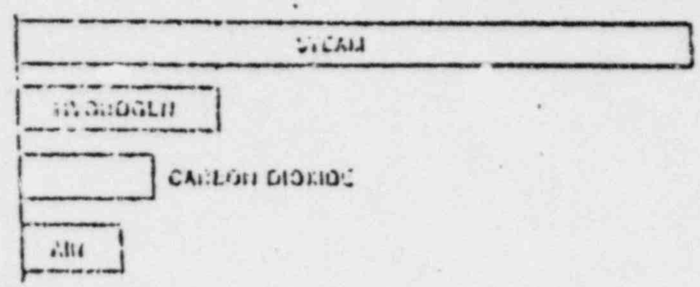


Relative Importance of Containment Failure Modes

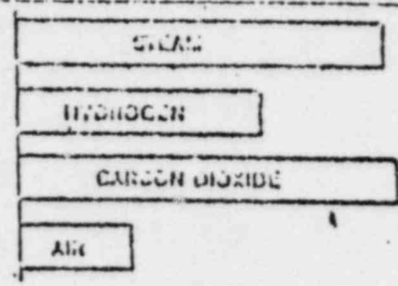
#7

BASIS: LWR DESIGNS IN WASH-1400

RELATIVE CONTRIBUTIONS TO PWR CONTAINMENT FAILURE PRESSURE



RELATIVE CONTRIBUTIONS TO BWR CONTAINMENT FAILURE PRESSURE



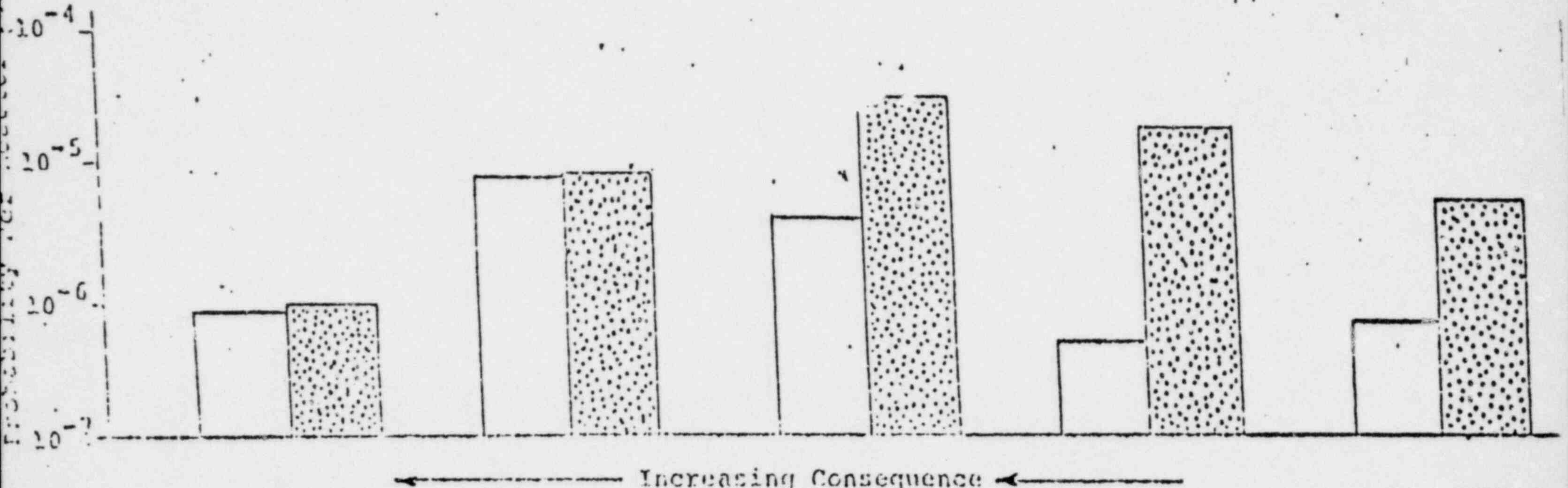
NOTE: Subsequent Studies Reveal that Steam is more Dominant than WASH 1400 indicated.

BASIS: LWR DESIGNS IN WASH-1400

#8

Comparison of Dominant Accident Sequences: RSS PWR and Ice Condenser PWR

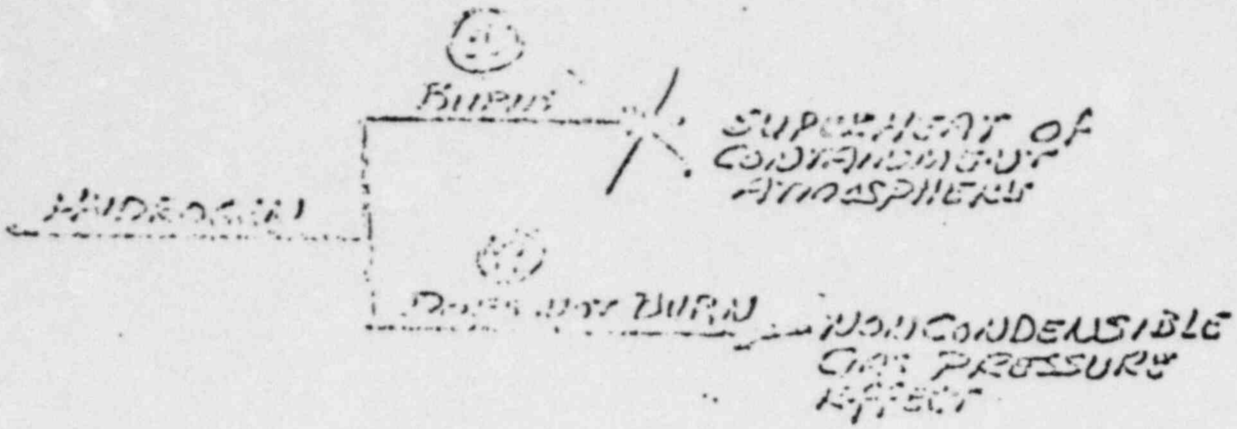
Category 1		Category 2		Category 3		Category 4		Category 5	
RSS	IC	RSS	IC	RSS	IC	RSS	IC	RSS	IC
None	$S_1H-\alpha$	V	$S_2HF-\gamma$	$S_2C-\delta$	$S_2H-\gamma$	None	$S_1H-\gamma$	None	$S_1D-\gamma$
Dominant	1×10^{-7}	4×10^{-6}	5×10^{-6}	2×10^{-6}	2×10^{-5}	Dominant	1×10^{-5}	Dominant	4×10^{-6}
		TMLB'-δ	V		$S_1HF-\gamma,\delta$		$S_2D-\gamma$		
		3×10^{-6}	9×10^{-7}		3×10^{-6}		$.6 \times 10^{-6}$		
		TMLB'-γ			TML-γ				
		7×10^{-7}			3×10^{-6}				

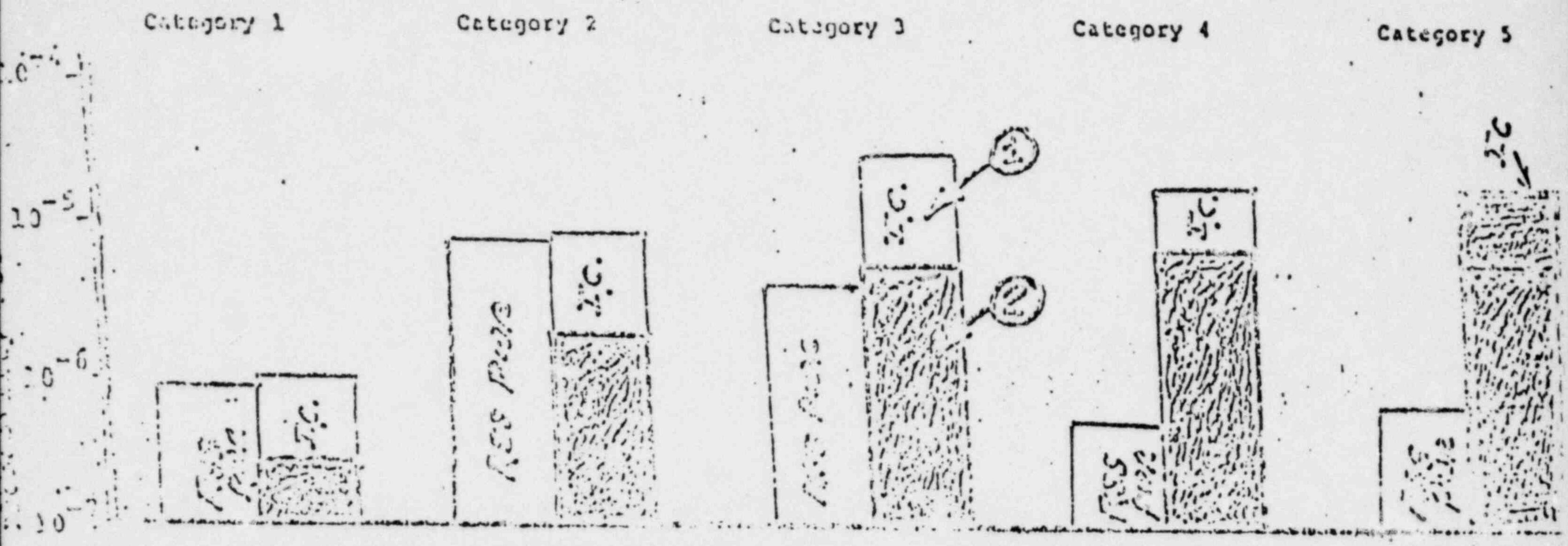


δ ≡ Steam overpressure failure
γ ≡ Steam + Hydrogen burn overpressure failure

#9

CONCEPTUAL EFFECT OF PREVENTING H_2 BURN IN ICE CONDENSER CONTAINMENT





← Increasing Consequence ←

RSS PWR and Ice Condenser PWR

#10

PERSPECTIVES ON RSS-BWR DESIGN

(BWR 4, MARK 1 CONTAINMENT, INERTED)

CONTAINMENT OVERPRESSURE FAILURE SCENARIOS	ACCIDENT PROCESS PREDICTIONS*			POTENTIAL CONCEPTUAL VALUE: POTENTIAL RISK IMPACT OF SCENARIO	INERTING	CONTROLL[ED] VENT FILTE[R]
Transient followed by failure to shutdown, ATWS (TC)	CONT. FAILS ~77 MIN.	MELT STARTS ~100 MIN.	MELT ENDS ~144 MIN.	Large (Dominant) Sequence	Negligible	Small to Modera[te]
Transient followed by failure of shutdown heat removal system (TW)	CONT. FAILS ~2820 MIN.	MELT STARTS ~3260 MIN.	MELT ENDS ~3390 MIN.	Large (Dominant) Sequence	Negligible	Modera[te] to Large
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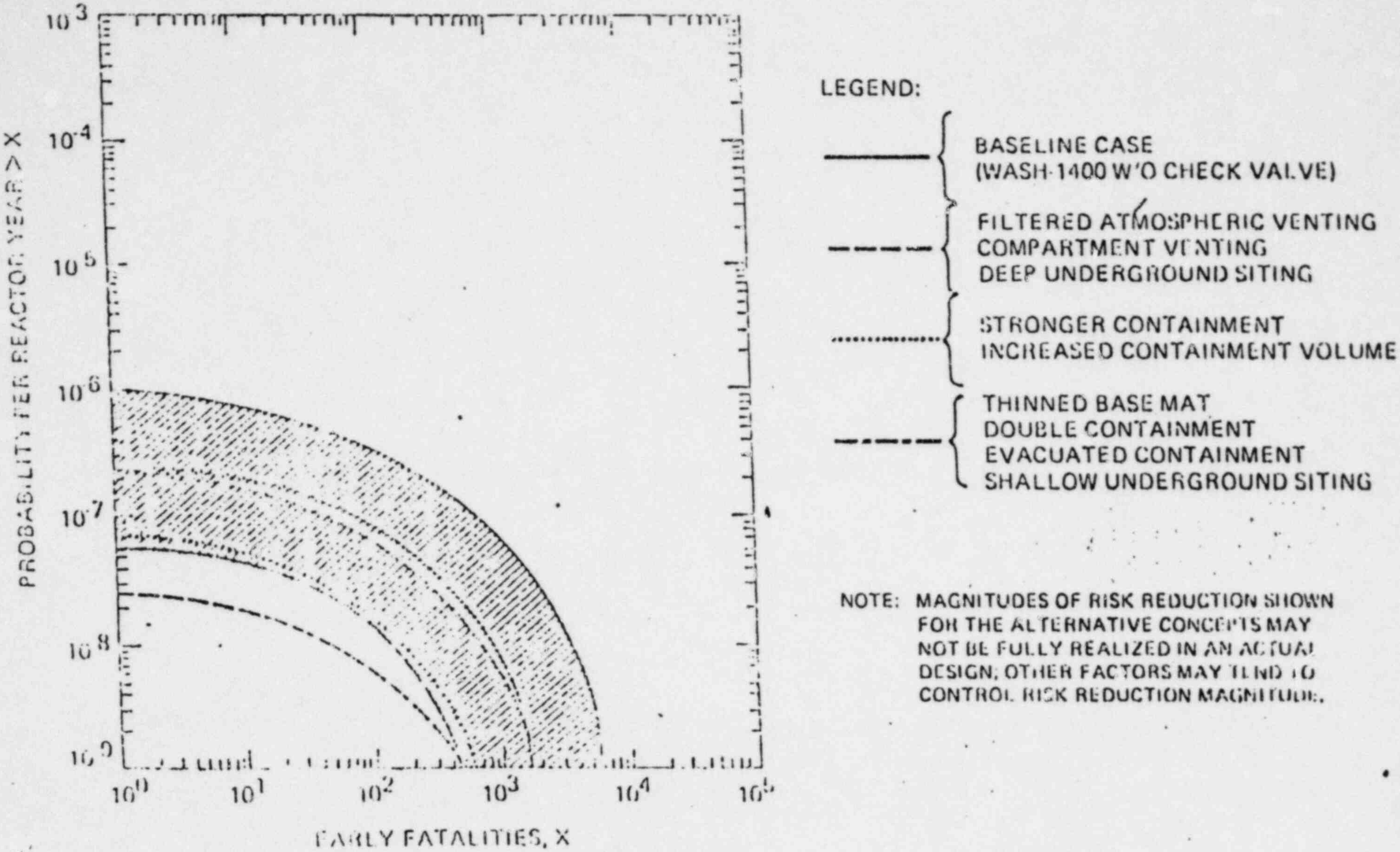
Small LOCA followed by failure to provide makeup water (S_2E)	START MELT ~57 MIN.	END MELT ~102 MIN.	CONT. FAILS ~[illegible] MIN.	Medium to Small	Small	Small to Modera[te]

*MARCH/CORRAL: BCL Accident Process Modeling

#11

ALTERNATE CONTAINMENT CONCEPTS MAY SIGNIFICANTLY REDUCE RISKS FROM NUCLEAR ACCIDENTS



NOTE: MAGNITUDES OF RISK REDUCTION SHOWN FOR THE ALTERNATIVE CONCEPTS MAY NOT BE FULLY REALIZED IN AN ACTUAL DESIGN; OTHER FACTORS MAY TEND TO CONTROL RISK REDUCTION MAGNITUDE.

SOME CONCLUDING OBSERVATIONS

- INERTING APPEARS TO HAVE SMALL VALUE IN REDUCING OVERALL ACCIDENT RISKS. IN SOME CASES, REDUCING ACCIDENT SEQUENCE PROBABILITY APPEARS TO HAVE EQUAL OR GREATER VALUE.
- LARGER, HIGH DESIGN PRESSURE CONTAINMENTS ARE LESS SENSITIVE TO THE EFFECTS OF HYDROGEN.
- H_2 CONTROL MEASURES THAT MAY BE ADOPTED PURSUANT TO TMI #2 SHOULD HAVE BENEFIT OF OVERALL RISK-BASED INSIGHTS AND CONTEXT.
- WASH-1400 EMPHASIZED CORE MELTDOWN ACCIDENTS; THE RISK REDUCTION BENEFITS OF CURRENT LICENSING H_2 CONTROL MEASURES FOR SUCH ACCIDENTS APPEAR SMALL.
- RESEARCH ON IMPROVED LWR SAFETY CONCEPTS, E.G., CONTROLLED FILTERED VENTING SHOULD CONTINUE WITH PRIORITY SINCE SUCH CONCEPTS APPEAR TO HAVE RISK REDUCTION BENEFIT AND LOW-COST IMPACTS.

OCTOBER 3, 1979

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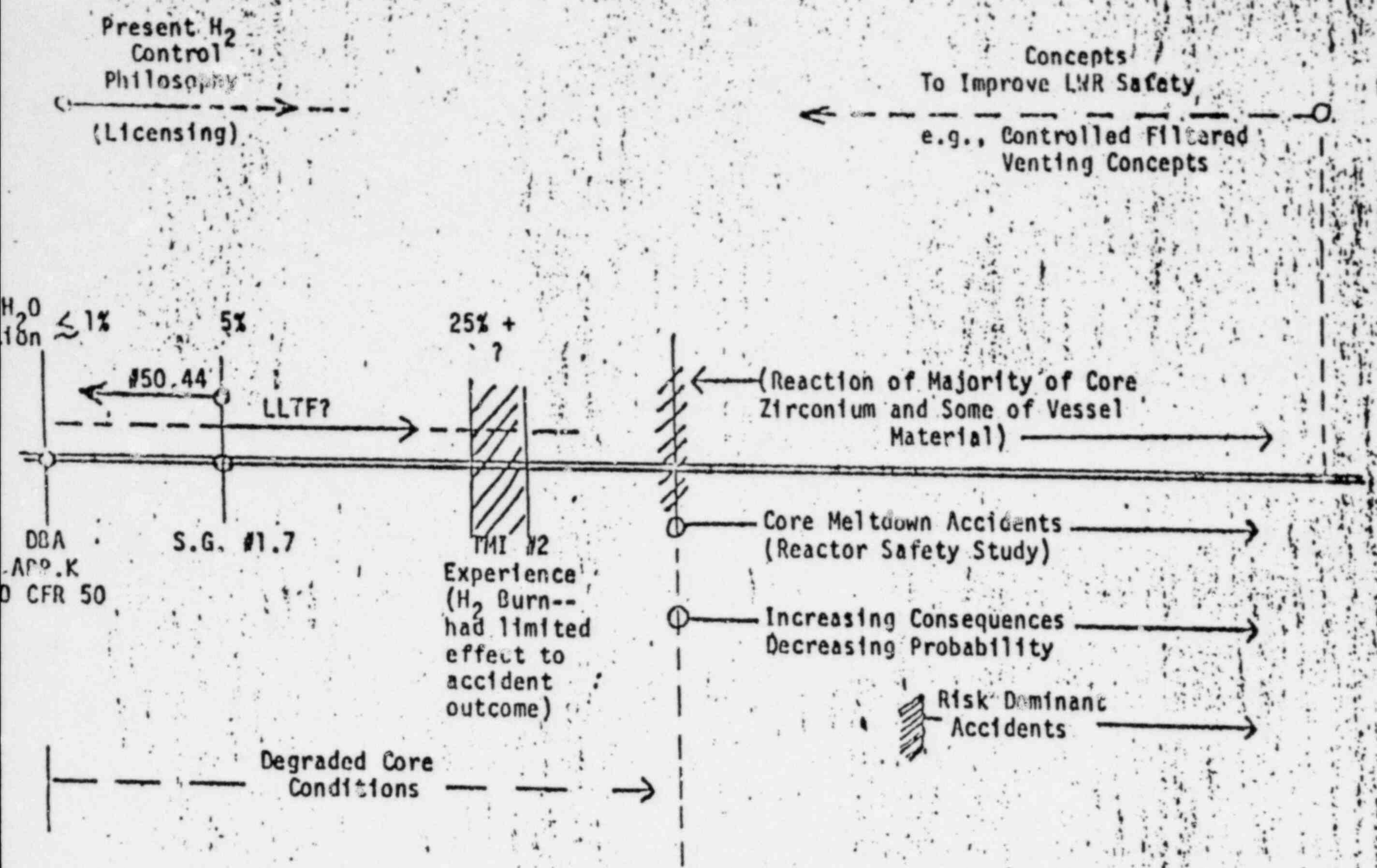
BACKGROUND



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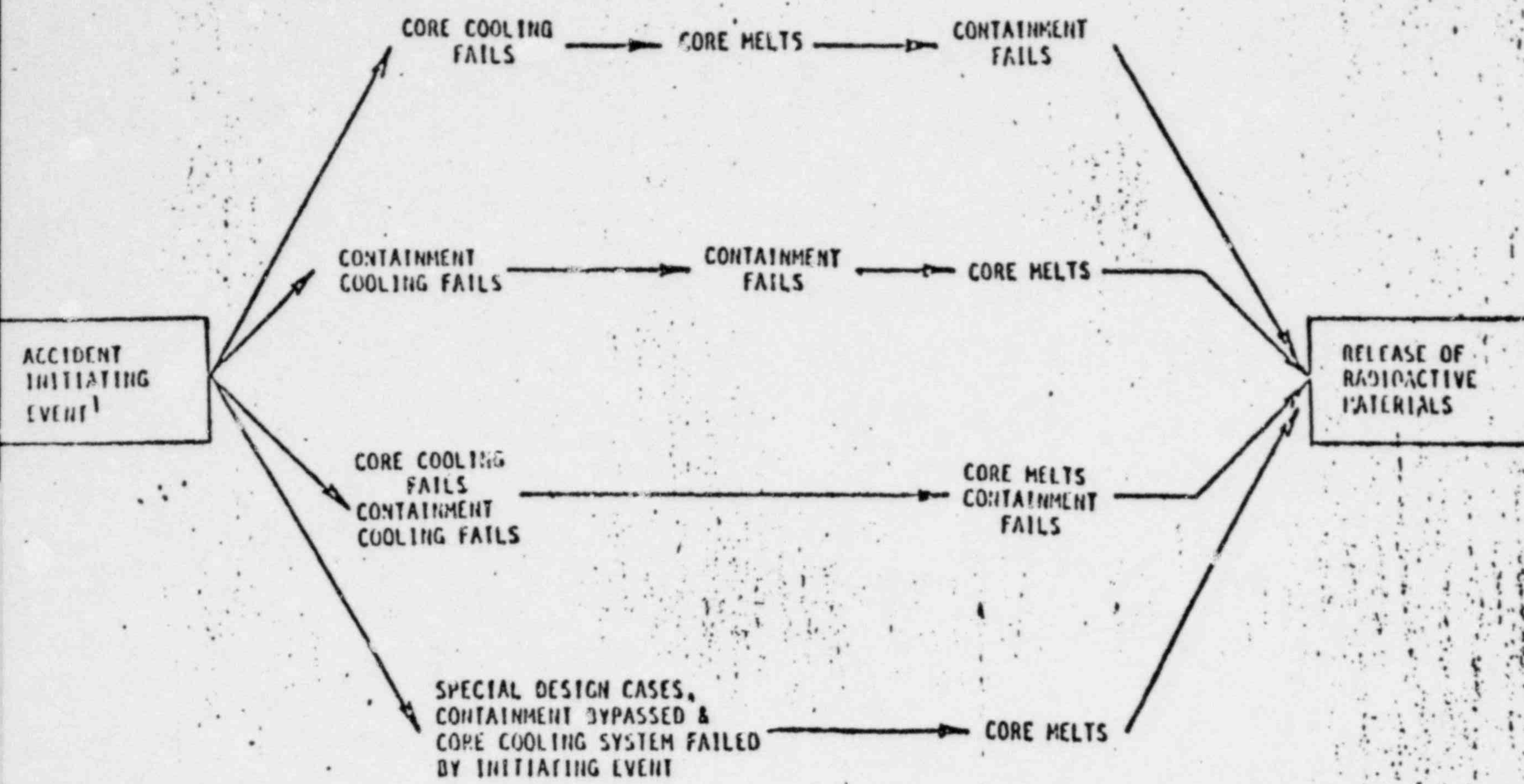

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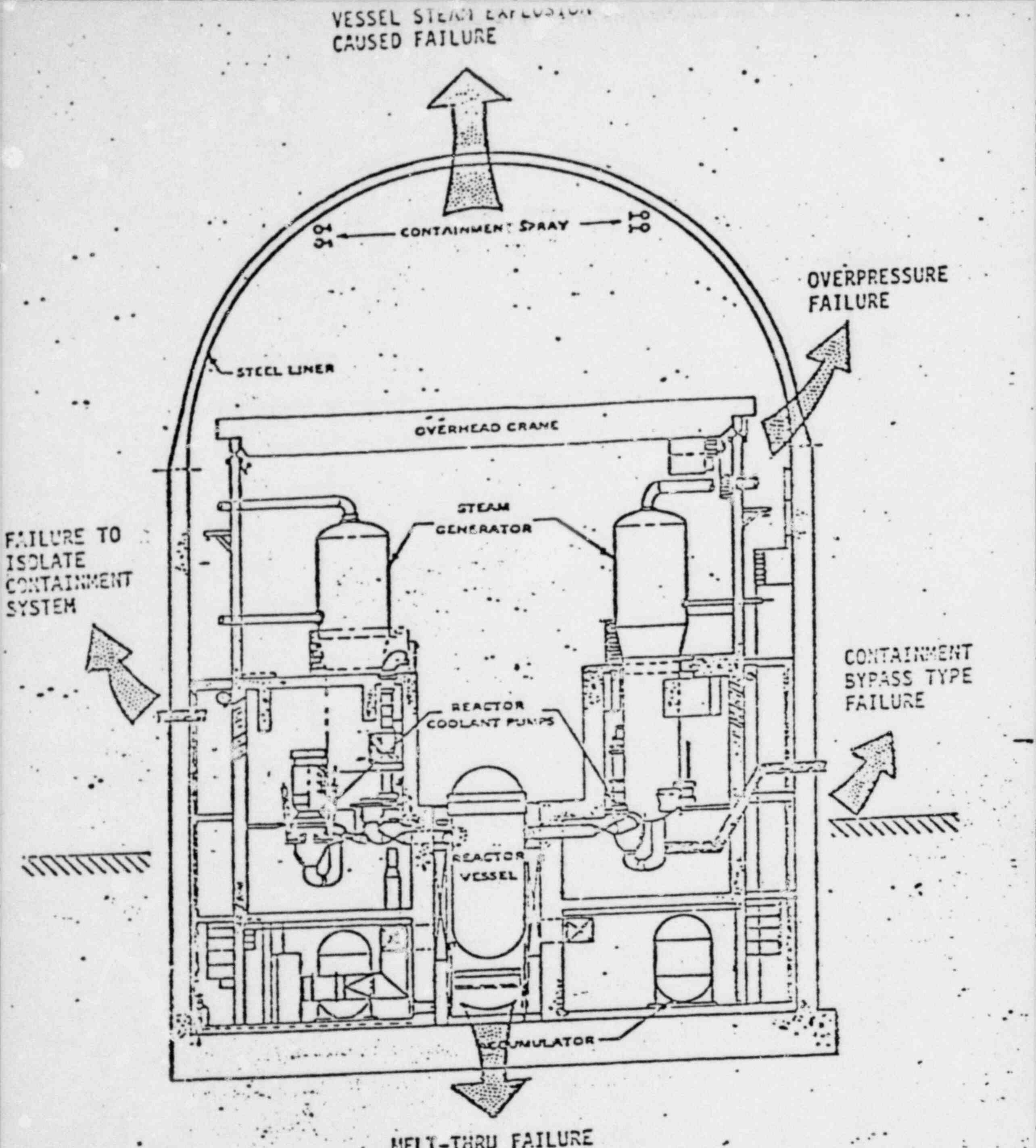
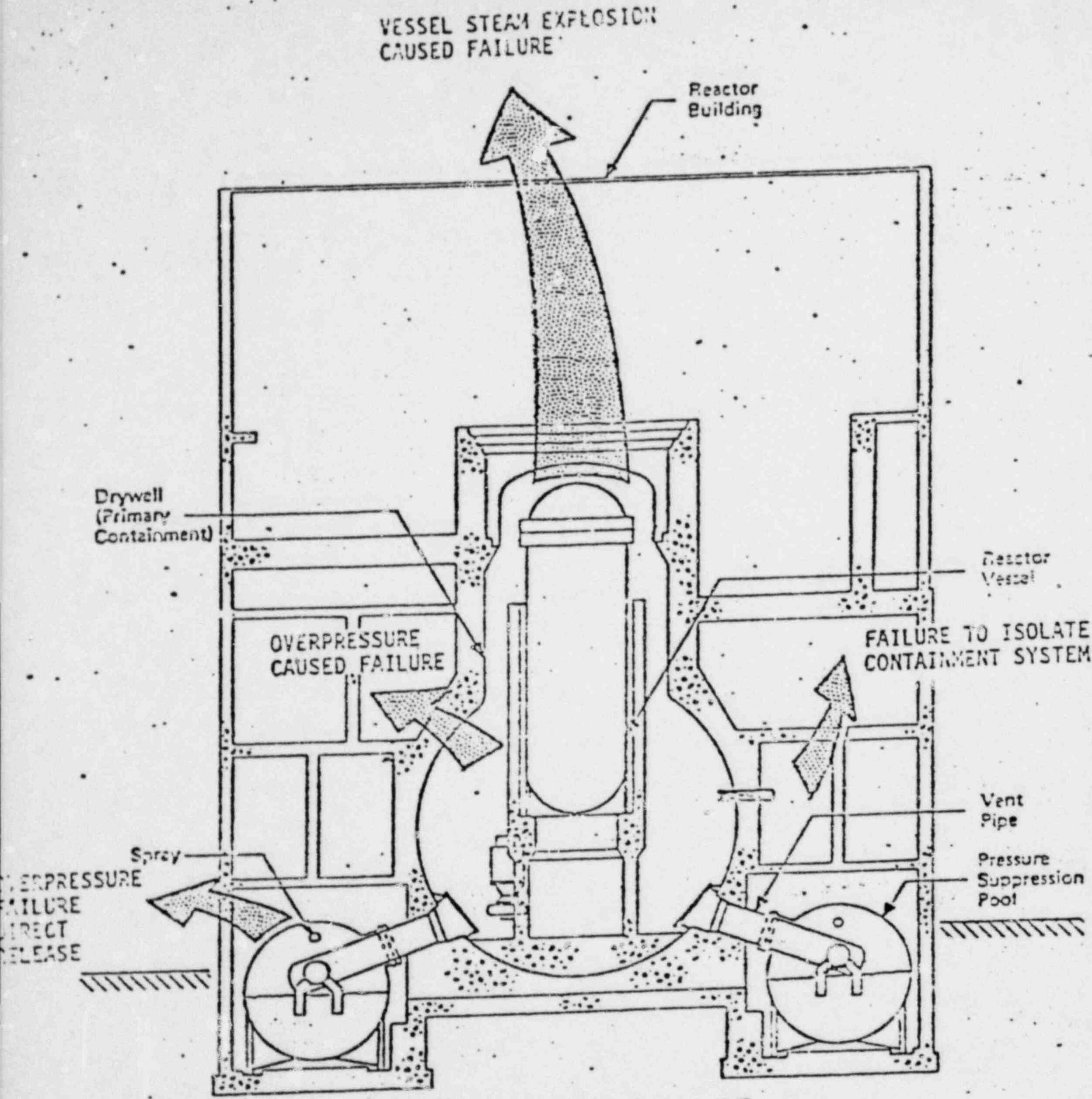


PWR CONTAINMENT



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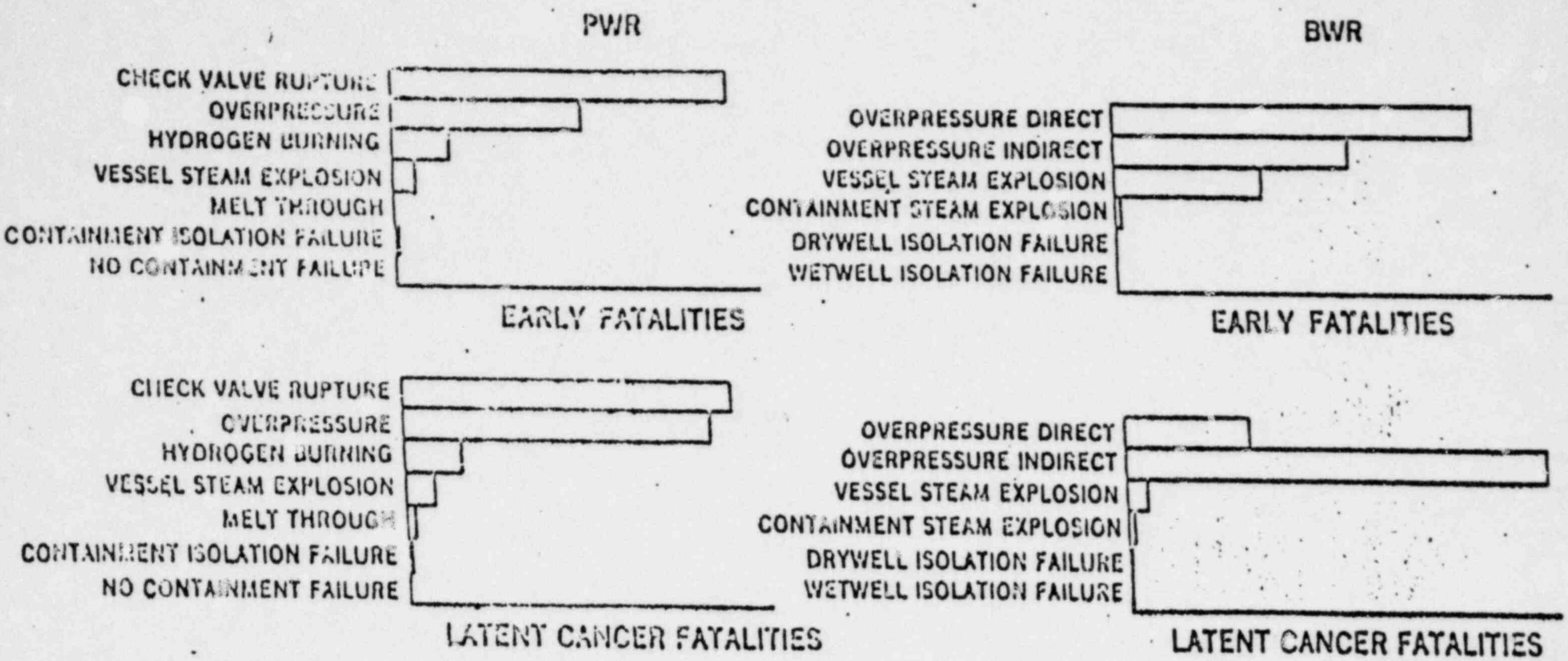
BASIS: LWR DESIGNS IN WASH-1400



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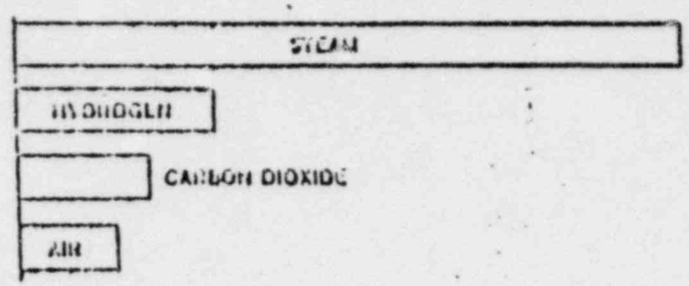

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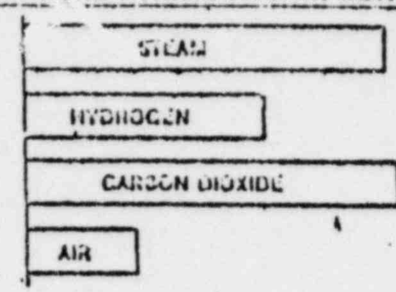

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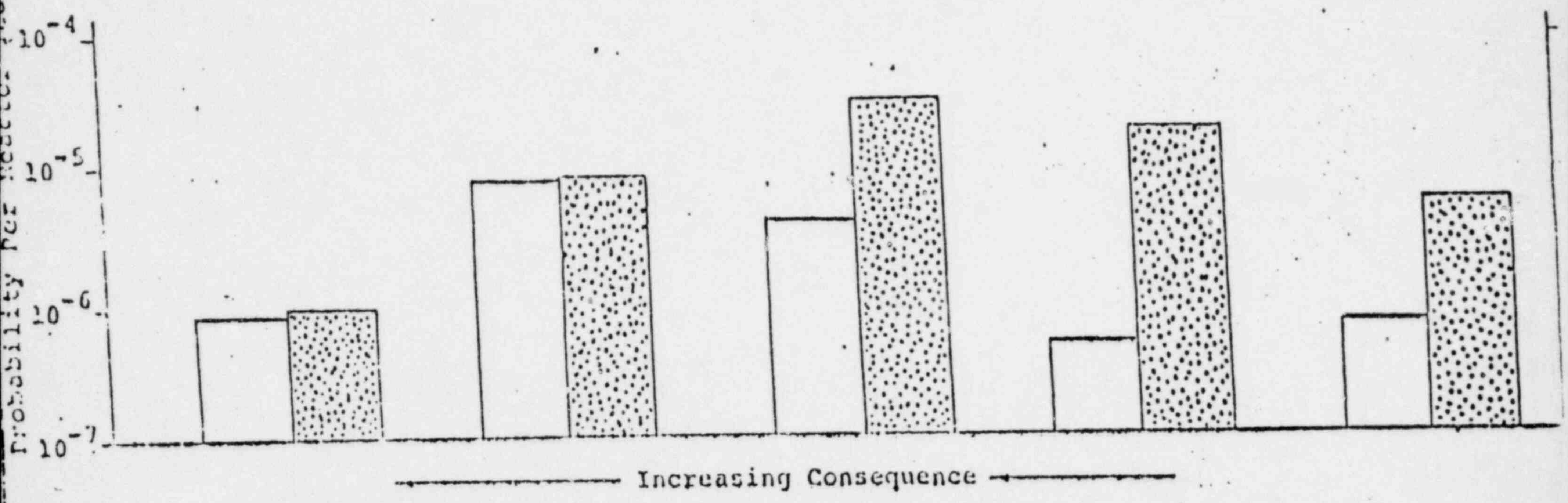

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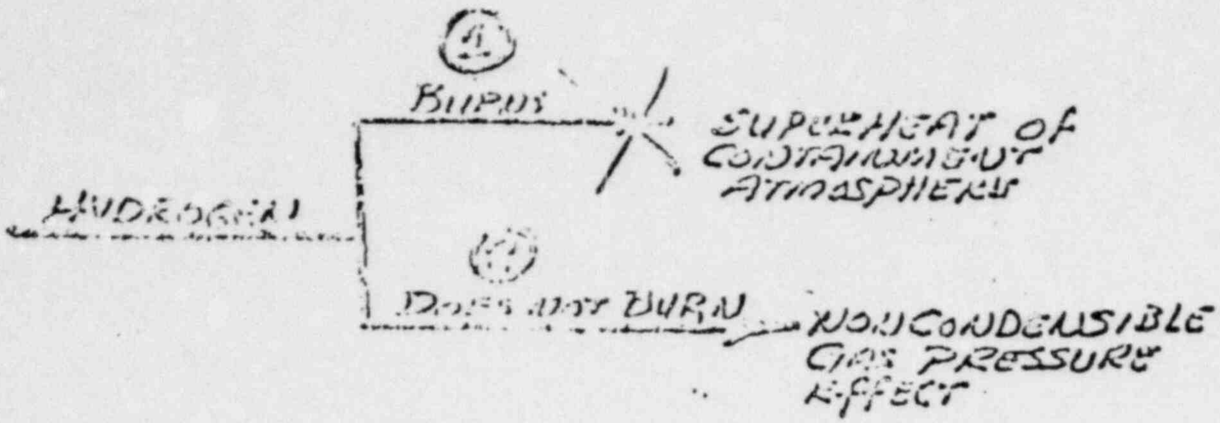

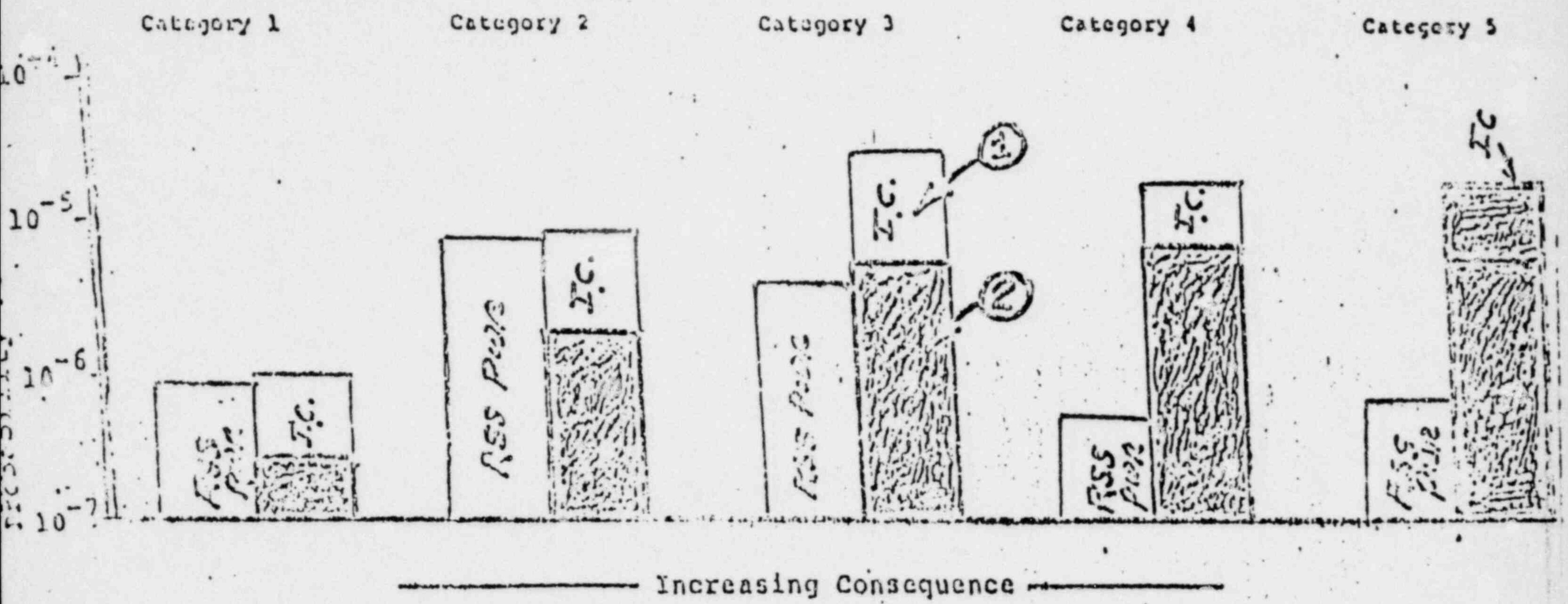

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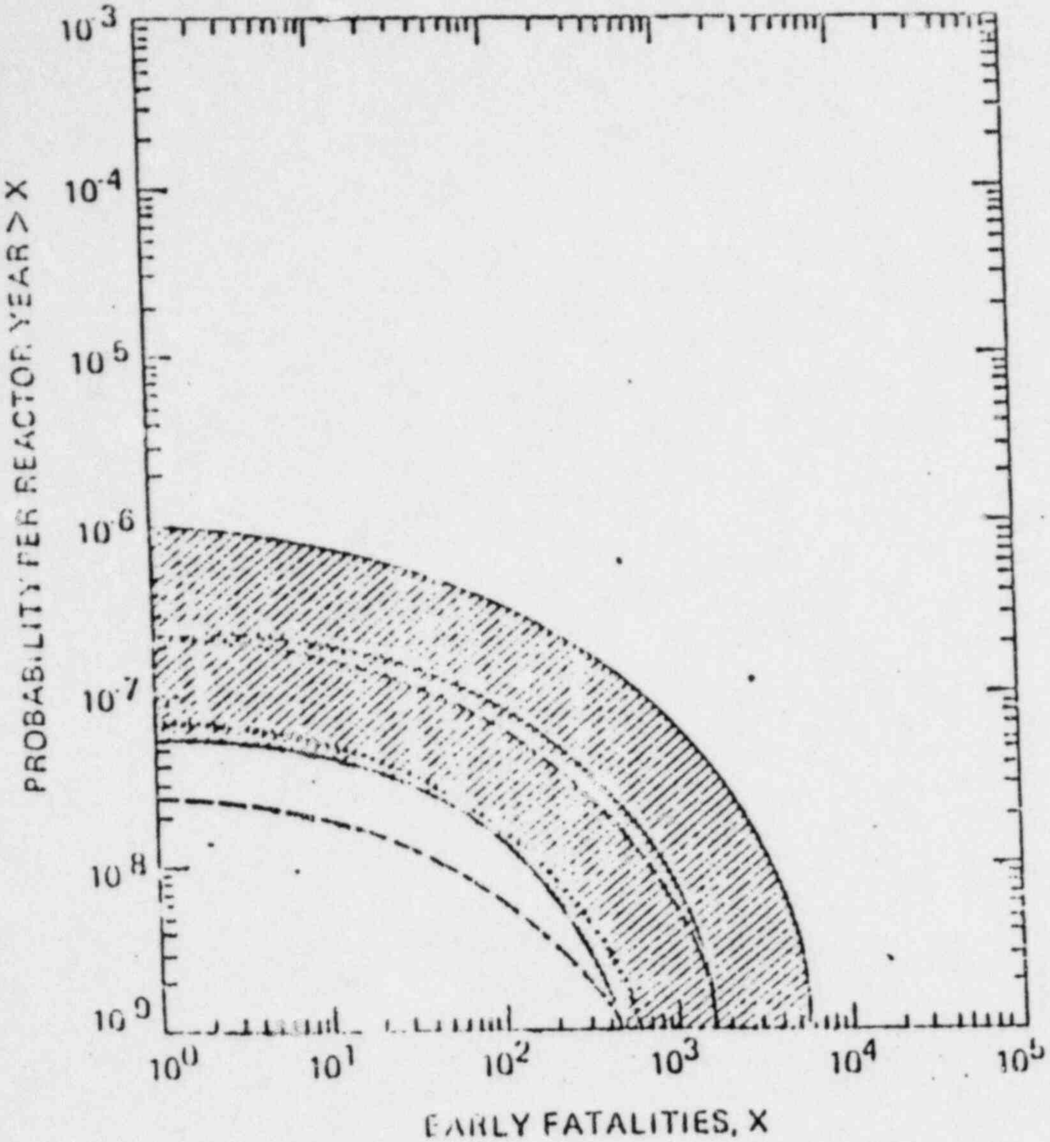

LEGEND:

- (solid line) BASELINE CASE (WASH-1400 W/O CHECK VALVE)
- (dashed line) FILTERED ATMOSPHERIC VENTING, COMPARTMENT VENTING, DEEP UNDERGROUND SITING
- (dotted line) STRONGER CONTAINMENT, INCREASED CONTAINMENT VOLUME
- (dash-dot line) THINNED BASE MAT, DOUBLE CONTAINMENT, EVACUATED CONTAINMENT, SHALLOW UNDERGROUND SITING

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