EXTERNAL EVENTS

ZION/INDIAN POINT
PROBABILISTIC RISK ASSESSMENT
STUDY REVIEW BOARD MEETING

Prepared for
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EXTERNAL EVENTS

- ADDITIONAL COMMON ENVIRONMENTAL CAUSES
- ENHANCEMENT OF SOME PREVIOUSLY ORDER ϵ FAILURE MODES
- SENSITIVITY (FRAGILITY) OF EACH FAILURE MODE TO THE EXTERNAL CAUSE
- SENSITIVITY OF EACH INITIATING EVENT TO THE EXTERNAL CAUSE
- PROBABILISTIC DEPENDENCE OF FAILURE MODES WITH RESPECT TO DISCRETIZED SETS OF EXTERNAL CAUSES

EXTERNAL CAUSES

- EARTHQUAKE
- SEICHE
- FLOOD
- TORNADO
- HURRICANE
- FIRE
- AIRCRAFT

EARTHQUAKE

INITIATING EVENTS

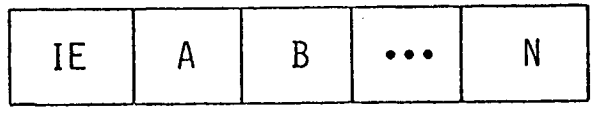
- TRANSIENT - LOSS OF LOAD
- SMALL LOCA
- LARGE LOCA
- LOCA BEYOND DESIGN BASIS

SEISMIC EVENT TREES

- BUILDING FAILURES

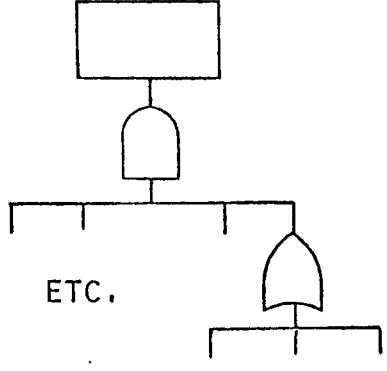
EARTHQUAKE METHODOLOGY
(SIMILAR FOR OTHER EXTERNAL CAUSE)

1. PLANT MODEL: $\{\mathcal{L}, S, \mathcal{L}_P\}$

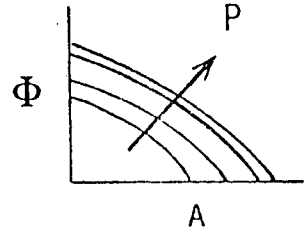


2. SYSTEM MODELS:

SYSTEM (OR IE) = $\{C, \mathcal{L}_S\}$,



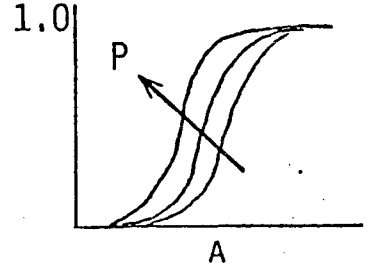
3. SEISMICITY:



, $\{\langle P_I, \Phi_I(A)\rangle\}$

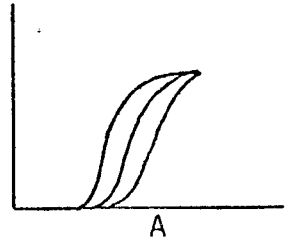
EARTHQUAKE METHODOLOGY (CONTINUED)

4. FRAGILITY:

(FOR COMPONENT C) F 

, $\{\langle Q_J^C, F_J^C(A)\rangle\}$

5. SYSTEM (OR IE) FRAGILITY:

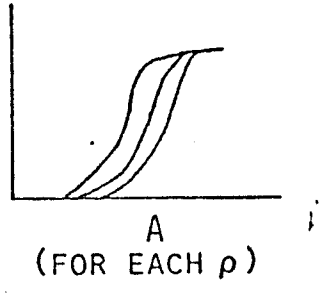
$\{F_J^C(A)\} \rightarrow \{\mathcal{L}_S, \mathcal{D}_S\} \rightarrow F_J^S(A) \rightarrow$ 

FOR SYSTEM S

SYSTEM DEPENDENCY RULES

6. PLANT FRAGILITY:

$$\left\{F_J^S(A)\right\} \rightarrow \left\{\mathcal{L}_P, \mathcal{D}_P\right\} \rightarrow F_J^\rho(A) \rightarrow F_J^\rho$$



7. FREQUENCY OF RELEASE ρ

$$\phi_{IJ}(\rho) = \sum_A \phi_I(A)\, F_J^\rho(A)$$

$$\Longrightarrow \left\{\langle P_I Q_J, \phi_{IJ}(\rho)\rangle\right\}$$

$$\longrightarrow \Phi^{\varphi}(\rho)$$