Performance Assessment Demonstration: Flow and Transport Modeling

Presentation to:
Panel on Risk & Performance Analysis
U.S. Nuclear Waste Technology Review Board

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FLOW AND TRANSPORT MODELING STRATEGY

1) Determine Modeling Approach
   - current site concepts
   - pathways
   - flow and transport phenomena
   - availability

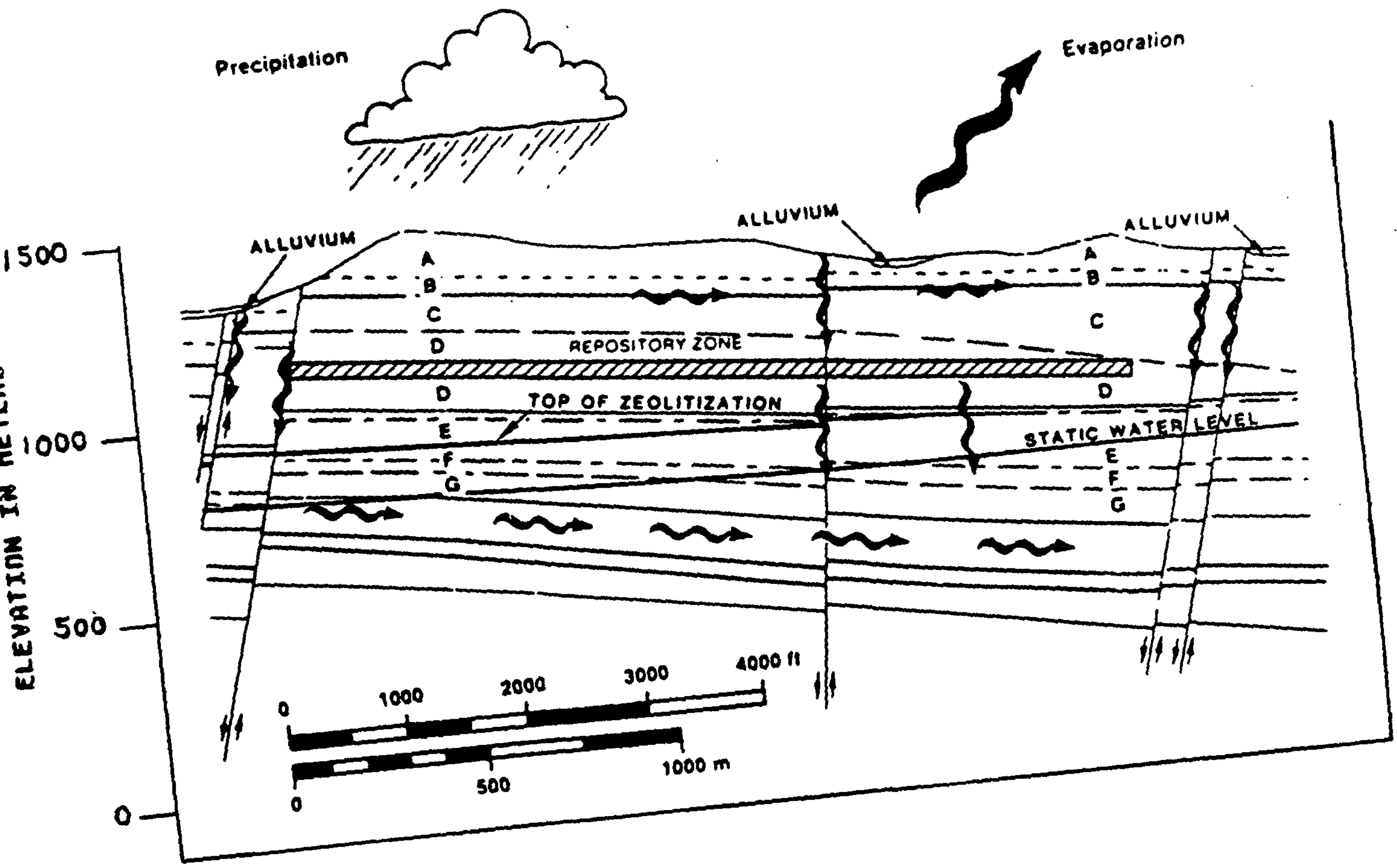
2) Develop/Acquire Model(s)

3) Perform Calculations
   - auxiliary analyses
   - cumulative release

4) Conduct Sensitivity and Uncertainty Analyses

Site Concepts

- layered with large contrasts in permeability
- fracture - matrix interactions are not well understood (i.e., role of fracture coatings)
- low flux would imply primarily vertical flow
- areal extent and dip of the repository could be important



A Tiva Canyon (welded)

B Paint Brush (nonwelded)

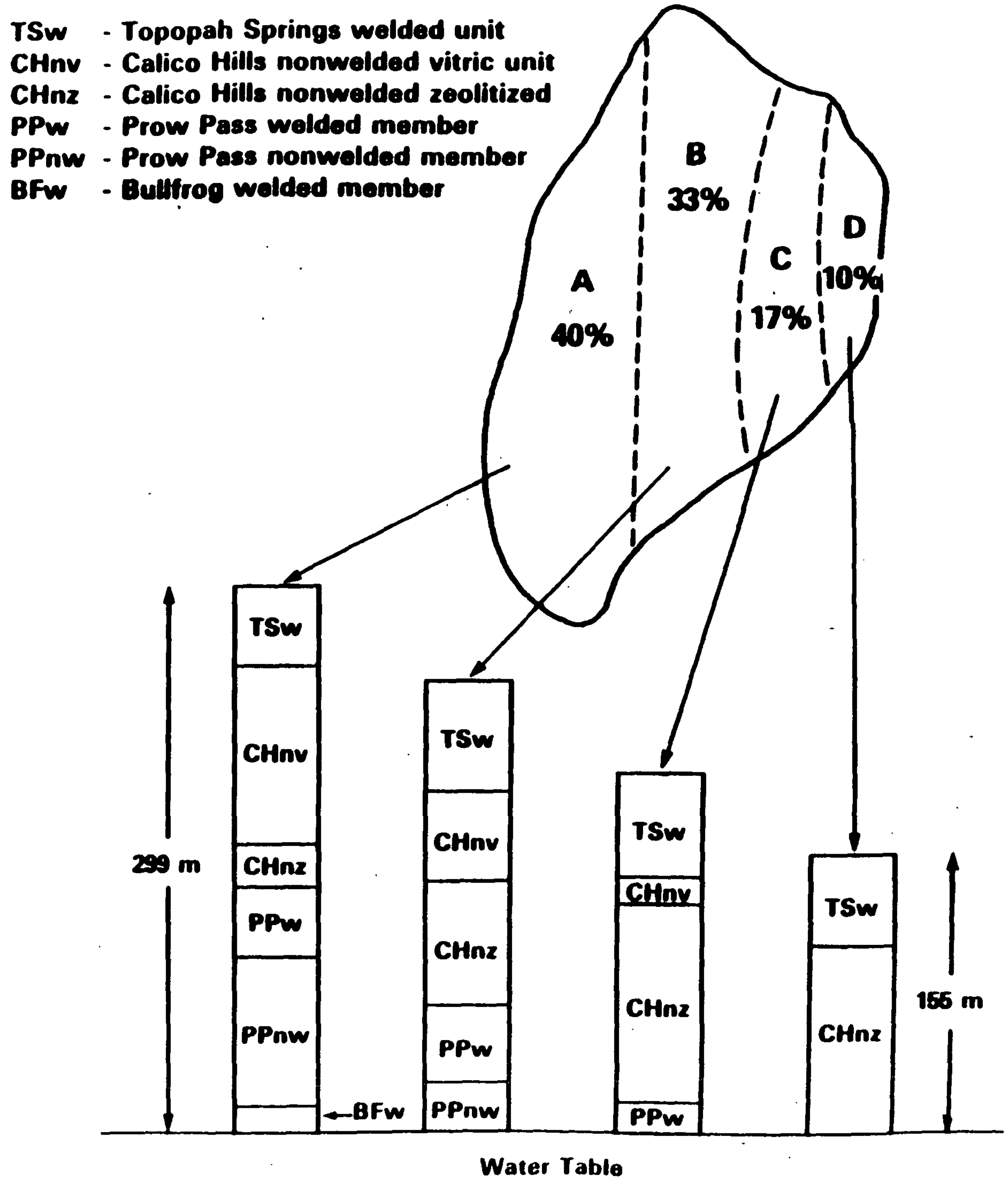
C Topopah Springs #1

D Topopah Springs #2

E Calico Hills (nonwelded)

F Prow Pass (nonwelded)

G Bullfrog (welded)


TSw - Topopah Springs welded unit
CHnv - Calico Hills nonwelded vitric unit
CHnz - Calico Hills nonwelded zeolitized
PPw - Prow Pass welded member
PPnw - Prow Pass nonwelded member
BFw - Bullfrog welded member
A 40%
B 33%
C 17%
D 10%
TSw
CHnv
CHnz
PPw
PPnw
BFw
299 m
155 m
Water Table

COLUMNS REPRESENTING YMP REPOSITORY MODEL

Column	Thickness (meters) A	B	C	D	Average ksat
TSw	45	60	55	55	0.72 mm/yr
CHv	100	50	10	0	107.0
CHnv	20	70	120	100	0.54
PPw	34	45	10	0	88.0
PPnw	90	20	0	0	22.0
BFw	10	0	0	0	118.0
Fraction of waste in column	0.40	0.33	0.17	0.10	--

LIQUID PATHWAY SCENARIOS

1) Base Case

   - Infiltration rate (0.1 - 5.0 mm/yr)

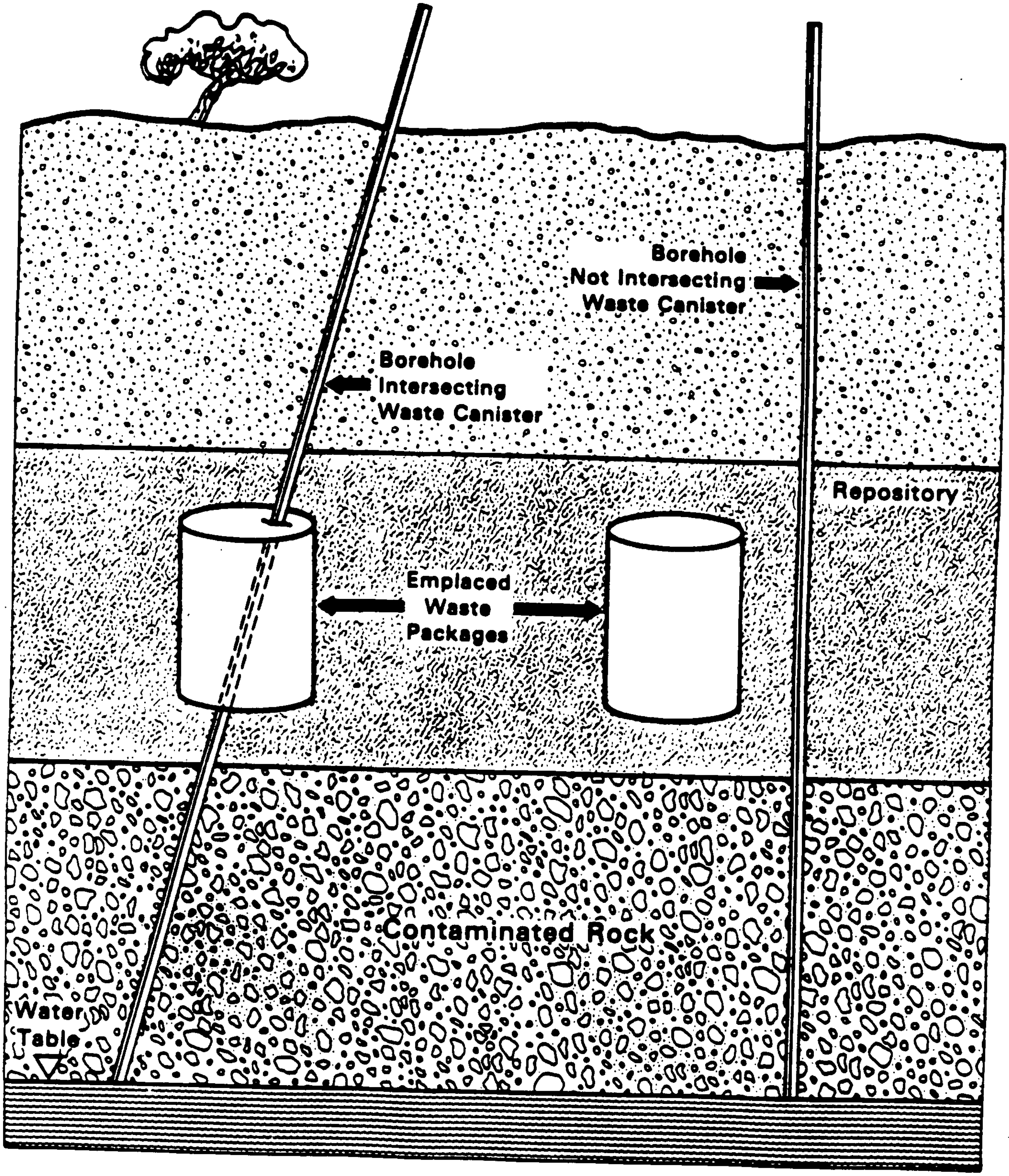
2) Pluvial Case

   - Infiltration rate (5.0 - 10.0 mm/yr)
   - Water table raised 100 meters

DRILLING MODEL

- Calculates Probability of Drilling
  - Based upon drilling rate (#/time/area) and area considerations
- Accounts for Waste and Contaminated Rock
- Uses Initial Inventory with Decay and No Production of Daughter Products
- Uses NEFTRAN Leach Model

DRILLING SCENARIO



DETERMINATION OF SCENARIO PROBABILITIES FROM THE PROBABILITIES OF FUNDAMENTAL EVENTS

	P 0.9	$\bar{P}$ 0.1
$\bar{D}$ 2.3×10^{-7}	Scenario class # 0 Probability $= 2.0 \times 10^{-7}$	Scenario class # 1 Probability $= 2.3 \times 10^{-8}$
D ~ 1.0	Scenario class # 2 Probability ~ 0.9	Scenario class # 3 Probability ~ 0.1

$\bar{P}$ is not pluvial — $\bar{D}$ is no drilling

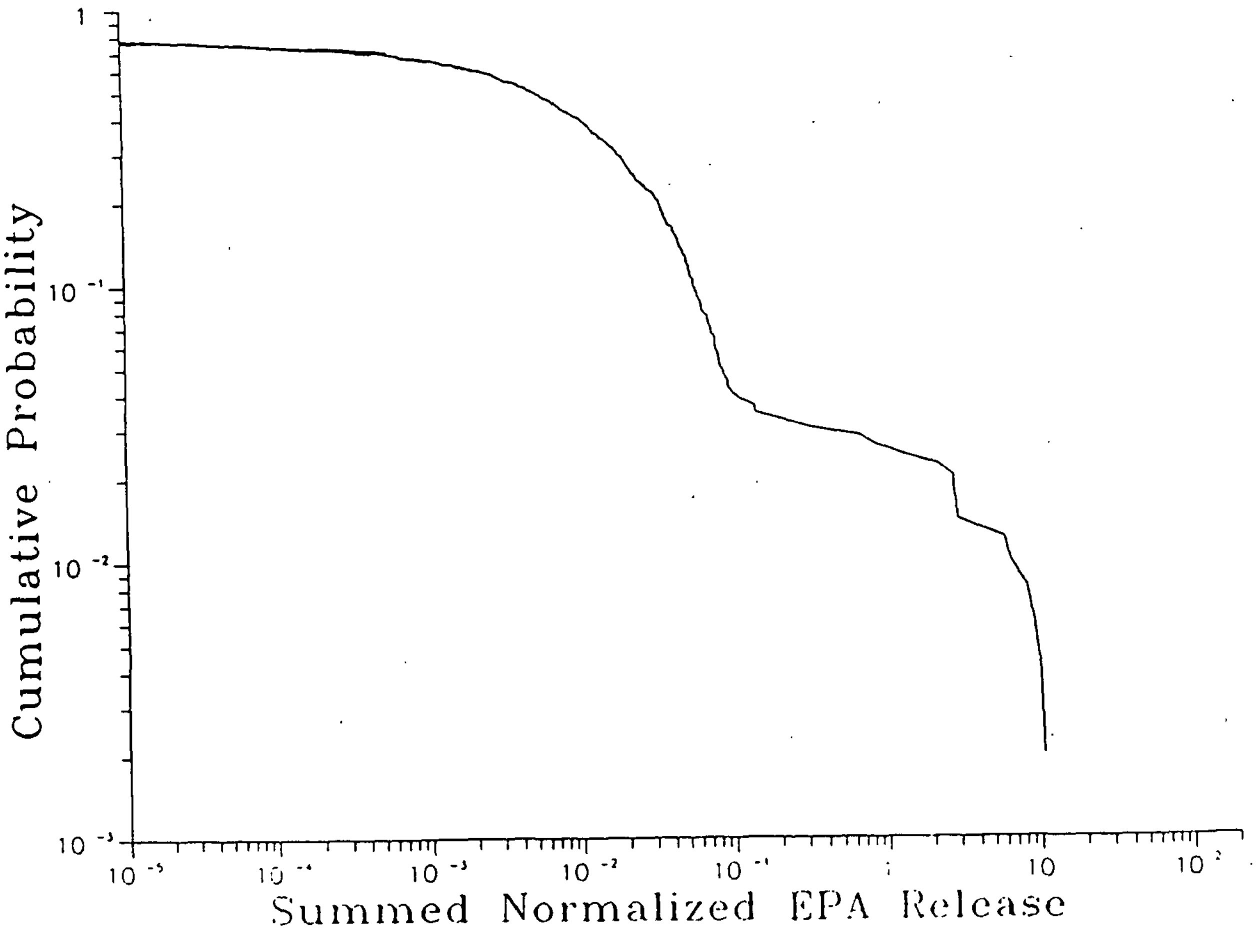
P is pluvial — D is drilling

Scenario class # 0 is no drilling, not pluvial
Scenario class # 1 is no drilling, with pluvial
Scenario class # 2 is drilling, not pluvial
Scenario class # 3 is drilling and pluvial

Note: Probability combinations assume that fundamental events have independent probabilities of occurrence; this is not a general restriction.

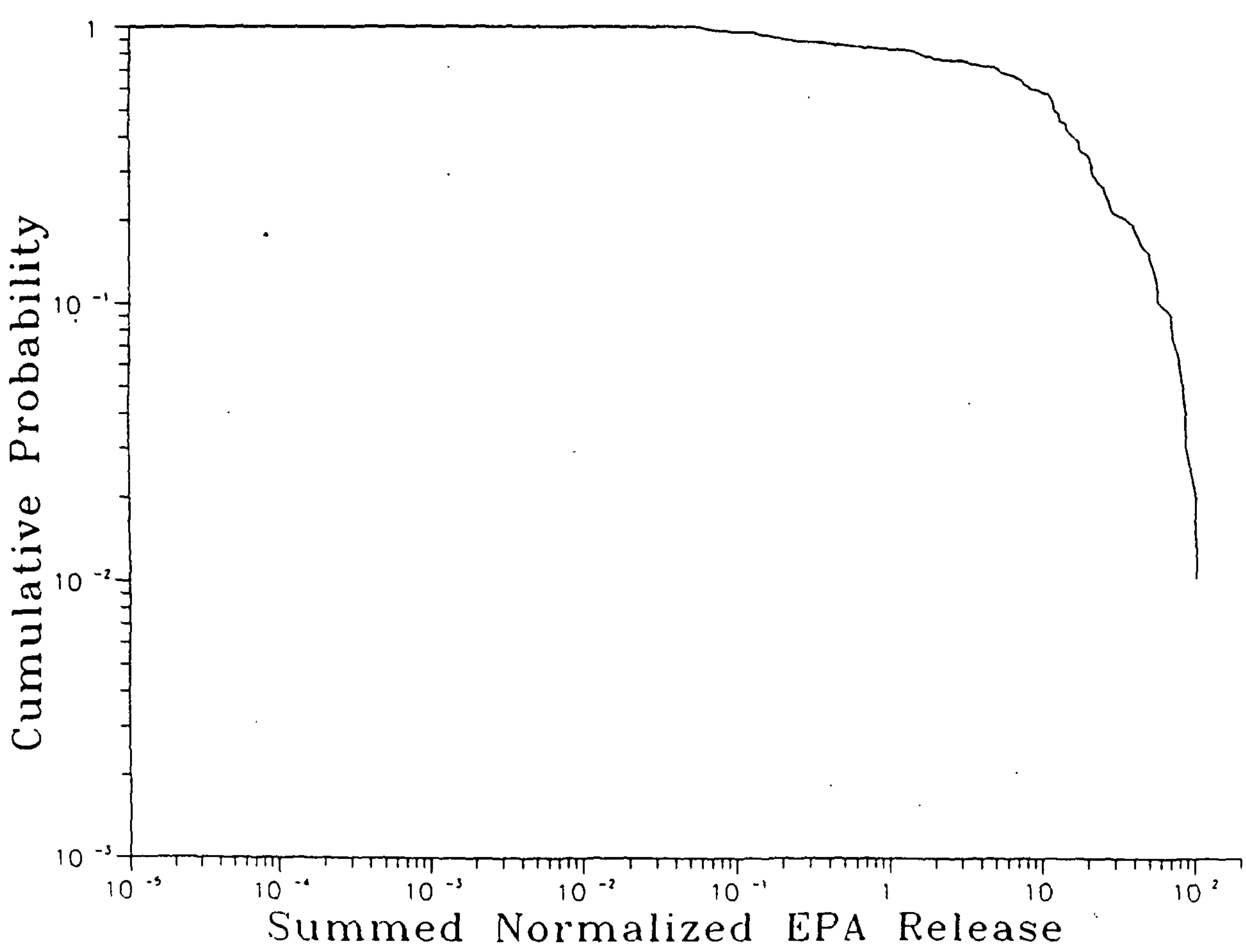
CONSEQUENCE DISTRIBUTION

(Base Case)



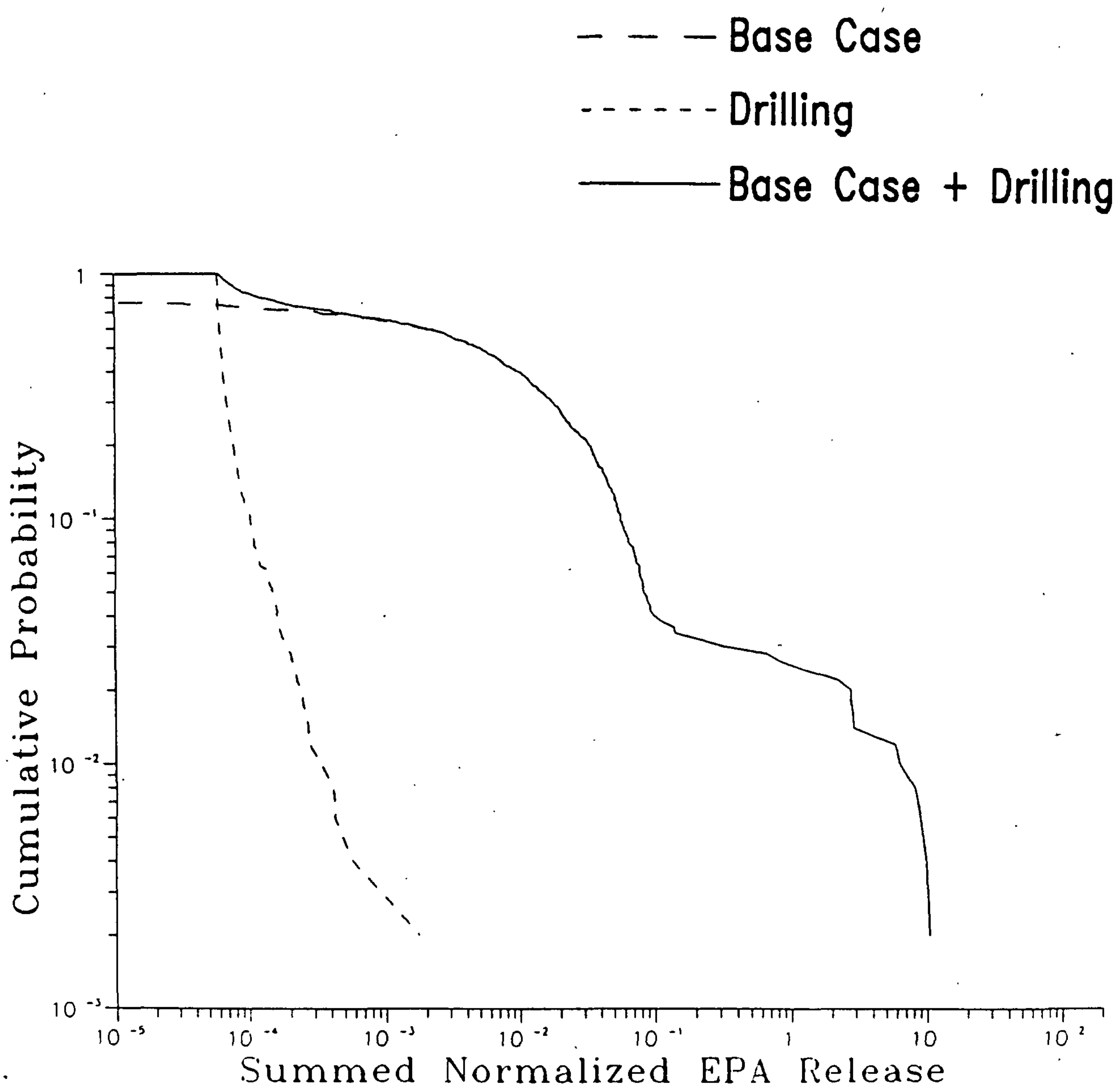
CONSEQUENCE DISTRIBUTION

(Pluvial Case)



CONSEQUENCE DISTRIBUTIONS

(Base Case and Drilling)



CONSEQUENCE DISTRIBUTIONS

(Pluvial Case and Drilling)