Policy Discussion #3

Two Criteria Calculation Methods:

Deterministic and Probabilistic

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April 2, 2014 Negotiated Rulemaking,
Docket 58-0102-1201

Outline

- Human Health Criteria Equations - Revisited
- Needed Input Data
- Sources of Data / Selection of Input Value(s)
- Flowchart of Probabilistic Calculation
- Comparison of the Two Approaches
- Recommendations

Criteria Equations

Non-cancer effects

$$AWQC = RfD \times RSC \times \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \times BAF_i)} \right)$$

Cancer effects: linear low-dose extrapolation

$$AWQC = RSD \times \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \times BAF_i)} \right)$$

Inputs …

Describing the target population

BW = Body Weight (Kg)

DI = Drinking-water Intake (L/day)

FI = Fish Intake, aka consumption rate (g/day)

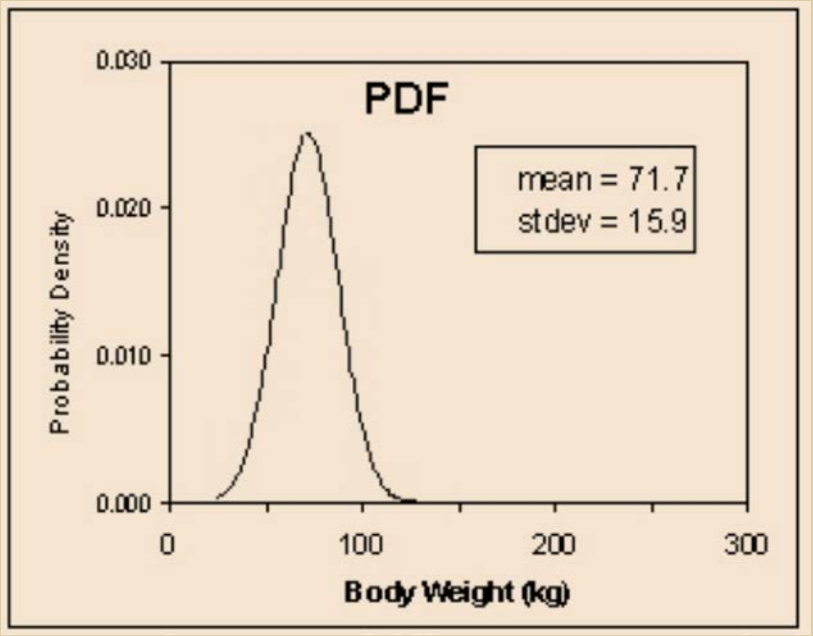
Describing each chemical

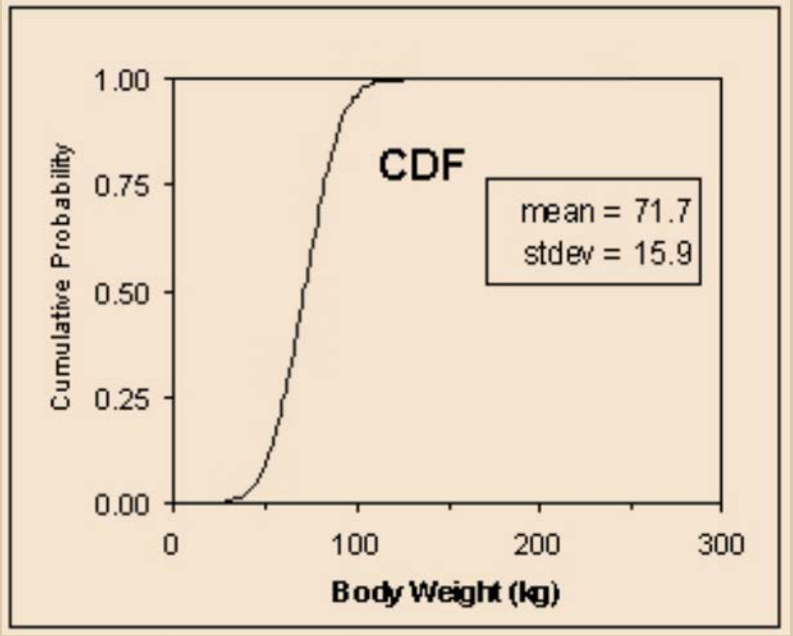
BAF = Bioaccumulation Factor (L/Kg)

RfD / RSD = Reference Dose, non-carcinogens or Risk Specific Dose, for carcinogens (mg/Kg-day)

RSC = Relative Source Contribution (ratio)

Sources of data





Deterministic Approach

Non-cancer effects

$$AWQC = RfD \times RSC \times \left(\frac{BW}{DI + (FI \times BAF)}\right)$$

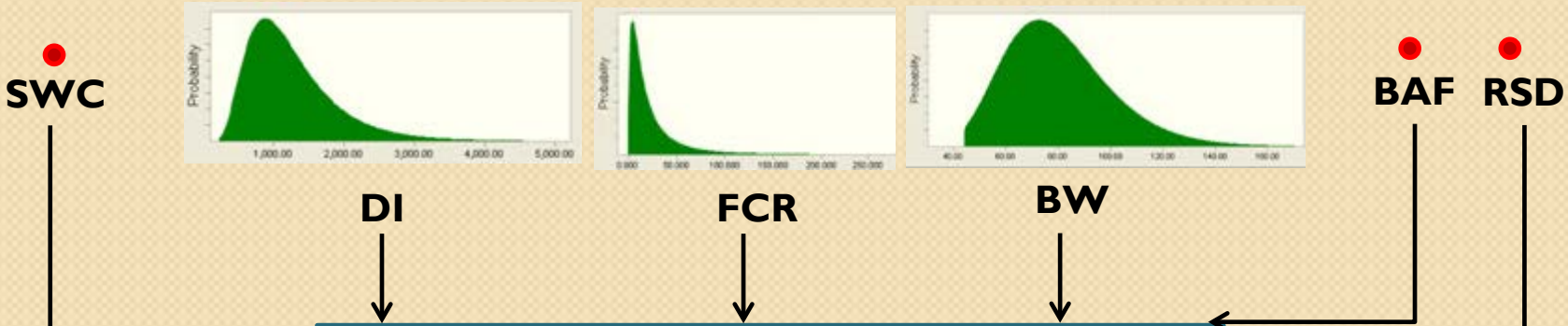
Cancer effects: linear low-dose extrapolation

$$AWQC = RSD \times \left(\frac{BW}{DI + (FI \times BAF)}\right)$$

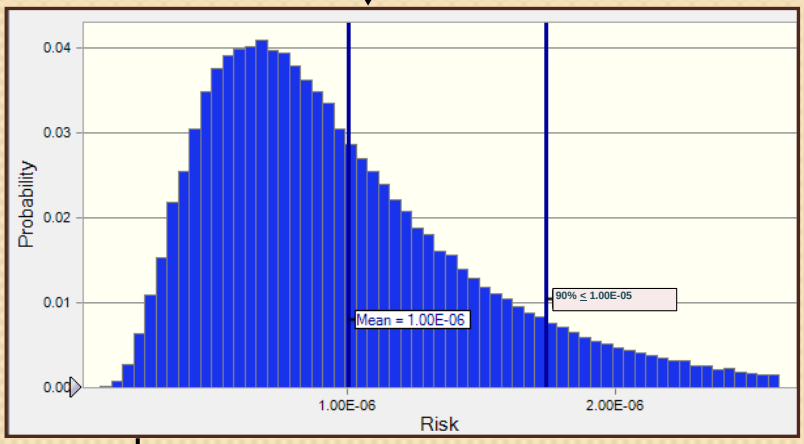
Select values for each input and calculate, once

DERIVING WATER QUALITY CRITERIA USING A PROBABILISTIC METHODOLOGY: CARCINOGENS

$$Risk = \frac{SWC \times [DI + (FI \times BAF)]}{BW \times RSD}$$



Calculate risk probabilistically with **distributions** (DI, FI, BW) and **point estimates** (BAF*, RSD) for a specific water concentration (SWC)



This is a policy choice

Risk = Target?

Iterative selection of higher or lower SWC to achieve risk target

Yes

Use SWC as water quality criterion

Conduct sensitivity analysis with high fish consuming subpopulation

The key difference, going in

- For a deterministic calculation we need to choose **a value** out of each distribution to represent the population

- For a probabilistic calculation we use **whole distributions** to represent the population

The key difference, coming out

- With deterministic calculation the result is **a criterion value,** with uncertain risk
- With probabilistic calculation result is a **distribution of risk,** for a concentration

Deterministic Calculation

Pros	Cons
• Well established • Easy to calculate • Criteria calculation less costly	• Uncertainty in risk / level of protection provided • Compound conservatism • Does not use all the information and knowledge we have

Probabilistic Calculation

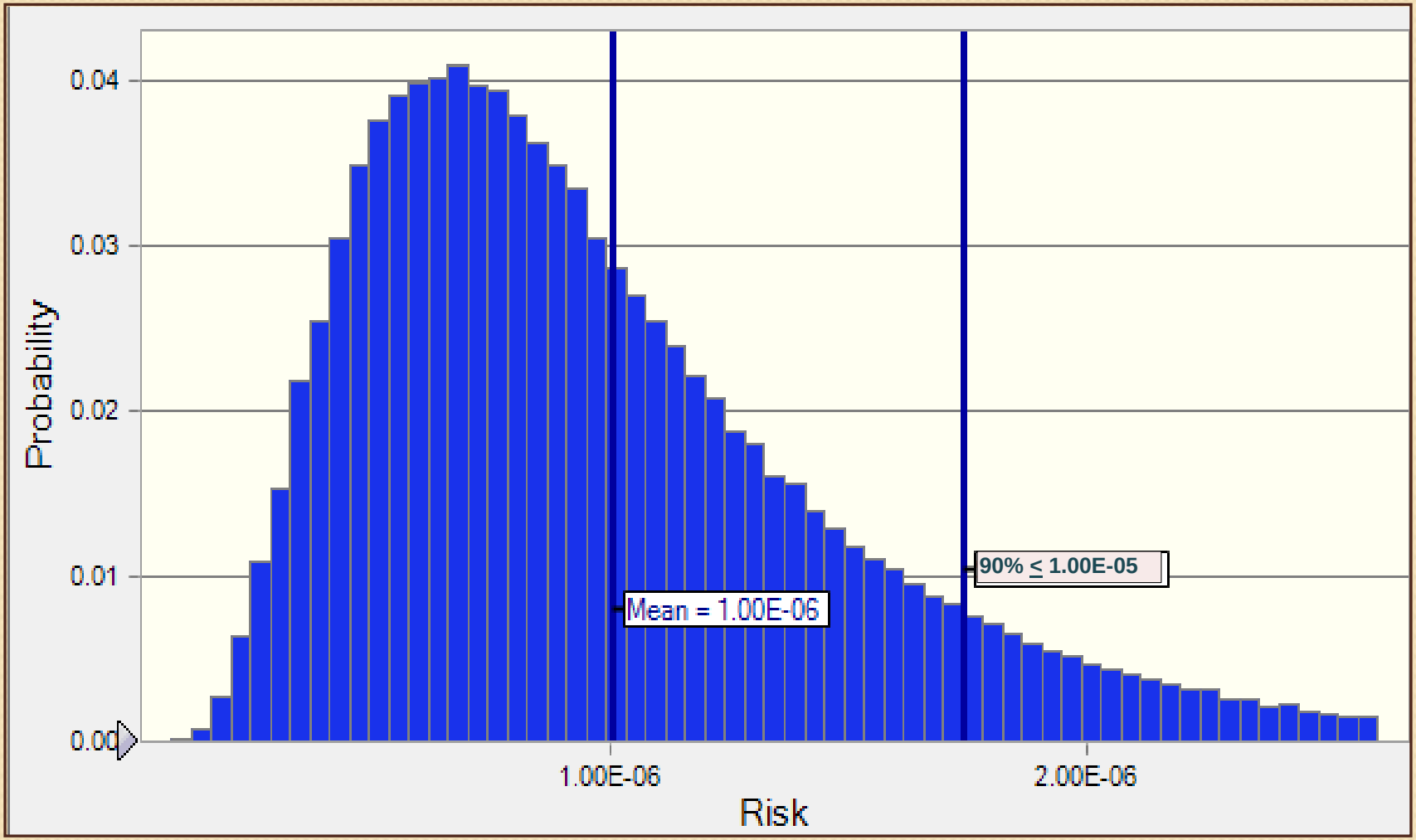
Pros	Cons
• Uses all available information • Addresses variability and uncertainty directly • Clearer communication of risk to public and for policy makers	• More complex • Process is not easily explained • Does not eliminate difficult policy decisions > Target population > Sources of fish consumed > Protective risk level

DEQ Summary & Recommendations

- PRA is more "state of the art"
- Could only do partial PRA:
  - Fish consumption rate
  - Body weight
  - Drinking water intake
- PRA is a step forward, but we would likely need outside help
- Unclear what difference it would make to criteria

We would like your comments on these matters…

- **Comment deadline is April 23rd, 2014**


0.04
0.03
0.02
0.01
0.00
Probability
Mean = 1.00E-06
90% ≤ 1.00E-05
1.00E-06
2.00E-06
Risk