

Probabilistic Performance Assessment issues

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**West Valley Citizen Task Force meeting
September 24, 2025**

First aspect of the PPA, regarding probabilistic distribution of the inventory or source term of radionuclides in the SDA and NDA

Paul Duffy and I disagreed about this during the post-QPM meeting on August 28. We disagreed about whether Neptune's distribution encompasses SDA and NDA source term estimates other than those in Ralph Wild's URS reports. See Vaughan (2009), pdf page 262, last five sentences of my comment 112A (starting "Both the NDA and the SDA..."). The point at issue is whether all (or at least most) of the source term estimates in the reports cited in the last five sentences are incorporated in the inventory/source term distribution that Neptune has created for the PPA.

Second aspect of the PPA, on whether/how the future rate of stream channel widening can be reasonably calculated or inferred from the past rate

Neptune's photogrammetric work has provided a good record of the past rate of stream widening. The issue is whether, especially given the effects of climate change, the future rate has a known or knowable relationship to the past rate. The uncertainty about this comes from the behavior of cohesive sediments, particularly their "bimodal" erosion properties, and from the likelihood that the past rate of stream-widening erosion and the future rate of stream-widening erosion are mainly on opposite sides of the critical shear threshold for mass erosion.

Second aspect of the PPA: Background information on cohesive sediments and their erodibility

Corps (2020), especially pdf pages 239-245, provides a good overview. See, for example, p. 244 for the observation that shear thresholds and erosion rates "are site specific and can vary by five orders of magnitude..." See also p. 241 for the observations that particle erosion begins as the shear stress removes individual 'particles' or flocs, and that the rate increases approximately as a linear function of shear, and that "if bed shear gets high enough, it begins to remove clods from the bed, introducing a non-linear inflection point...in the erosion rate."

The same page notes that the "Erosion rate above the mass erosion threshold is also linear, but increases as a function of shear at a different (usually higher) slope." The word "usually" provides guidance for a probabilistic approach, allowing for the possibility that the linear erosion rate below the mass erosion threshold may, but with a probability of less than 50%, be greater than the rate above the mass erosion threshold. But this is scant guidance on the erosion behavior of a cohesive sediment such as Lavery Till.

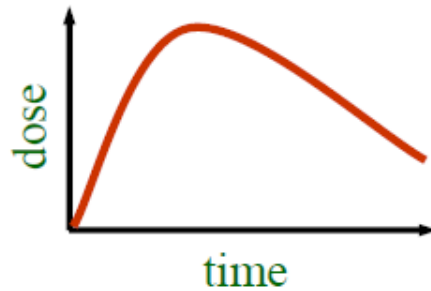
Second aspect of the PPA: Possible evidence that the August 2009 storm crossed the mass erosion threshold in Quarry Creek, while other past storms have rarely or never done so

See Vaughan (2009), pdf pages 295-96, my comment 205, for my September 2009 written description of my August 19, 2009 observations of onsite erosion effects from the August 2009 storm. Note particularly my observation of large clasts, apparently rip-up clasts, in the Quarry Creek ravine. (While not noted in my 2009 comment, Lee Gordon was there with me.) I am not aware of other past storms that have left debris such as these clasts within the Erdman, Franks, or Quarry ravines.. There is a question here of absence of evidence as opposed to evidence of absence -- but since such clasts/clods are a key hallmark of mass wasting erosion, it appears that the August 2009 storm may have crossed the threshold into the "usually higher" slope (erosion vs. shear stress) that is associated with mass erosion. This is relevant because of the likelihood that climate change will bring an increasing number of storms that exceed the mass erosion threshold, where the erosion from such storms is not predictable from Neptune's photogrammetric work.

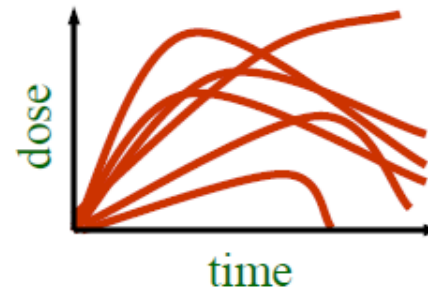
Managing Uncertainty

- We know that our knowledge is incomplete.
- How can we account for imperfect knowledge?
- Each modeling parameter and process has inherent uncertainty and variability.
 - Inputs are based on what we think we know (expectation) and how unsure we are (uncertainty).
 - Therefore the results must also be uncertain.

no single
answer is
correct

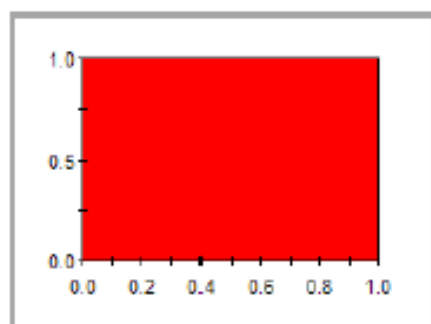


a collection
of answers
reflects our
knowledge

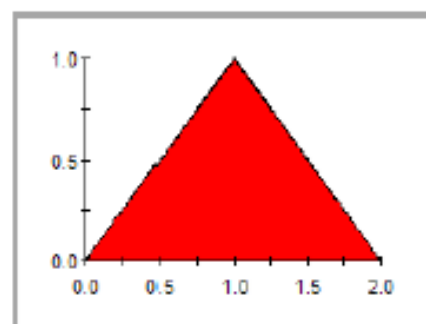


Many Types of Distributions are Available to Represent Uncertainty

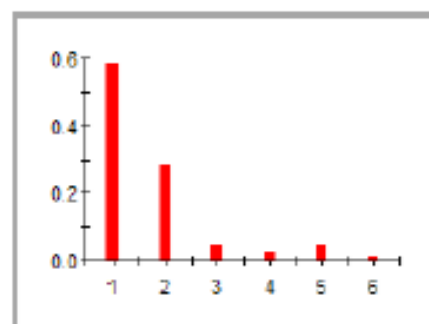
uniform



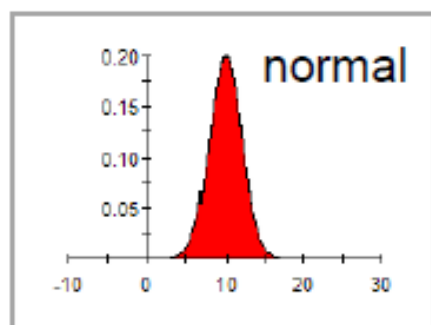
triangular



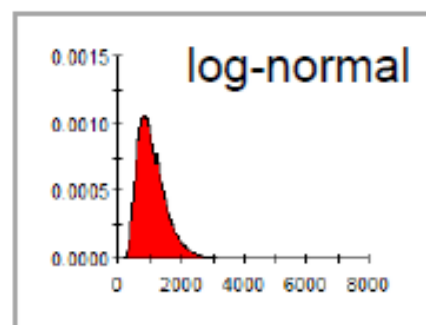
discrete



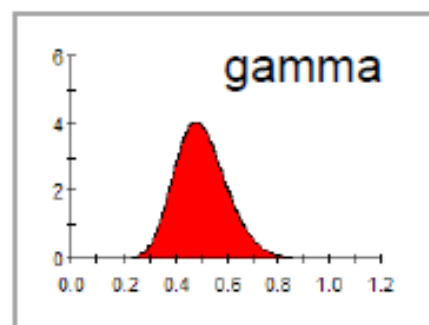
normal



log-normal



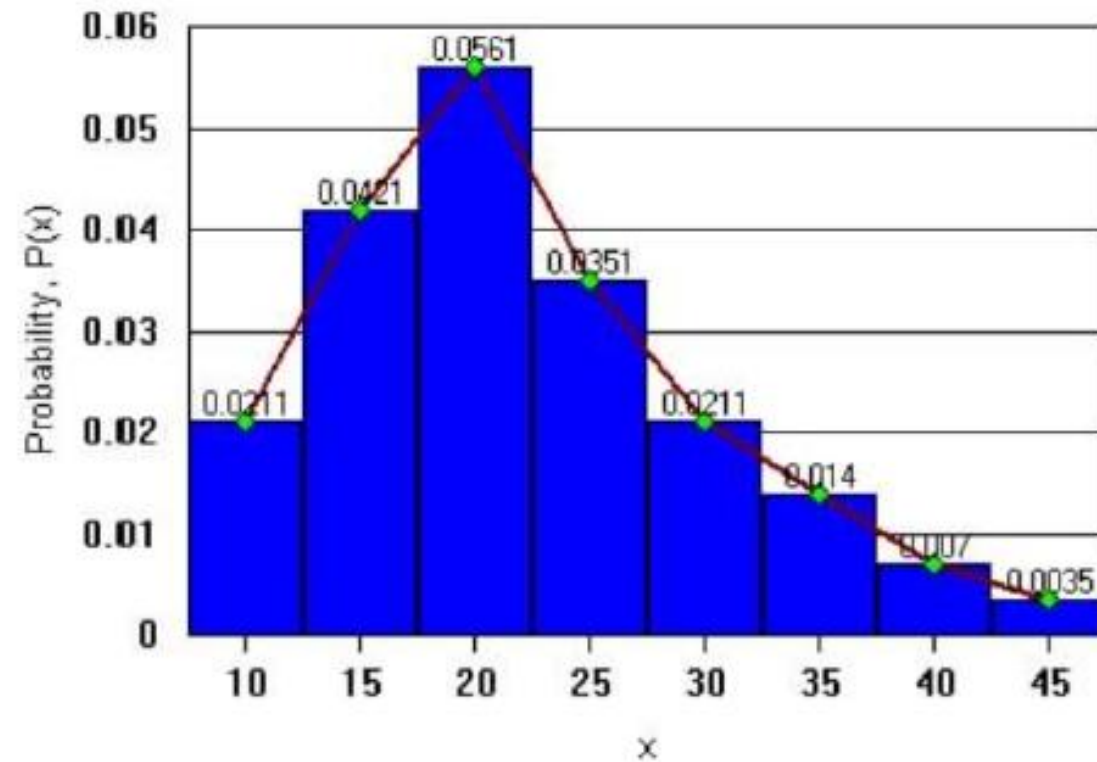
gamma



What is chosen must have some basis in reality.

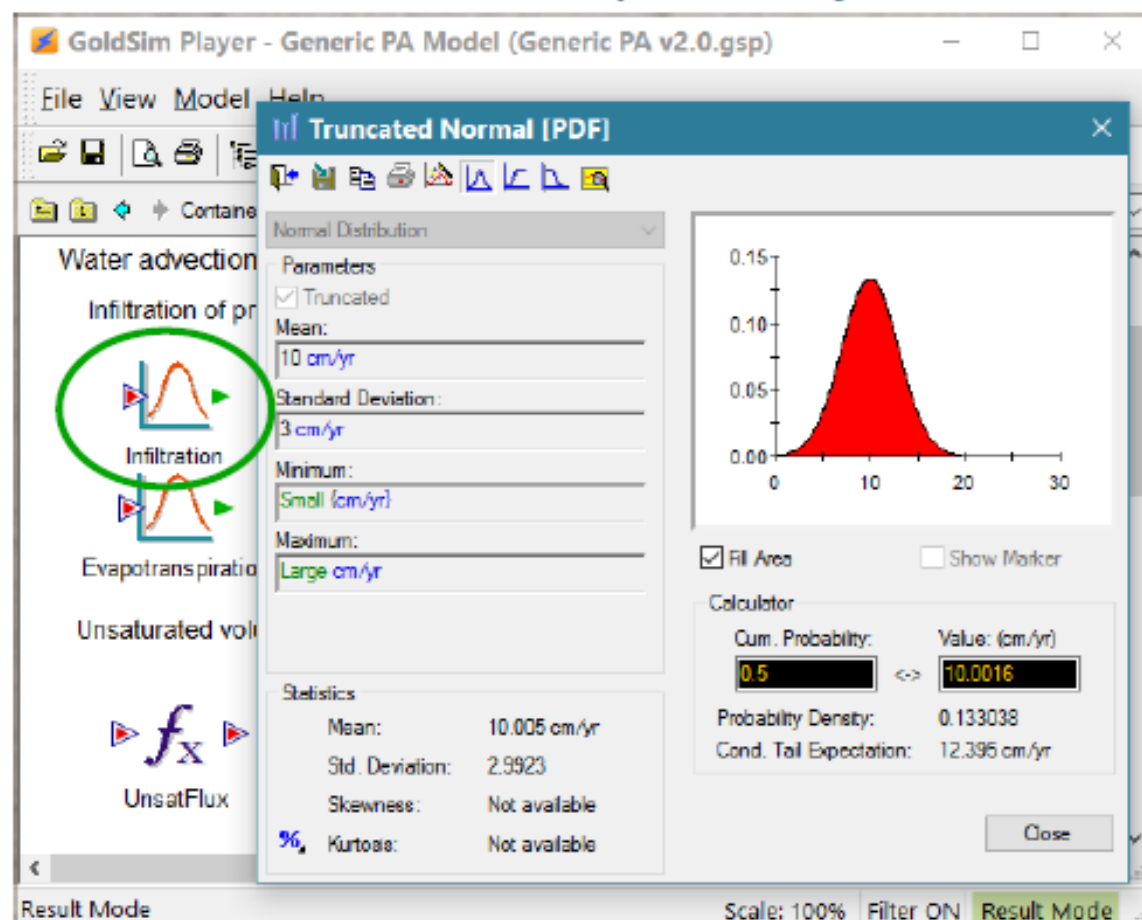


Probability Distribution



Source: pindling.org

Infiltration is defined with some uncertainty, since we do not know the value perfectly.



NDA inventory or source term

The purpose of PPA (avoiding deterministic choices of input values) is defeated when there's a deterministic choice to use certain information sources and reject others

This is a fundamental source of bias in any case, but the problem becomes worse when done quietly (secretly)

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