HLWYM HEmails

From: Christopher Grossman
Sent: Thursday, November 09, 2006 7:42 AM
To: David Pickett; Gordon Wittmeyer; James Myers; Sitakanta Mohanty; Yi-Ming Pan; Abou-Bakr Ibrahim; Brittain Hill; Christopher Grossman; David Brooks; Mahendra Shah; Mysore Nataraja; Randall Fedors; Sheena Whaley; Timothy McCartin; Tae Ahn
Cc: James Winterle; Osvaldo Pensado; Andy Campbell; Bret Leslie
Subject: Re: Time Change: Proposed TPA Code Modification
Attachments: DriftDeg_recommendation_02.ppt

Follow Up Flag: Follow up
Flag Status: Flagged

Slides are attached. Also, note the time below (different than initial send last week) CNWRA is scheduled to meet in A137. Bridge # is also below.

>>> Christopher Grossman 11/07/2006 11:18 AM >>>
Date: Thursday, Nov. 9
Time Change: 3:00pm - 5:00pm (ET)/2:00pm-4:00pm (CT)

Bridgeline #: 1-800-638-8081
Passcode: 6658#

Action: ISI (UZ2, ENG1, ENG2, ENG4) leads should ensure that appropriate staff are available to support this. We would like to keep the meeting to a manageable size (i.e., small) but ensure appropriate staff are available to address the issues.

I will distribute slides, bridge number, and location soon.

Purpose: To discuss proposed revision to TPA code involving degraded drift scenario

Background: Previously the conceptual model in TPA envisioned a largely open drift environment in which dripping water resulted in the corrosion of waste package was the major failure mechanism. With the degraded drift scenario, waste package damage may result from other factors besides dripping water resulting in corrosion. Additionally, mechanically failed features such as the drip shield may divert water and continue to offer protection after failure. Therefore, a modification to the code's conceptual model is needed to account for these possibilities. Essentially the modification will involve adjusting the amount of inventory that water contacts. The adjustment will be based on the likelihood of features in a degraded drift minimizing/optimizing water contact with exposed fuel.

Outcome: Understanding of proposed approach and feedback on areas needing further consideration

Process: CNWRA will present the proposed approach and will solicit feedback in the following areas:

1. Is the approach appropriate for the degraded drift scenario?

2. Are the factors considered appropriate? Should there be additional processes considered? Should some of the processes be removed?

3. Are the ranges for the factors appropriate? Does the basis seem reasonable? Are you aware of information to support the basis?

4. Are there impacts on specific modules that need to be considered for consistency and integration during the implementation?

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Subject: Re: Time Change: Proposed TPA Code Modification
Sent Date: 11/9/2006 7:41:32 AM
Received Date: 11/9/2006 7:41:52 AM
From: Christopher Grossman

Created By: Christopher.Grossman@nrc.gov

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Files	Size	Date & Time
MESSAGE	2441	11/9/2006 7:41:52 AM
DriftDeg_recommendation_02.ppt	153152	

Options

Priority:	Standard
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Reply Requested:	No
Sensitivity:	Normal
Expiration Date:	
Recipients Received:	Follow up

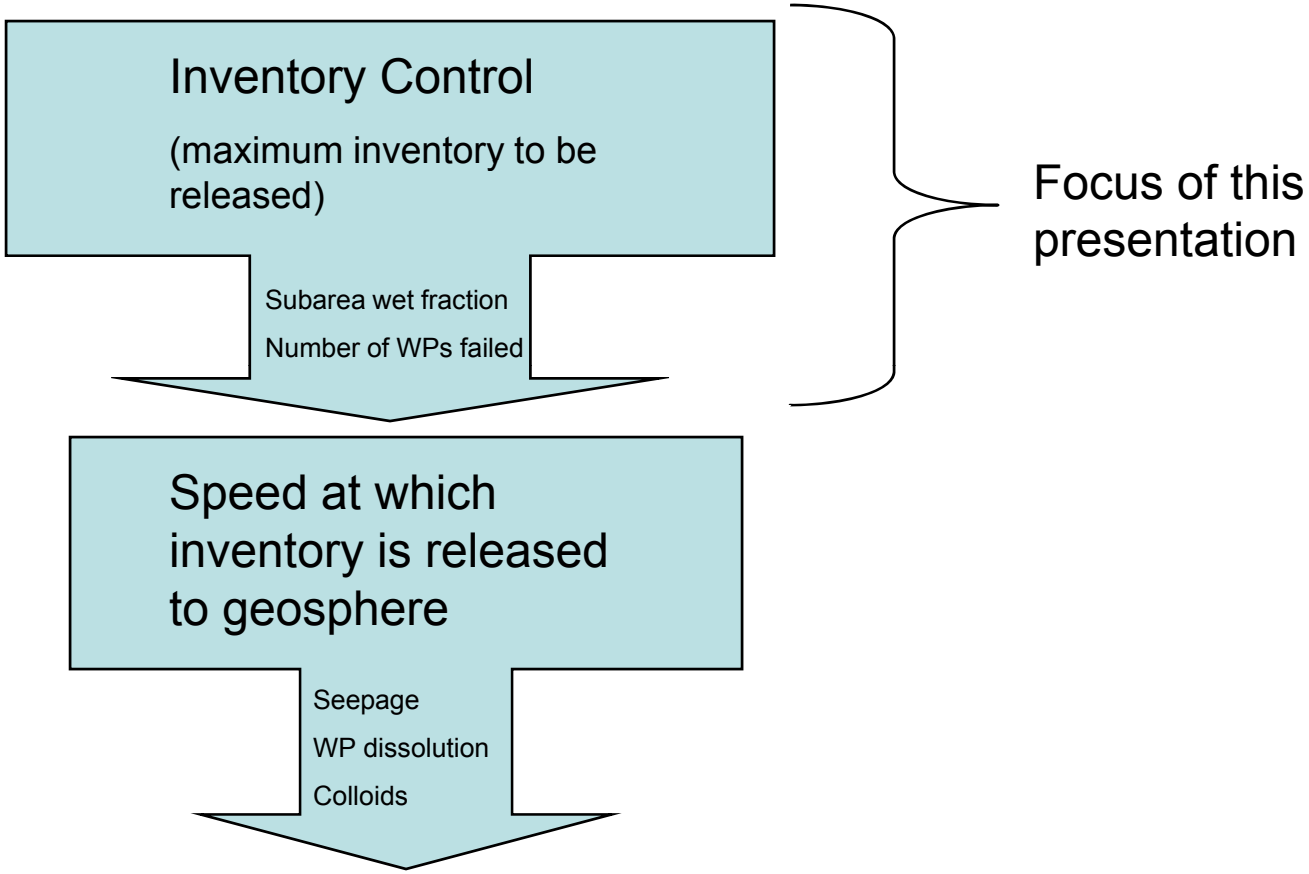
Recommendations on Drift Degradation Scenario

Osvaldo Pensado

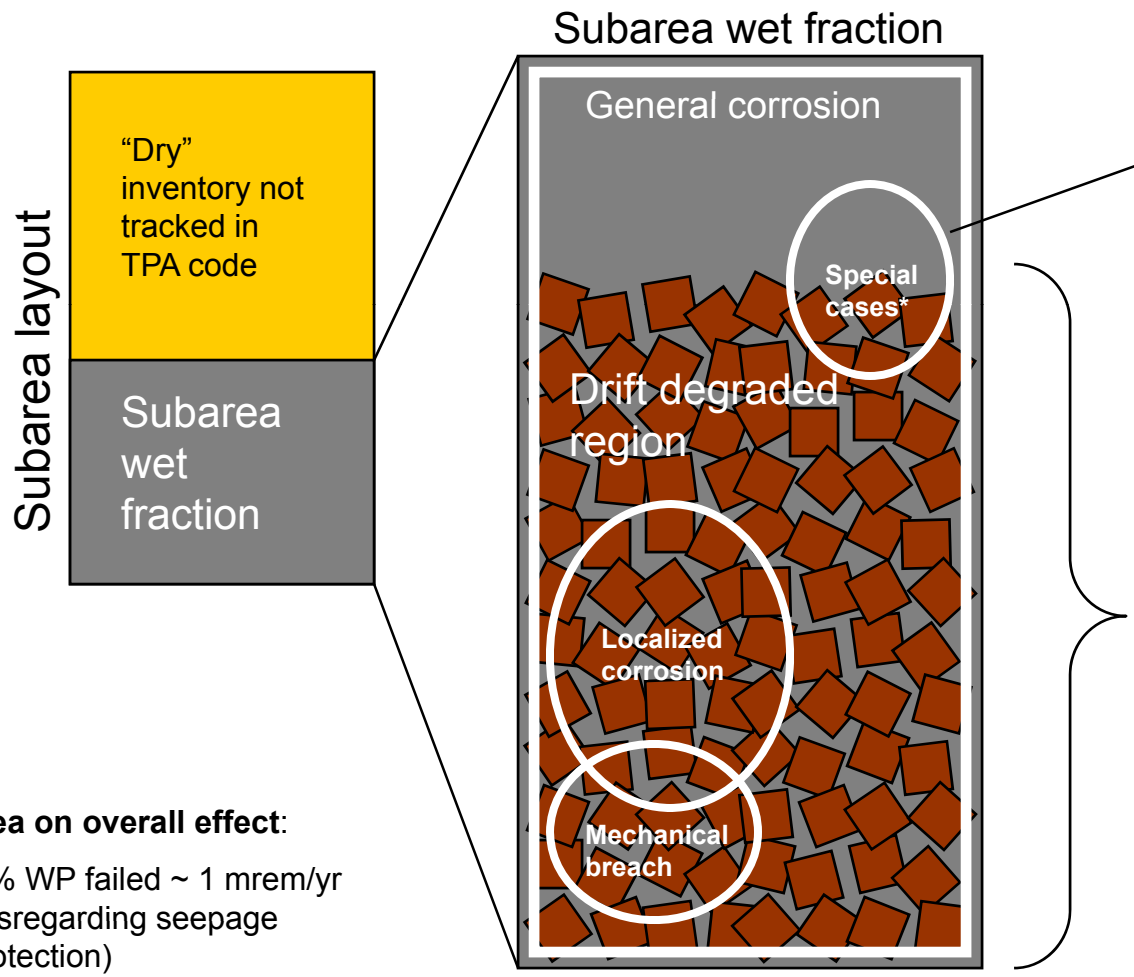
Contributors: J. Winterle, R. Rice, C. Grossman

November 7, 2006

TPA Code Approach



WP distribution by failure type in the subarea



Conservative to assume that the "special cases" set does not intercept the localized corrosion (LC) or mechanical breach sets

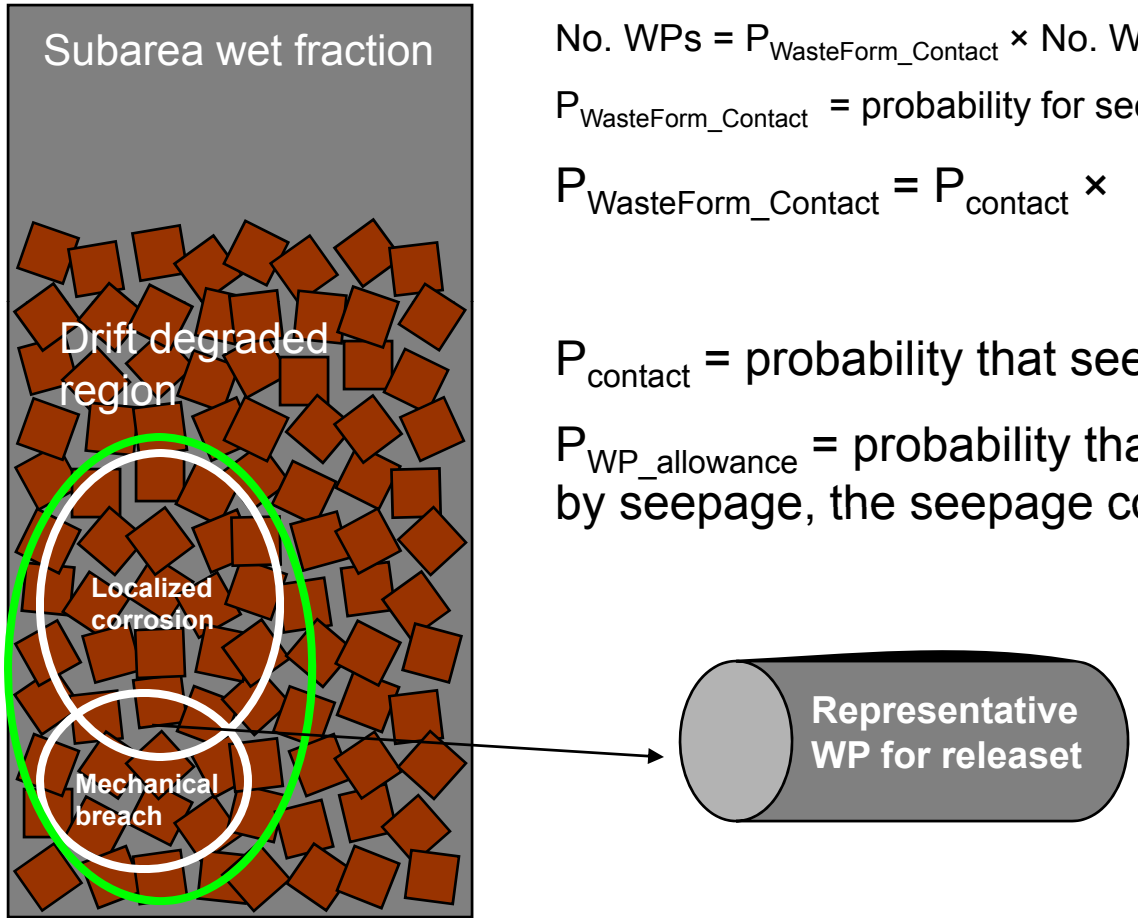
Originally, we considered that all WPs in the drift degraded region could experience localized corrosion or mechanical breaching. We want to move away from that representation.

Idea on overall effect:

1 % WP failed ~ 1 mrem/yr (disregarding seepage protection)

*Special cases: initially defective WPs, faulting, igneous

How many WPs can contribute to release?



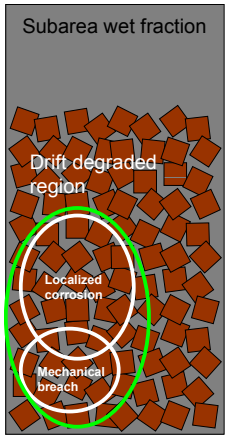
No. WPs = $P_{WasteForm_Contact}$ × No. WPs in subarea

$P_{WasteForm_Contact}$ = probability for seepage to contact waste forms

$$P_{WasteForm_Contact} = P_{contact} \times P_{WP_allowance}$$

$P_{contact}$ = probability that seepage contacts the WP

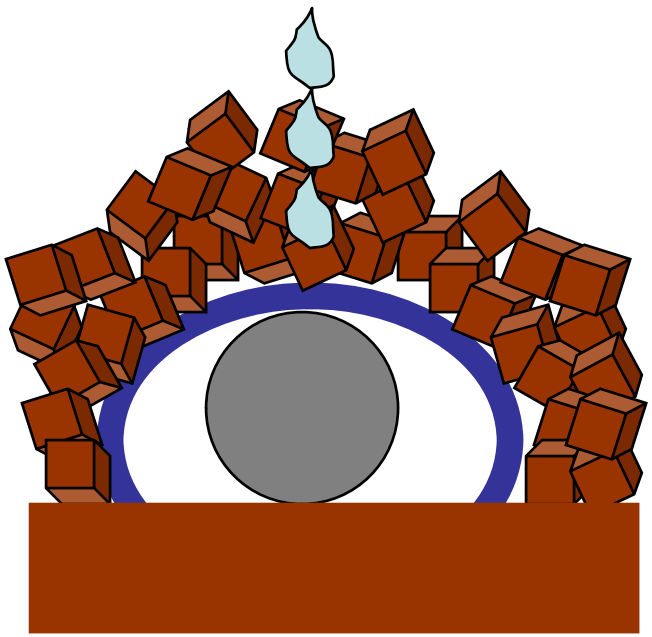
$P_{WP_allowance}$ = probability that, if the WP is contacted by seepage, the seepage contacts the waste forms



$P_{contact}$

$P_{contact}$ = probability that waste package is contacted by seepage

$P_{contact} = P_{Drift}\, P_{Rubble}\, P_{DSopening}\, P_{DSdrip_capture}$



P_{Drift} = fraction of drift collapse along longitudinal direction

~uniform[0.8, 1.0]

P_{Rubble} = probability for drip to go through rubble ~ 1.0

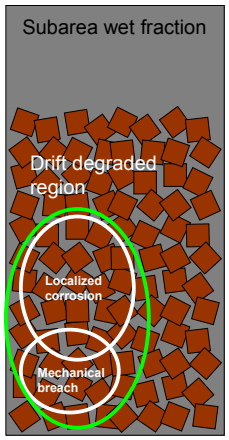
$P_{DSopening}$ = probability for collapse drip shields to have openings

~1.0

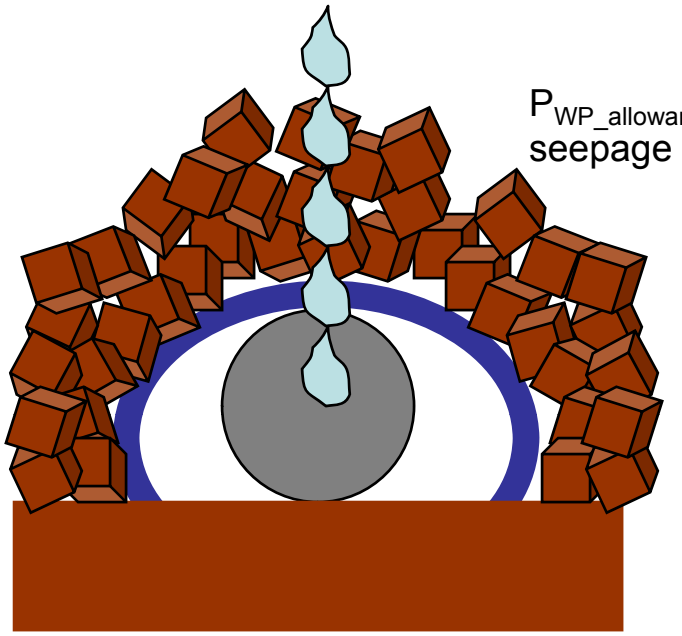
$P_{DSdrip_capture}$ = probability for open drip shields to capture seepage

~ compromised or failed DS surface fraction

$P_{contact} \sim P_{Drift}\, P_{DSdrip_capture}$



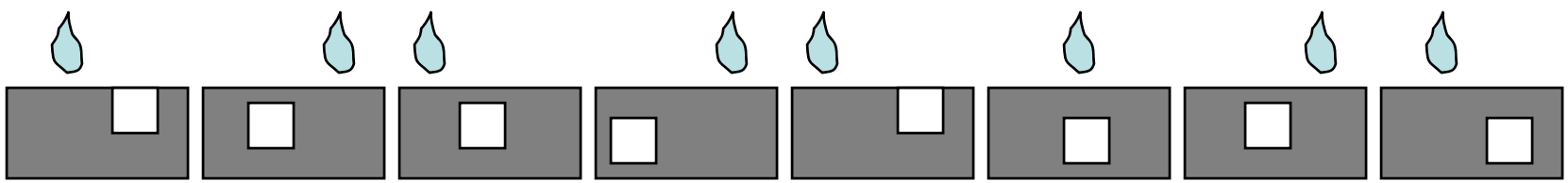
$P_{WP_allowance}$



$P_{WP_allowance}$ = probability that in WPs contacted by seepage, the seepage is captured by the failed WP area

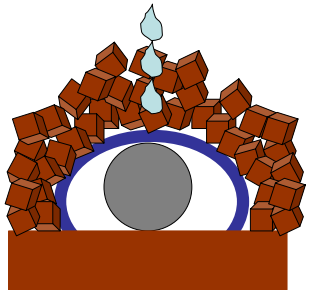
~ failed WP surface fraction

WP ensemble

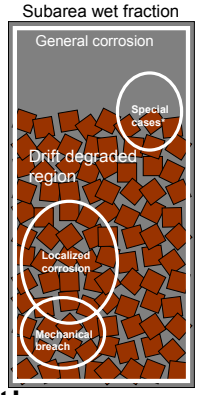


$P_{WP_allowance}$ is the probability that the seepage point is captured by the “window” on the waste package

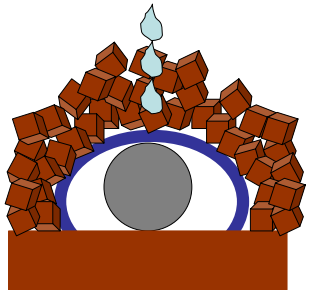
$P_{WP_allowance}$ should be function of the “window size”



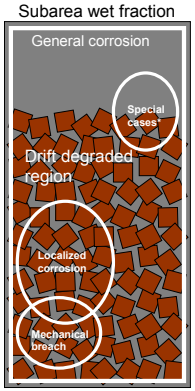
Notes on $P_{contact}$



- $P_{contact}$ = probability that waste package is contacted by seepage
- Should be a function of the failed DS surface fraction. This surface fraction is a function of time!
- Three value kinds of $P_{contact}$:
  - Initial defects, general corrosion, faulting, igneous WPs
    - Suggest $P_{contact}$=1
    - WPs could be located on a degraded drift or on a “pristine” drift. In the later case, those WPs could release radionuclides when DS fail by general corrosion. Not worth differentiating between WPs located on drift degraded or undegraded areas.
  - Localized corrosion
    - Compute as $P_{contact} = P_{Drift}\ P_{DSdrip_capture}$ (slide 1)
    - Uncertainty in $P_{contact}$ must account for the fact that $P_{DSdrip_capture}$ is a function of time. However, LC can only happen during the thermal pulse (past the thermal pulse there is no more LC WP failure). Need to account for size of DS opening during thermal pulse.
    - Propose $P_{DSdrip_capture}$ ~ initially compromised DS surface fraction by mechanical breaching

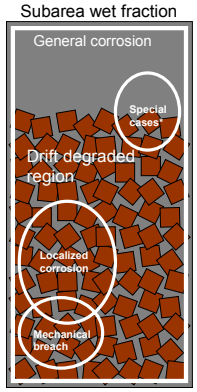


Notes on $P_{contact}$



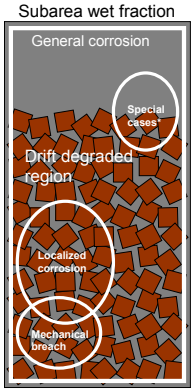
- Three value kinds of $P_{contact}$ (continued):
  - Mechanically breached WPs
    - Drip shields eventually fail by general corrosion, at that time, the probability that seepage may contact the waste packages is high (close to 100%)
    - Suggest $P_{DSdrip_capture}$ ~ uniform[0, 1] or Uniform[0.8, 1]

Notes on $P_{WP_allowance}$



- General corrosion, faulting, igneous
  - $P_{WP_allowance} = 1$
- Initially defective WPs
  - Could use $P_{WP_allowance}$ ~ fraction of initially compromised surface
  - Initially defective WPs could exhibit localized corrosion, mechanical breach, and general corrosion eventually; thus, good idea to use high value of $P_{WP_allowance}$
  - Small number of WPs already, with more decrease we will soon end with less than 1 WP failed in the entire repository
  - Conservative to use a high bound distribution ~ uniform[0.8, 1]
- Localized corrosion
  - Could be WP weld only, WP body only, or combination
  - Could use combined compromised WP surface to define $P_{WP_allowance}$
  - However, spatial location of seepage point is likely to coincide with failed surface, thus, suggest using $P_{WP_allowance}$ ~ uniform[0.8, 1]
  - Also failed area may grow with time and, eventually, all WPs fail by general corrosion
  - Good idea to use a high value of $P_{WP_allowance}$

Notes on $P_{WP_allowance}$ (cont'd)

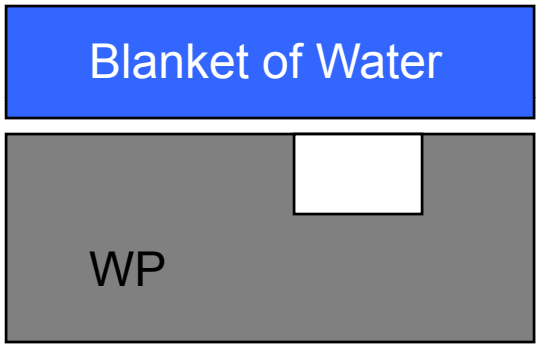


- Mechanically breached WPs
  - $P_{WP_allowance}$ ~ initially breached WP surface fraction
  - Mechanically breached WPs could also exhibit localized corrosion; however, breach tends to occur later in time when LC is not longer possible. Propose to ignore additional contribution to probability by localized corrosion, or slightly overestimate $P_{WP_allowance}$
  - Recall that we assume that mechanical breach can only occur in the first ~200,000 years (not sufficient time for WPs to fail by general corrosion)

Caveat on Seepage Factors

- Need to use carefully, to avoid double counting

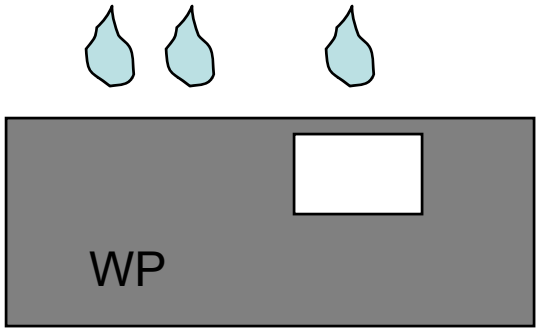
Old paradigm



Water available for release ~ proportional to compromised surface (size of window on WP).

All WPs get <u>some</u> water.

New paradigm



Water available for release is likely high fraction of **seepage points** contacting the WP. No significant reduction in seepage should occur.

<u>Some</u> WPs get water, but at higher rates than in the old paradigm

Concrete Proposal

	$P_{contact}$	$P_{WP_allowance}$
General corrosion, faulting, igneous	1	1
Initially defective	1	Uniform[0.8, 1]
Mechanical breach	P_{Drift} $P_{DSdrip_capture}$ = Uniform[0.8, 1] × Uniform[0.8, 1]	Initially breached WP surface fraction
Localized corrosion	P_{Drift} $P_{DSdrip_capture}$ = Uniform[0.8, 1] × Fraction of initially breached DS surface	Uniform[0.8, 1]

Insert 8 new parameters: 2 probabilities × 4 failure modes.

Combine general corrosion, faulting, igneous into one failure mode.

Compute the number of WPs contributing to release as

$$P_{contact} \times P_{WP_allowance} \times \text{No. WPs in subarea}$$

Idea on overall effect:

1 % WP failed ~ 1 mrem/yr (disregarding seepage protection)