HLWYM HEmails

From: Randall Fedors
Sent: Tuesday, August 14, 2007 5:03 PM
To: James Rubenstone; Keith Compton; Timothy McCartin
Subject: Summary of Bulking Factor
Attachments: BulkingFactorBriefing-Davis_31Jul07.doc

Attached is the summary of the bulking factor issue from a couple weeks ago.
Add to it the redundancy in the TPA of using the residual bulking factor for the thermal degradation, then further reducing the bulking factor due to seismic shaking.

--Randy

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Subject: Summary of Bulking Factor
Sent Date: 8/14/2007 5:02:34 PM
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From: Randall Fedors

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Recipients:
"James Rubenstone" <James.Rubenstone@nrc.gov>
Tracking Status: None
"Keith Compton" <Keith.Compton@nrc.gov>
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"Timothy McCartin" <Timothy.McCartin@nrc.gov>
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MESSAGE	256	8/14/2007 5:02:34 PM
BulkingFactorBriefing-Davis_31Jul07.doc	41536	

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Collaborative ENG2 (Raj, Goodluck), UZ2 (Fedors, Lenhard), PA (Grossman), & Geologists

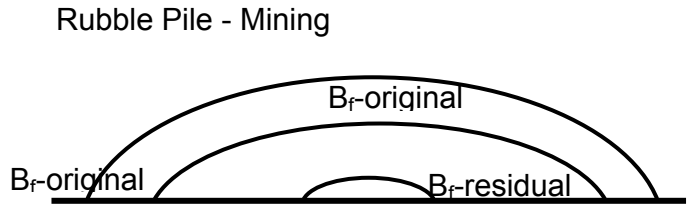
1. **Bulking Factor -** Lower Lithophysal unit of Topopah Springs tuff (85% of repository)
   - NRC definition → $\mathbf{V_B/V}$ = 1.15 - 1.25; range based on DOE info & some literature review
   - DOE definition → $\mathbf{V_B/V - 1}$ = 0.1 to 0.4 based on modeling exercise (discontinuum)
   - Higher bulking factor values lead to self-arresting degradation, threshold not known
     - Lowest values defendable from risk standpoint, but imply fine-scale porosity, thus capillarity effects on flow become important and heat transfer is reduced
   - TPA needs versus Appendix 7 on Drift Degradation perspective

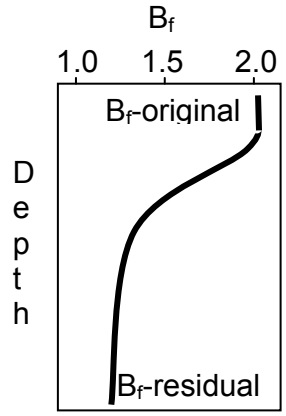
2. History of NRC Values

Bulking Factor (B_f)	Comment
1.05-1.35	Table in Gute et al (2003) MechFail Report; TPA meetings
1.15-1.5	Text recommendation in Gute et al. (2003) MechFail Report
[1.15,1.25] uniform	Distribution in TPA 5.1beta; Documented in Ibarra et al. (2006), based on DOE values for range of static load
[1.0,2.0,23,93] beta, dominantly 1.15 - 1.25	Distribution in TPA 5.1, current as of July 2007

Note: Static load versus bulking factor is dependent on drip shield design

3. Packing experiment of lower lithophysal fragments from Fran Ridge outcrop
   - Other analogs considered (fire-niche mat'l, talus on hillslopes, muck pile)
   - Presumption that rock will break along existing fractures
     - Thus enabling connection of fractures and fragments sizes to tunnel and drift
   - Lab packing variations lead to wide range in bulking factors
     - B_f=1.25, minimum, hand packed using all small fragments, exclude some large
     - B_f=1.75 to 2.15, maximum, fragments dropped into either box (1 m^3 scale)
   - Lab values analogous to "B_f original" rather than "B_f residual" in mining terminology
     - Lab values are relevant for top portions of rock piles
     - Assume no compressive load from overlying fragments, no seismic shaking
   - Lab values consistent with reasonable analog rock (basalt, limestone, and sandstone)
   - Report in prep for UZ2, completion maybe before end of FY07
   - Where does drift rubble fall on depth curve???
     - Need representative value for TPA, pre- and post-seismic compression





4. To Do: Drip shield creep and threshold for self-arresting drift degradation
   - At what bulking factor will static load lead to failure? Need to use current design.
     - Failure for creep mechanism requires some factor beyond stress failure

5. To Do: More extensive literature review
   - Focus more on mining industry book values, scheduled for FY08 Activity for ENG2
   - Address issue of to "B_f-original" rather than B_f-residual, where would YM drift fall?