From: Roland Benke
Sent: Monday, March 26, 2007 1:27 PM
To: Brittain Hill; 'John Trapp'
Cc: James Rubenstone; John Stamatkos; Donald Hooper
Subject: RE: Fwd: Question about slide 32 from my February presentation to ACNW

It appears to me that the code documentation preceeded the offical release of TPA Version 3.0, and the "test" values reported in the 1997 User Guide differ from the values delivered with the code to NRC on March 17, 1997.

By looking at the header information, the values presented in the 1997 User Guide were "test" values from February 26, 1997 that cooresponded a Beta version of the TPA code.

In contrast to these "test" values, the official release version of the TPA Version 3.0 code (March 17, 1997) included an "Example input file" with different values for the HLW particle size distribution.

For comparison purposes, I've pasted excerpts (below) from the 1997 User Guide/"test file"/Version 3.0Beta and "Example file"/Version 3.0 data. Based on this quick review, the values reported by Coleman in slide 32 relate to TPA 3.0Beta and not to those values delivered in TPA 3.0. If further investigation into what was actually "in" the TPA code is needed, just provide Don and me with the specific version number so that we can fetch it.

Roland

TOTAL-SYSTEM PERFORMANCE ASSESSMENT **(TPA)** VERSION 3.0 CODE:

MODULE DESCRIPTIONS AND USER'S GUIDE (ML040200150 dated March 14, 1997 in ADAMS)
####

title
This is the test file for TPA 3.Obeta version
which is being supplied to NRC on February 26, 1997.

constant MinimumFuelParticulateSize[cm]

0.01

**

constant ModeFuelParticulateSize[cm]

0.1

**

constant MaximumFuelParticulateSize[cm]

1.0

##########
TPA Version 3.0 Code
##########

(Header info from tpa.inp)

Example input file, supplied with TPA Version 3.0 Code

Supplied to NRC on March 17, 1997

(Parameter info from tpa.inp)

**

constant

MinimumFuelParticulateSize[cm]

0.0001

**

constant

ModeFuelParticulateSize[cm]

0.001

**

constant

MaximumFuelParticulateSize[cm]

0.01

**

-----Original Message-----
From: Brittain Hill [mailto:BEH1@nrc.gov]
Sent: Monday, March 26, 2007 7:48 AM
To: John Stamatakos; Roland Benke; <Don Hooper; John Trapp
Cc: James Rubenstone
Subject: Re: Fwd: Question about slide 32 from my February presentation to ACNW

Although the TPA 3.0 users guide uses the stated distribution, the only citation related to where this distribution came from is Jarzemba and LaPlante (1996). The technical basis in that citation is a report that looked at in-situ particle sizes for several SNF samples, with the

upper bound constrained by "this is how big a fuel pellet is when intact." There was no consideration for igneous (or any type of) disruption in that basis. No technical basis was provided (then or subsequently) to indicate an igneous event would not affect SNF size, either.

Yes, the size distributions changed from the initial scoping values because an enhanced technical basis specific to igneous events was considered. Certainly, many parameters have changed from initial values to more refined values in subsequent versions of the TPA code.

The logic developed for the SNF size distribution used subsequently was along these lines: If average diameter for in-situ was on order of 1mm, the data (not assumption) from the crush-impact studies (e.g., NRC, 1999, IRSR) showed order of magnitude reduction in average size. Consideration of the thermal, mechanical, and chemical conditions of exposure to basaltic igneous conditions warranted an additional order-of-magnitue reduction in SNF size, relative to a single crush-impact event (NRC, 1999). This enhanced technical basis was incorporated into TPA no later than 4.0, which supplanted the scoping estimate from Jarzemba and LaPlante (1996).

Some confusion may arise between the different versions of TPA3 that were floating around. As I recall, there was little actually done with TPA3.0. Instead, most of the sensitivity analyses etc. were done with TPA3.1.1 and TPA3.1.3, along with some work using TPA3.2. In particular, I recall doing a series of analyses using TPA3.1.3, which were documented in the Hill and Trapp (1997) sensitivity analyses report.

A median diameter is not "nearly all." SNF is composed of a cermacized powder that has an average diameter on order of 10 um, with very little dispersion in size about the median (i.e., very well sorted). The size distribution with a median of 10 um has a much larger dispersion, accounting for intact pieces of SNF to 100 um, and transgranular fracturing associated with igneous disruption down to 1 um. Again, due consideration needs to be given to potential oxidation/reduction/chemical state reactions, which affect transgranular fracturing. See, for example, the SNF sizes used in the EBSREL module, which decrease the SF grains from ~10^-5m to 10^-6 to 10^-7m diameters in response to simple low-temperature oxidation alone.

This size range represents an order-of-magnitude estimate, not an absolutely precise determination. The sensitivity analyses in, for example, KTI agreement IA-2.02 show that variations within these magnitudes are relatively insensitive to waste isolation capabilities.

Britt

>>> John Trapp 3/26/2007 7:47 AM >>>
Based on don's e-mail there is something wrong someplace on documentation. This is more then technical.

>>> Neil Coleman 03/23/2007 9:43 AM >>>
Dear John,
You had a comment about this slide which you passed on to Bill Hinze, specifically what is

represented by the two triangular distributions for fuel particulate size. He asked me to respond to you.

To avoid confusion lets be specific and refer to the TPA code variable names. The data sets tablulated in the user's guides provide the following values (which can be changed by the user):

TPA 4.0 Mohanty, McCartin, and Esh 2002

Minimum fuel particulate size (cm) = 0.0001 1 micron
Mode fuel particulate size (cm) = 0.001 10 microns
Maximum fuel particulate size (cm) = 0.01 100 microns

TPA 3.0 Manteufel et al. 1997 ML040200150 (publically available document)

Minimum fuel particulate size (cm) = 0.01 100 microns
Mode fuel particulate size (cm) = 0.1 1000 microns
Maximum fuel particulate size (cm) = 1.0 10,000 microns

The triangular distributions in my presentation are based on these. Codell's triangular distribution is not shown in the figure but is of an intermediate size distribution.

I have run the TPA code 4.1j and evaluated the effects of these two distributions, as well as the intermediate size range used by Dick Codell (who also used an alternate ash incorporation method). Codell's size distribution produces smaller doses by a factor of 2. But going from the TPA 4.0 distribution to the size distribution used in TPA 3.0 lowers dose by more than 2 orders of magnitude. It appears that the volcanism scenario is VERY SENSITIVE to the assumptions about fuel particulate size.

John, is NMSS aware based on the above considerations that there is this extreme sensitivity? To get a substantial dose from extrusive volcanism you have to reduce nearly all the fuel to clay and silt sized particles (like talcum powder). A grain of talcum powder is about 10 microns across. A grain of table salt is roughly 100 microns.

Best regards,
Neil

Hearing Identifier: HLW_YuccaMountain_Hold_EX
Email Number: 1371

Mail Envelope Properties (00a201c76fcb$e68be300$1cc8a281)

Subject: RE: Fwd: Question about slide 32 from my February presentation to ACNW
Sent Date: 3/26/2007 1:26:32 PM
Received Date: 3/26/2007 1:26:34 PM
From: Roland Benke

Created By: rbenke@cnwra.swri.edu

Recipients:
"James Rubenstone" <James.Rubenstone@nrc.gov>
Tracking Status: None
"John Stamatkos" <jstam@cnwra.swri.edu>
Tracking Status: None
"Donald Hooper" <dhooper@cnwra.swri.edu>
Tracking Status: None
"Brittain Hill" <Brittain.Hill@nrc.gov>
Tracking Status: None
"'John Trapp'" <JST@nrc.gov>
Tracking Status: None

Post Office: cnwra.swri.edu

Files	**Size**	**Date & Time**
MESSAGE	7213	3/26/2007 1:26:34 PM

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received: